



This project is funded
by the European Union



CES-MED

CLEANER ENERGY SAVING MEDITERRANEAN CITIES

Contract No. ENPI 2012/309-311/EuropAid/132630/C/SER/MULTI

● Jordan Municipality of Greater Irbid

Sustainable Energy & Climate Adaptation Plan (SECAP)



The document was produced as part of the CES-MED project activities (EuropAid/132630/C/SER/MULTI). Managed by a Consortium led by Hulla & Co. Human Dynamic KG, and with the active participation of National Authorities in Jordan and municipality of Greater Irbid, it was prepared by Consortium of consultants from Georges B. Tabet- Lebanon and Oussama Kaassamani-Lebanon with direct support of CES-MED's experts.



Sustainable Public Procurement	44
Summary of actions related to Municipal building and facilities	46
Residential buildings	48
Implementing and promoting the Green Building law in new buildings	48
Initiatives towards existing buildings, promote installation of Solar Water Heaters (SWH) in buildings through public advertising in collaboration with NGOs & Distribution of SWH for 1,000 low income houses	50
Awareness campaigns to reduce energy consumption.	52
Energy consumption analysis and behaviour	54
Summary of Residential sector actions	55
Tertiary buildings	57
Implementing and promoting the Green Building law in new buildings.	57
Awareness campaigns to reduce energy consumption.	59
Summary of actions in the Tertiary sector	62
Public Lighting	63
Modern street lighting system	63
Private and commercial Transportation	65
Identify a Single-track Road	66
Traffic Links Design (West Irbid Mall).....	67
Transport Complex East of Irbid.....	68
Bicycle sharing Project	69
Public Transport Project	71
Shuttle bus / Express bus.	72
Intelligent and Smart Control of Traffic Lights	74
Provide Car Parking Spaces by applying Park Meters in Side Roads.....	75
Light Train Project	76
Speed-camera and Radar Control Project	77
Constructing a Multi-Storey Parking Lot	78
Replacement of Vehicles Operating in the Municipality with Electric Vehicles.	79
Summary or actions in the Transportation sector	80
Water supply for Parks and Gardens.....	81
Development of Irrigation Methods and Saving Sources closer to Water	81
Background.....	81
Solid Waste Management	83
Updating the Solid Waste Management, Collection and Transportation.....	83
Local Electricity Production	86
Establishment of a 16 MW Solar/Photovoltaic Cell Station.....	86
Summary of actions.....	88
Section V: Climate Adaptation Current Status Analysis	95
Introduction on climate change impact.....	95
National and Regional Strategy on Climate Change Adaptation	97
The commitments at national level	97
The national strategy, its goals and commitments, sectors affected	98
Climate data and Climate projections.....	98
Adaptation Scoreboard	99
Section B: Climate Change Risk Assessment and Vulnerability Analysis.....	100
Section C to Adaptation Actions	103

Section VI: Citizens Awareness Promotion Plan	110
Priority Action Fiche 1	121
Title: 16MW utility-scale solar PV power plant	121
Priority Action Fiche #2	135
Title: Brilliant lighting for Greater Irbid Municipality	135
Priority Action Fiche #3	139
Title: Smart Municipal services	139
Priority Action Fiche #4	143
Title: Smart multi-storey parking lot	143
Priority Action Fiche #5	147
Title: Shuttle Bus	147
References:	151

List of Tables

Table 1 Fuel conversion factor KWh/L.....	24
Table 2 Fuel conversion factor t/MWh	25
Table 3 Electrification consumption per sector in Irbid year 2015- EF: 0.649 tCO ₂ /MWh.....	25
Table 4 Tertiary sector –Municipal electricity consumption in 2015	27
Table 5 Tertiary sector’s non-governmental electrification consumption in 2015	27
Table 6 Comparison between Private and Municipal hospitals and schools in Irbid	28
Table 7 Public street lighting consumption in 2015.....	29
Table 8 Proposed development for the public street lighting in Irbid.....	30
Table 9 Kerosene Fuel consumptions in 2015	30
Table 10 LPG fuel consumption in 2015	30
Table 11 Diesel and Gasoline fuel consumption in Irbid Governorate in 2015	31
Table 12 Diesel and Gasoline fuel consumption in Greater Irbid Municipality in 2015	31
Table 13 Fuel consumption in Irbid Municipality in 2015.....	31
Table 14 Summary of energy consumption with GHG emissions in Irbid in 2015	31
Table 15 BAU scenario per sector for year 2030	32
Table 16 Greater Irbid Municipality score in the adaptation Cycle Specific Steps (SECAP template).....	99
Table 17 Vulnerability Analysis	100
Table 18 Risk Assessment	101

List of Symbols

BEI	Baseline Emissions Inventory
BDG	Backup Diesel Generators
CAS	Central Administration for Statistics
CES-MED	Cleaner Energy Saving Mediterranean Cities project
CoM	Covenant of Mayors
GHG	Green House Gas
SEAP	Sustainable Energy Action Plan
SECAP	Sustainable Energy and Climate Adaptation Plan
SWH	Solar Water Heater
UNDP	United Nations Development Program
IPCC	Intergovernmental Panel on Climate Change
UNFCCC	United Nations Framework Convention on Climate Change

Acknowledgements

This report has been prepared for the Municipality of Greater Irbid- Jordan through its participation in the CES-MED programme, which is financed through EU. One of the main objectives of the CES-MED programme is to support the local and national authorities in joining the Covenant of Mayors, as well as preparing Sustainable Energy and Climate Adaptation Plan. The preparation was undertaken to support the local authority through several training and technical assistance in formulating and applying sustainable policies in the city.

The CES-MED programme is established to support local authorities in the ENPI South, in responding more actively to sustainable policy challenges and developing their capacities to formulate and implement more sustainable local policies, such as renewable energy solutions, energy efficiency measures to reduce CO₂ emissions, efficient water and waste management and environmental-friendly public transport. The programme also represents a step towards making National Authorities more aware of and responsive to the need for a strong involvement of cities in policy issues, which have a direct impact on them, as well as the related advantages. These issues include the local waste and water management, urban mobility and transport, and local energy use.

The CES-MED programme is managed by Human Dynamics, in a consortium with the Centre for European Policy Studies (CEPS), Pescares (part of HCL group) and the Institute of Communications and Computer Systems (ICCS), the EURO MED cities Network, the Assembly of European Regions (AER) and the Associated Consulted Engineers (ACE)

The preparation of the report greatly benefited from the joint efforts, close collaboration and strong engagement of the municipality with EU programs under the patronage of the Ministry of.

The report was drafted by the Consortium Georges B. Tabet and Oussama Kassamani, the SECAP Consultant, with the support from the Municipality of Greater Irbid-Jordan and under the guidance of Dr. Naguib Amin, the Team Leader for CES-MED project and Dr. Alexandra Papadopoulou, the CES MED Energy Expert and Ms. Myriam Makdissi Senior Communication and Networking Expert.

The information and data developed in this report wouldn't have been achieved without the support which has been provided by all parties of the project. We would like to express our gratitude and appreciation to the following persons, for their patience, support, cooperation and efforts in preparing this report:

Ms. Florentine Visser Key Expert of CES-MED team in Jordan

Mr. Maher Abdelrahim Ministry of Planning

Mr. Mohammed Abu Kawood Ministry of Municipalities

Mr. Hussain Muhidat President of Committee of Greater Irbid municipality

All staff and Engineer who support preparation of this report from Municipality of Greater Irbid

Mr. Hussain Bin Hani the Mayor of Greater Irbid Municipality

Mr. Ziad Al Tal Mayor assistance for Engineering affairs

Ms. Reham Al Jamal Director of Study and Planning Department

Mr. Hassan Al Akour Mayor consultant for Traffic affairs

Mr. Kahlid Jaradat Director of Electrical Department

Mr. Kasem Al Routan Director of Parks department

Mr. Saber Jaradat Director of accountant Department

Mr. Rizek Al Jamra account department

Mr. Ahmed Shati Director of Electricity department

Mr. Nafith Shattat Director of design and study department

And all other team of the municipality

Harry Urpatyan, design and layout Human Dynamic

Our deep appreciation also goes to all parties who are not mentioned in this report for their devotion and dedication in work. We are looking forward to a city that undertakes sustainability and works towards a healthy future, with clean power, clean air and clean water for its people to live and work in.

Section I: SECAP Executive Summary

Irbid, anciently known as Arabella or Arbela, is the capital and largest city in Greater Irbid Municipality, and Jordan's second largest city located 85 km north of Amman. The area is 30 km² and rises 600 meters above sea level. Irbid is located on the Highland Plateau, a central urbanized axis that runs from Irbid in the north to Aqaba in the south. Its strategic position close to both the Syrian and Palestinian borders makes Irbid an important transportation and business hub in the region, while the rich cultural heritage and agricultural area contribute to its good reputation as well, on top of being a gateway for the country.

With a clear will to lead the fight inside the city against global warming and anthropogenic CO₂ emissions, based on the long-term vision of the future state of the city, especially from its sustainable perspective, Greater Irbid Municipality has approved the CES-MED Project, an EU-funded initiative set up to provide training and technical assistance support, with a view to help them respond more actively to sustainable policy challenges.

Based on the existing CO₂ reduction potential, the municipality of Greater Irbid is committed to reduce the emissions to a 40% by 2030, satisfying the CoM target. This commitment is subject to the availability of funds to implement the measures developed in the SECAP in close collaboration with local, national, and international initiatives. However, Jordan, nationally, is determined to reduce the GHG emissions by 14% until 2030 compared to a BAU scenario level. If the objectives aren't achieved, the municipality of Greater Irbid will have to assign possible actions and measures to respect the national commitment of Jordan- INDC "Intended National Determined Contribution".

The calculated budget for the implementation of SECAP is 212,151,735 JOD (299,226,706 USD) for the SEAP actions and 70,750,000 JOD for the adaptation plan.

For Greater Irbid municipality, climate change poses serious risks to a number of sectors and especially the economy, the society and the ecosystem. Reducing these risks requires actions to reduce GHG emissions (mitigation), combined with measures to increase resilience to the related impacts (adaptation). Following this principle, a methodology to integrate adaptation to climate change in the Sustainable Energy Action Plan in Irbid will be promoted as well as implemented covering all sectors. As a consequence, the Sustainable Energy and Climate Action Plan (SECAP) will contain a strategy on how to address the impacts of climate change in the municipality at local level, instead of focusing solely on the municipality's existing and future energy consumption and production. Whereas, the SEAP constitutes a tool to implement the objectives of the municipality strategy that is structured around reducing energy consumption in all sectors through energy conservation and efficiency and promoting energy production from renewable energy sources with an emphasis on the awareness raising actions.

The document provides the Baseline Emission Inventory (BEI), and the detailed step-by-step action plan for the entire process of elaborating a local energy and climate strategy, from initial political commitment to implementation permitting the Local Authority to come on board the Covenant of Mayors Initiative. It also examines the climate change adaptation through risks assessment, vulnerability analysis and adaptation actions for each sector.

The establishment of the SEAP and its success requires careful planning and methodological data collection, the development of the emission source categories' inventory, as well as the clear description on the origin of data for the analysis and the calculation methods used. All this is reflected in the BEI results and in the planned actions.

Baseline Emission Inventory (BEI)

Baseline Emission Inventory (BEI): Quantifies the amount of CO₂ emitted due to energy consumption in the territory of the Local Authority in the baseline year. It allows to identify the principal anthropogenic CO₂ emission sources and to prioritise the reduction measures accordingly.

Elaborating a BEI is of critical importance. This is because the inventory will be the instrument allowing the local authority to measure the impact of its actions related to climate change. The BEI will demonstrate the local authority's starting point, and the successive monitoring emission inventories will show the progress towards the objective. Emission inventories are very important elements to maintain the motivation of all parties willing to contribute to the local authority's CO₂ reduction objective, allowing them to see the results of their efforts.

The Municipality of Greater Irbid included in its Baseline Emission Inventory the following sectors:

- Municipal Building and Facilities;

- Residential Buildings;
- Tertiary Buildings;
- Public Lighting;
- Transportation: Private and Commercial;
- Water Supply for Gardens and Parks;
- Solid Waste Management;
- Local Electricity Production.

According to the data provided by the Local Authority, the analysis for the Greenhouse Gas Emissions shows that the Residential, Tertiary and Transportation sectors represent the majority of emissions in the city. As a result, the actions targeting those sectors would significantly affect the emissions' reduction and at the same time support the energy bill savings for the private and public sectors. In the below Chart the emissions per sector are presented according to the data provided for year 2015.

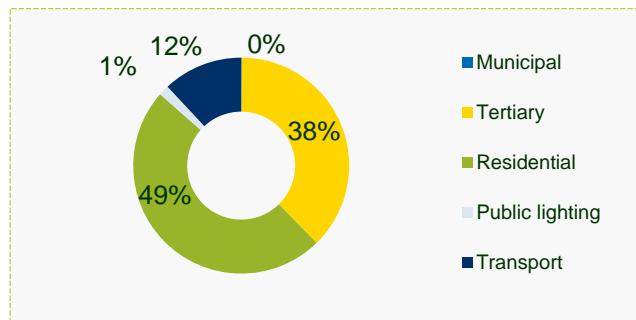


Chart 1 Greenhouse gas emissions per sector

Actions and measures related to SECAP

The SECAP section dedicated to the mitigation actions describes a range of initiatives/measures for each sector that the city has already undertaken, as well as a set of planned priority actions which will help to attain a sustainable city by 2030. The actions consist of both awareness raising activities for the public and different stakeholders, and of actions related to energy consumption and energy production as provided below.

1. Municipal building and facilities

The actions set in this sector are summarized as follows:

➤ Evolving from traditional management into e-management

The institutional framework in the Greater Irbid Municipality needs a strong, fast, reliable and flexible IT system capable of facilitating the work that could serve the local community's interests. Hence, evolving from traditional management into e-management- **a priority action** - contributes in automating the municipality and transferring all municipal and paper-based information to electronic information, ensuring the necessary infrastructure to connect all municipal departments with a single information network and exchange of information between different departments, and determining all transactions between the citizen and municipal departments and converting them into electronic transactions.

The adopted actions in this area will save 885 MWh/a, and mitigate the emissions by 220 t CO₂/a.

➤ Transforming the Main building of Greater Irbid Municipality into a Green Building

The main building's energy consumption cost is responsible for about 36% of all municipal buildings' consumption, thus the building is imposing an enormous economic burden on the annual budget that reaches JOD 651,780 annually (920,000 USD).

A set of measures are undertaken and are summarized as follows:

- Transform the municipal building into an environmental landmark.
- Implement energy conservation measures.
- Install window shadings (Sun shade).

- Design, calculate and visualize light professionally with new efficient lights.
- Install heat insulation on the external walls.
- Periodic maintenance of the equipment.

These measures will reduce emissions and the energy bill, strengthen its sustainability, enhance sustainable development opportunities in the short term, and raise awareness among citizens to use such technologies since the municipality leads by example.

The adopted actions in this area will save 493 MWh/a, and mitigate the emissions by 307 t CO₂ /a.

➤ **Implementation of the Consumption Saving Measures in the Municipal Buildings**

Greater Irbid Municipality has 144 buildings distributed over the 23 districts, while their respective electricity cost is about JOD 1,800,000. These buildings are consuming between 1 and 102 kWh of electricity on a daily basis.

The measures to be taken will help reduce consumption and improve energy efficiency. They include among others the implementation and follow up of energy saving measures, also by providing and distributing instructions, as well as holding an internal awareness campaign on how to apply them. Also, an analytical consumption study in these facilities will be realized, to identify the specific consumption sources and their contribution in the overall consumption, as well as identify measures that could help reduce it.

The adopted actions in this area will save 553 MWh/a, and mitigate the emissions by 356 t CO₂/a.

➤ **Sustainable Public Procurement**

In Greater Irbid municipality, public procurement accounts for around 20 million JOD /year, making it an important tool for public authorities in order to implement national energy efficiency policies, through the integration of energy efficient products and services.

Thus, there is a need for new Sustainable Procurement Regulation with a new legal framework and specific institutional arrangements related to the execution of contracts, as well as development of policies at the central level that are ensuring methodical supervision, as well as other provisions that reinforce transparency and accountability.

However, the expected obstacles lay in the fact that most of the municipal departments are not well trained on implementation, and the contractors are not fully aware of the rules of the sustainable procurement and how to implement them.

A set of actions has been conducted:

- Development of Sustainable Procurement procedures with legislative & regulatory framework according to international legislative models;
- A comprehensive capacity building program on the new Regulation to cover the municipal and private sectors;
- Training of private sector representatives;
- Implementation of Sustainable Procurement procedures.

2. Residential buildings

Precise actions are undertaken in these areas:

➤ **Implementing and promoting Green Building law in new buildings**

Greater Irbid Municipality has recently witnessed rapid population growth that affected urbanization due to the natural internal migration from rural areas to the city. However, much of that increase is comprised of international migrants, who commonly migrate for conflict and political reasons. 240,240 refugees live in Irbid governorate, making up 23 % of the total refugees in Jordan.

The electric consumption in the residential sector has reached 500 GWh in 2015 that is 44% of the total electricity consumption in the city, feeding 237,000 households and 1,137,000 people with an average consumption of 8.8 kWh/day.

The measures taken vary between promoting green buildings, using renewable energy, and raising awareness on electricity and water- saving household appliances and insulating buildings, which in turn, could save energy.

The adopted actions in this area will save 18,965 MWh/a, and mitigate the emissions by 4,912 t CO₂/a.

➤ **Promote installation of Solar Water Heaters (SWH) in buildings**

Irbid has more than 300 sunny days annually. Considering that buildings in the municipality represent about 44% of the electricity consumption, 30% of which goes to water heating, solar water heaters are a significant alternative solution to electricity consumption. Their distribution success and penetration at the regional level will contribute to the generalization of the Renewable Energy concept.

The main goal of this action is to motivate the installation of 1,000 solar water heaters in Greater Irbid Municipality through enhancing coordination between the Universities and the Private sector under the umbrella of the Greater Irbid Municipality.

The action comprises a sustainable solution that creates new employment opportunities, promotes sustainable development, reduces the burdens on citizens, and helps reduce the annual cost of electricity subsidies, which will improve the government services, increase the opportunities for creating sustainable energy solutions, expand the economic cycle and reduce environmental issues.

The adopted actions in this area will save 145,855 MWh/a, and mitigate the emissions by 94,660 tCO₂/a.

➤ **Awareness campaigns to reduce energy consumption**

The rapid urbanization growth, accompanied by the population increase, has imposed economic burdens and more responsibilities on the municipality due to the increased demand for services and the need to create new job opportunities that go along with the municipality's sustainable vision through its awareness- raising role.

The municipality could support the reduction of the energy bill's burden for its citizens and contribute to the increase of the living standards among its residents, through awareness raising campaigns. Besides, the awareness campaigns influence the customer consumption patterns and purchasing behavior. To this end, the municipality, through the promotion of optimal and sustainable methods in licensed ads to be published at different timings, in collaboration with various governmental parties, community sectors and residents, could support the above mentioned goals.

The adopted actions in this area will save 17,004 MWh/a, and mitigate the emissions by 54,186 tCO₂ /a.

➤ **Energy consumption analysis and behaviour**

Due to the rapid growth in Greater Irbid's municipality area, the electricity consumption in the residential sector reached 500 GWh in 2015 with an average consumption of 8.8 kWh/day per household. Hence, it is crucial to analyze the energy consumption of the existing residential buildings to find the proper solutions or measures in reducing consumption and saving energy costs. In this concern, various stakeholders such as universities, government parties and Irbid Electricity Company are involved to ensure this effort's success.

The adopted actions in this area will save 340,326 MWh/a, and mitigate the emission by 220,871 tCO₂ /a.

3. Tertiary buildings

Provided below are the actions set out in each of the following areas:

➤ **Implementing and promoting Green Building law in new buildings**

The Building sector, the main contributor to energy consumption, represents the main pillar that should be addressed in the SECAP's mitigation actions.

The electricity consumption in the Tertiary sector has reached 571,973 MWh in 2015 that is 50% of the total electricity consumption in the city.

The measures taken vary between promoting green buildings, using renewable energy, awareness raising on using electricity and water- saving household appliances and insulating buildings, that in turn, could save energy.

➤ **Awareness campaigns to reduce energy consumption**

The municipality could support the reduction of the energy bill's burden for its citizens and contribute to the increase of the living standards among its residents, through awareness raising campaigns. These campaigns will involve the governmental departments and private sectors within Greater Irbid Municipality's boundaries to promote for energy conservation in their buildings in coordination with the national authority.

The adopted actions in this area will save 236,471 MWh/a, and mitigate the emission by 153,467t CO₂/a.



4. Public Lighting

Setting street lighting measures is of great importance as the operational bill is becoming high; and due to the technological advancement, effective and successful solutions have come to be available. For example, incorporation of the advanced and effective LED lighting offers high results in energy efficiency.

Therefore, there must be appropriate measures that would help in reducing energy consumption and costs and improve services. By implementing such measures, consumption will be reduced from 38,616 MW to 14,771 MW by 2030, and costs from JOD 5,184,000 to JOD 1,983,000, thus saving an annual rate up to JOD 3,201,000.

The adopted actions in this area will save 23,845 MWh/a, and mitigate the emissions by 15,476 t CO₂/a.

5. Transportation Private and Commercial

Knowing the fact that the transportation sector plays an important role in the life of the citizens, setting clear traffic operations and travel option strategies would improve traffic flows on roads with high congestion levels. Before performing any action, it is important to build support within the local community to ensure that the planned actions will be implemented and supported by it. For that, it is imperative to have a public input into the planning process and create a "Citizen Advisory Committee" to follow up the preparation of the action with local and national level representatives and stakeholders.

The strategies summarized below in each municipal area can create congestion benefits if they are implemented on the congested roads and on many parallel and intersecting roads, lanes or transit routes.

➤ **Identify a single - track road**

Identifying a single-track road for the Municipality's transport means will activate the sustainable transport system through mitigating the CO₂ emissions, activating the role of local community participation and maintaining a clean and healthy environment for pedestrians moving on the sidewalks adjacent to the main streets.

The adopted action in this area will save 41,968 MWh/a, and mitigate the emissions by 10,813 tCO₂/a.

➤ **Traffic Links Design (West Irbid Mall)**

The link in West Irbid Mall supports 36,000 cars on a daily basis and is characterized by congestion and traffic delay. Thus, designing traffic links, where the main commercial centers, offices and other public facilities are located, is necessary in order to achieve a sustainable and environmentally friendly transport system.

The adopted action in this area will save 34,973MWh/a, and mitigate the emissions by 9,011 tCO₂/a.

➤ **Transport Complex East of Irbid**

With the population growth, it became necessary to initiate transport complexes within the city to meet the community needs in accordance with Irbid's urban structure, so as to avoid the traffic jam. It is, therefore, necessary to find an optimal distribution of transport complexes to meet the growing demand from the surrounding areas for a sustainable and environmentally friendly transport system, where more than 229 buses and small buses use so as to reach the south complex.

Designing and building a new transport complex in east of Irbid to serve the connection between Mafraq, Ramtha, International Airlines (Syria, Iraq & Saudi Arabia) in addition to Yellow taxis and shared taxis will support this cause.

The adopted action in this area will save 13,989 MWh/a, and mitigate the emissions by 3,604 tCO₂/a.

➤ **Bicycle sharing Project**

The action aims at identifying alternative transport systems for university students to facilitate their movement so as to be sustainable and environmentally friendly, while safety regulation with regular accommodation of bicycle and pedestrian modes in the project development process is a key issue for the Municipality.

The adopted action in this area will save 6,995 MWh/a, and mitigate the emissions by 1,802 tCO₂/a.

➤ **Public Transport Project**

The public transport system becomes essential to facilitate the citizens' movement within the city. The growth in vehicle ownership and usage would lead to major traffic congestion and increase in CO₂ emissions. To avoid this issue, it is crucial to establish a sustainable and environmentally friendly public transport system that facilitates the citizens' movement within the city. Providing public transport in Greater Irbid Municipality will support the regulation of the traffic congestion and the low-income citizens and promote a sustainable solution for the traffic in the city.

The adopted actions in this area will save 20,984 MWh/a, and mitigate the emissions by 5,407 tCO₂/a.

➤ **Shuttle Bus/ Express Bus**

Express bus service, **a priority action for the municipality**, is a type of fixed route that typically picks up passengers from park-and-ride lots in suburban areas and takes them to a central urban location. This transit service usually operates for longer-distance trips on a Saturday through Thursday, peak commuter time schedule.

Commuters from suburban areas, including state employees, students, and employees working in the central city, are viable users of this service. Typically, commuters who would otherwise utilize freeways to travel to and from work during the week serve as potential users, because this service can use HOV lanes and create a less-stressful commute.

The adopted action in this area will save 13,989 MWh/a, and mitigate the emissions by 3,604 tCO₂/a.

➤ **Intelligent and Smart Control of Traffic Light**

The traffic signaling system is an important measure to control the traffic flow by providing green waves that coordinate between the traffic lights. Intelligent management of traffic flows can reduce the negative impact of congestion, allow for smooth traffic movement, reduce the frustrating for drivers scenario to be stuck in traffic, save fuel costs, and cut down on air pollution.

The adopted actions in this area will save 20984 MWh/a, and mitigate the emissions by 5407 tCO₂/a.

➤ **Provide Car parking spaces by applying Park meters in side roads**

Greater Irbid Municipality experiences a high increase of car owners and limited parking lots. This leads the drivers to pass by the same route several times in order to find a parking space, while most of the side road parking areas are usually full all over the day with no time limit for these parking lots. This causes traffic congestion and waste of time for people searching for parking lots, creating at the same time issues for the shopping areas and others.

The parking meters would be a proper solution to reduce traffic congestion, stimulate commercial and economic traffic in the capital and allow as many cars as possible to park regularly in the streets.

The adopted actions in this area will save 6,995 MWh/a, and mitigate the emissions by 1,802 tCO₂/a.

➤ **Light Train Project**

The road connecting the University of Science and Technology, King Abdullah Hospital and the urban area in Irbid is a vital one, and is characterized by the daily movement of the citizens who depend on their own cars to reach various places connected with vibrant facilities of universities, hospitals.

Therefore, using the light rail that connects Irbid with the University of Science and Technology, King Abdullah Hospital and the Development Region is necessary to encourage people use public transport instead of their own cars to avoid environmental pollution, and traffic congestion and apply the sustainable transport system.

The adopted actions in this area will save 76,941 MWh/a, and mitigate the emissions by 19,825 tCO₂/a.

➤ **Speed-cameras and radar control Project**

Speed measure of vehicles within the city of Irbid and its various regions will help in controlling the emissions and reduce the possibility of accidents and street congestion as a result of it. Installation of the speed-cameras and radar control system through the city will alert the drivers of their speed and encourage them to limit it to the optimum level.

The adopted actions in this area will save 6,995 MWh/a, and mitigate the emissions by 1,802 tCO₂/a.

➤ **Constructing a multi-storey parking lot**

Construction of a multi-storey parking lot (could be mechanical parking to increase capacity) of approximately 2,000 vehicles' capacity that will be lit and serviced using solar panels on the roof of the building. This will help reduce the traffic congestion problems by providing more parking lots. The establishment of the Smart Multi-storey Parking Lot **is among the priority actions** of Greater Irbid Municipality.

The adopted actions in this area will save 13,989 MWh/a, and mitigate the emissions by 3,604 tCO₂/a.

➤ **Replacement of municipal vehicles with electric ones**

The number of vehicles operating in the Municipality is about 355 vehicles (Pickup + Diana + Pressing Trucks, etc.) and the amount of fuel consumption was approximately JOD 1,151,000 in 2015. There are also some trucks, such as the cleaning up trucks, work around the clock at a rate of 365 days a year. Therefore, the replacement of the city's fleet with electric vehicles will be a proper solution, while the drivers and maintenance personnel will be trained on how to deal with the new machines.

6. Water supply for Parks and Gardens

Development of Irrigation Methods and Saving Energy & Water Resources

The Municipality of Irbid has about 20 parks covering an area of 495,487 dunums. It also has King Abdullah II Bin Al Hussein Park that extends to 177 dunums with administrative offices of 725 square meters, restaurants of 1,675 square meters and other services.

The Municipality suffers from decreased water supply in the summer, since there are no sufficient pipelines in the municipality to deliver water to all the required places. The difficulty lies in transferring water from the available sources into the city, since they are located at a great distance and their transportation cost is very high, even though the municipality transfers large quantities of water by tankers. There is also an increasing need for municipal water due to the expansion of the construction works and population increase within the city.

Hence, the adopted measures have to assist in water savings and reducing the consumption in parallel with other works through the improvement of irrigation methods and quality of plantations, installation of water tanks in the gardens to increase storage capacity and reduction of the cost for water transport, as well as awareness campaigns to rationalize water use in the agricultural sector.

Such actions will help save 575 MWh/a, and mitigate the emissions by 154 tCO₂/a.

7. Solid Waste Management

Updating the Solid Waste Management, Collection and Transportation

Solid waste management, collection and transportation consumes a large part of the municipal budget and the development of this sector is of great importance not only to save cost, but also to improve the service, raise its efficiency and transform it into a sustainable sector through the following measures:

- Develop written procedures for collection and transfer of waste;
- Identification of tracks for collection and removal of waste and location of containers;
- Develop a staff awareness program;
- Schedule a technical inspection of vehicles and equipment;
- Develop a future plan for sorting waste from the source;
- Standardize types of machinery when buying new types;

The adopted actions in this sector will save 6,663 MWh/a, and mitigate the emissions by 1,779 tCO₂/a.

8. Local Electricity Production

Establishment of a 16 MW Solar/Photovoltaic Cell Station

Because of the population increase on one hand and the migration from neighbouring countries on the other, Greater Irbid Municipality suffers greatly from the electricity demand. The burden of its energy bill increase reached JOD 4 million

annually due to the fuels' rising prices and expansion of the Greater Irbid Municipality's organizational area. The National Electric Power Company is facing a loss of 53 piasters for every dinar of electricity consumed in the Kingdom, while the government subsidies reach 1.9 billion dinars annually.

The increase in energy consumption is attributed to the need for additional services, which are steadily growing; thus, a 16 MW solar power plant has been decided **and is among the priority actions to be implemented**. This measure could help in reducing energy expenditures, diversifying its sources and reducing harmful emissions.

The adopted action in the section will save 31,162 MWh/a, and mitigate the emissions by 20,221 tCO₂/a.

Climate Adaptation

This section of the document provides detailed description of the Climate Change Risks Assessment and Vulnerabilities Analysis. It also provides adaptation actions in each area presented below.

➤ Adaptation actions for population and public health

The extreme heat events that the municipality is facing result in increased hospital admissions for heat-related illnesses, as well as cardiovascular and respiratory disorders. Thus, the main adaptation measures suggested on national level are:

- Establishing early warning system;
- Adopting healthy buildings, through the formulation of building guidelines which include instructions for advanced sanitary installation that separate grey water from black water;
- Sustaining and improving sanitary conditions.

➤ Adaptation actions for infrastructure

Since infrastructures currently being established are intended to survive for decades to come, it is critically important that adaptation options to climate change be developed today, incorporated into design and implemented as soon as possible.

The adaptation strategies and measures suggested for the water resources sector on the national level are:

- Rainwater harvesting;
- Wastewater treatment;
- Desalination;
- Increasing Efficiency of irrigation technologies;
- Grey water Reuse;
- Public awareness.

➤ Adaptation actions for the built environment

The adaptation actions in the built environment aim to:

- improve the resilience of the built environment in the face of climate change;
- protect the wellbeing of communities through targeted policy initiatives and better urban and building design;
- ensure appropriate institutional arrangements to facilitate adaptation;
- realise economic benefits from early adaptation through effective strategic planning and risk minimization;
- advance sustainability through better resource and risk management strategies;
- increase community education and awareness about climate change risks and adaptation.

➤ Adaptation actions for Economy (Agricultural Sector)

The expected impacts of climate change, particularly the reduced agricultural productivity and water availability, threaten livelihoods and keep vulnerable people insecure.

The most important adaptation measures in Agriculture are:

- Modification of cropping patterns;

- Modification of crop calendar including planting and harvesting dates;
- Implementation of supplemental irrigation and water harvesting techniques;
- Improvement of water use efficiency;
- Use of different crop varieties;
- Modification of policies and implementation of action plans.

➤ **Adaptation actions for biodiversity (Biodiversity and Ecosystems)**

The expected impacts from climate change on ecosystems in Jordan according to the climate exposure and the ecosystem's sensitivity are droughts, forest dieback, community composition change, expansion of drier biomes into marginal lands, habitat degradation and species loss.

According to the prioritization done by the Jordan's Third National Communication report on Climate Change (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.

Commitment

As many cities are developing energy action plans in response to growing concerns over climate change, energy security and the impact from the increasing costs of energy, Greater Irbid Municipality has also set out the actions to reduce GHG emissions and meet its target. Since the SECAP is a city-wide plan, community involvement and awareness raising activities among its citizens have to be strengthened. The city will provide leadership and commit resources in order to achieve a great impact, which is a city that is economically developed, sustained and culturally preserved.

Section II: Overall strategy

Introduction

The Municipality of Greater Irbid is leading the fight inside the city against climate change, and has made it its highest priority. It has committed to reduce its overall emissions to at least 40 % below 2015 levels by 2030, conditionally and subject to availability of international financial aid and support.

The outcome targets above are accompanied by an assorted combination of numerous GHG reduction oriented actions in all involved sectors in addition to the adaptation actions in targeted sectors.

The Municipality of Greater Irbid participates in the achievement of energy and climate objectives of the Covenant of Mayors for Climate and Energy, which is a European initiative where towns, cities and regions voluntarily commit to reduce their CO₂ emissions beyond the 40 % target. This formal commitment is to be achieved through the implementation of Sustainable Energy and Climate Action Plans (SECAPs).

The purpose of the current SECAP is to help Greater Irbid Municipality reach the commitments of the Covenant of Mayors. This document contains:

- a Baseline Emission Inventory (BEI);
- a Sustainable Energy Action Plan;
- A Climate Change Adaptation plan.

BEI is a prerequisite to SECAP elaboration, which will provide knowledge of the nature of the entities emitting CO₂ on the Local Authority's territory, and will thus help select the appropriate actions. Monitoring inventories conducted in later years will help in determining if the applied actions have provided sufficient CO₂ reductions and if further actions are necessary to be launched.

The current document provides a detailed, step-by-step action plan for the entire process of elaborating a local energy and climate strategy, from initial political commitment to implementation.

It is divided into 4 parts:

- **Part I** relates to the description of the overall SECAP process and covers the strategic issues;
- **Part II** gives the methodology followed to elaborate the Baseline Emission Inventory (BEI) along with the produced data on BEI;
- **Part III** is dedicated to the description of the technical mitigation measures that can be implemented at local level by the local authority in the different activity sectors;
- **Part IV** is devoted to the climate adaptation actions to be realized in the selected impacted sectors.

Overall, this document provides the strategy and a coherent set of actions and recommendations related to energy and climate action, allowing Greater Irbid Municipality to implement the SECAP in a way that suits its own circumstances and permits it to come on board the Covenant of Mayors, while continuing to follow the approaches previously used with as little adjustments as possible.

Objective(s) and Targets

At the National level

Jordan ratified Kyoto Protocol on the 17th of January 2003. The Kyoto Protocol is an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits State Parties to reduce greenhouse gas emissions, based on the premise that Global Warming exists and human-made CO₂ emissions have caused it. The Kyoto Protocol implemented the objective of the UNFCCC to 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 on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere.

Jordan submitted its Intended Nationally Determined Contribution (INDC) with the new climate action plan to the UN Framework Convention on Climate Change (UNFCCC). This INDC comes in advance of a new universal climate change

agreement. The agreement will come into effect in 2020, empowering all countries to act so as to prevent average global temperatures rising above 2 degrees Celsius and to reap the many opportunities that arise from a necessary global transformation to clean and sustainable development.

Jordan's INDC Summary

Jordan nationally determines to reduce its greenhouse gas emissions by a bulk of 14 % until 2030. This contribution of GHGs reduction will be unconditionally fulfilled at a maximum of 1.5 % by the Country's own means compared to a business as usual scenario level.

However, Jordan, conditionally and subject to availability of international financial aid and support regarding the means of implementation, commits to reduce its GHGs emissions by an additional 12.5 % at least by 2030.

The outcome targets above are accompanied by a diverse combination of numerous GHGs cut-oriented actions in all involved emission generating sectors in addition to the adaptation actions in targeted sectors. These actions (policies, strategies, legislations, measures, etc) are articulated in this document. The methodological approaches underlying Jordan's INDCs are included in this communication as well.

At the Local Level

The municipality of Greater Irbid is committed to reduce its emissions by 40% till 2030 against the baseline emissions of 2015. Through its commitment the municipality would be achieving the Covenant of Mayors target of 40% by 2030.

This commitment is subject to the availability of funds to implement the actions presented in the SECAP. On the other hand, if the circumstances weren't achieved, the Municipality of Irbid will need to assign possible actions and measures to respect the national commitment of Jordan- INDC "Intended National Determined Contribution".

Current framework

Geographical Locations and sites

Irbid, anciently known as Arabella or Arbela, is the capital and largest city in Greater Irbid Municipality, and Jordan's second largest city located 85 km north of Amman. The area is 30 km² and rises 600 meters above sea level. The city is at an equal distance from Pella and Umm Qais and is a major ground transportation hub between Amman, Syria to the north and Mafraq to the east. The climate of Irbid is predominately of the Mediterranean type, which is characterized by hot summers and cool wet winters.

Irbid's demographic profile is a major factor affecting development opportunities. In the year 2014, according to the population census, the population of Irbid reached 535,199 living mostly in urban areas. The increase in population is attributed to the internal rural-to-urban migration, combined with the influx of refugees and migrants mainly from Palestine, and Syria.

The Municipality enjoys a number of natural components and resources, such as valleys, springs, fertile plains and diverse climate, making Irbid one of the most important agricultural areas in Jordan in terms of the percentage of cultivated land, especially in the production of citrus, olives, wheat and bee honey, and a reference model for replication because it is considered to be the main rain fed area in the Yarmouk basin. The Municipality has a number of archaeological sites, such as Um Qais, Tabaqet Fahel, and mineral baths.

The high concentration of institutions of higher education has played a key role in carving a unique identity of the city that has earned good reputation in education outputs. Irbid is a home to Yarmouk University, one of the elite centres of learning in the Middle East, and the Jordan University of Science and Technology. There are three Qualified Industrial Zones in Greater Irbid Municipality: Prince Hasan Industrial City, Cyber City, and Jordan River Crossing City, that contribute to the development of the economic and service sectors of the city. Clothing, chemicals and electronics constitute Irbid's main exports. Although Irbid is considered poor in tourism, it houses two worthwhile museums, the Clock tower, mosques and a church, and forms a good base in order to explore the northern Jordan Valley.

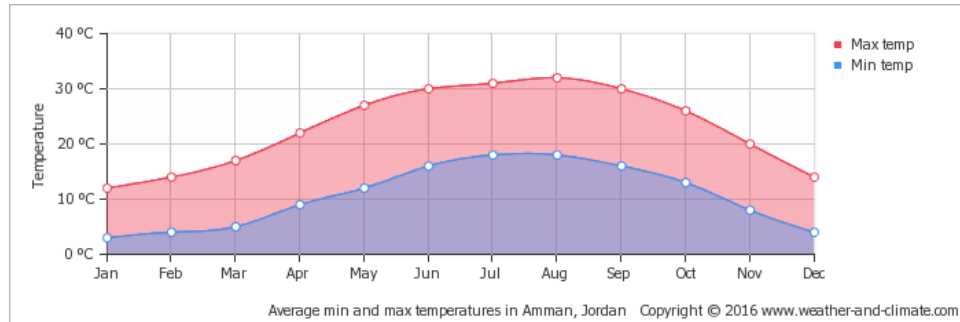
Demographic Tendencies

The demographic data from the national census of 2014 in Jordan, indicate that Greater Irbid Municipality had a population of 535,199 that year.

According to the data from the Department of Statistics, its population totalled 1.137 million persons, or 17.8% of the total population in the country. Around 59% of the Municipality's population ranges between 15 and 64 years of age, with around 38% below 15. Females constitute about 52% of the Municipality's population.

Climatic Characteristics

Greater Irbid Municipality enjoys a Mediterranean climate with hot summers and cool wet winters. The following figure shows the average high and low temperature in each month:



Employment

The estimated number of workers in the Municipality is estimated at about 252,683 individuals in 2013, or 27.7% of the total population. The level of unemployment was 13.6% in the same year, corresponding to 39,642 individuals, one of the highest rates compared to other Municipalities and the Kingdom's average. The unemployment rate among females in the Municipality stood at 28.1%, which is more than double of the unemployment rate for males at 10.6%.

A study of the relative distribution of workers in the Municipality by sector, and based on the Statistics Department data for 2013, reveals:

- The public sector in the Municipality continues to make up the highest percentage of the workforce, at 34.3%, followed by the education sector at 14.7%, the commerce sector at 13.2%, the transport sector at 7.2% and the health and social services sector at 4.7%;
- As the public sector employs the highest percentage of the workforce, this increases the salary burden in the Municipality, where the public sector employees' salaries constitute about 65% of the budget allocated for the Municipality as an average. In some municipalities, it rises to 88% of the total budget of the municipality, as in the case of Shula Municipality and 75% in New Mazar Municipality;
- In spite of the conducive natural circumstances (fertile land, water availability and diverse climate), the agricultural sector employs only 2.7% of the total workers. The same applies to the tourism sector, where the number of workers constitutes about 1.7% of the total;
- The overall contribution of some productive sectors that generate job opportunities, like tourism and agriculture, does not exceed 4.5%;
- The number of job applications to the Municipality's Civil Service Bureau reached 56,455 individuals, or 5.2% of the population, while the number of appointed persons among them did not exceed 3.2%;
- The Municipality also has 30,043 migrant workers constituting about 10.7% of the total migrant workforce in the Kingdom. This is a very high percentage compared to other municipalities, constituting 13.6% of the number of the Municipality's workers in 2012, including about 9,966 in transformation industries and 8,750 in the agriculture sector.

The Labour market in Greater Irbid Municipality was affected by the ongoing flow of Syrian refugees with the start of the crisis in March 2011. This escalated the unemployment problem in the Municipality, as the Syrian workers are taking over a number of job opportunities, which led to competition with the local workforce.

Existing Infrastructure

Roads and Drains

In Irbid, a clear preference of the local stakeholders is to implement works dealing with agricultural feeder roads. In general, roads are in quite poor condition although passable, and routine maintenance is rarely performed. The practice is to utilize budget by building the maximum length possible without including drains. A second practice is to seal all carriageways with bitumen (asphalt). Instead of including routine maintenance, the current practice is to re-seal all roads after about 4 years,

once the pavement is severely damaged. Even though Jordan may see less than 300mm of rain per year, the absence of drainage systems and routine maintenance causes roads to rapidly deteriorate.

Wastewater system

The existing sewer system in Irbid consists of three short lengths of 50 cm (20 in.) pipes having a total length of about 600 Km. Wastewater from these sewers is discharged untreated into a storm water box culvert located in the Wadi Tariq Saum. All other domestic and commercial sewage is collected and disposed of in cesspools or septic tanks. Collected septic tank solids are trucked to Wadi el Hamam and discharged untreated.

Several low- and medium-technology alternatives were formulated and analysed regarding appropriate methods of treatment and disposal of wastewater from Irbid, including direct land application of wastewater, waste stabilization ponds and biological treatment systems.

Storm water drainage system

Two major drainage basins receive storm water runoff from Irbid, namely Wadi Tariq Saum and Wadi el Hamam. Both of these basins contain existing storm water drainage facilities that are hydraulically constrained due to the location of inlets, have sediment accumulation and structural damage, carry sanitary wastewater flows and have flooding problems due to inadequate design capacity.

Solid waste disposal system

The Municipality of Irbid presently provides solid waste collection and disposal service to its residents. Currently, waste material is placed in plastic or burlap bags, and stored in vacant lots until it is picked up by a collection truck. Pick-up schedules are irregular.

Studies show that solid waste is presently generated at the rate of about 0.55 kg per capita per day (1.2 lbs/capita/day) which is less than one-half of the European or United States generation rates. Several solid waste disposal alternatives were studied, including energy recovery, landfilling, and composting. Landfilling was selected mostly on the basis of economic cost-effectiveness.

Electricity

Irbid District Electric Co. Ltd. engages in the generation, transmission, and distribution of electric power in Jordan. Its service area includes the municipalities of Irbid, Mafraq, Jerash, and Ajloun, as well as parts of the Balqa Municipality.

In addition to the power stations operated by the public utilities, there are also a number of industrial enterprises that generate electricity in their own plants. Some of these also feed excess electricity into the Jordanian interconnected grid. Since the amount of electricity generated in Jordan has for some years been insufficient to cover the country's needs, additional power used to be imported from Egypt and Syria. However, due to the circumstances in the region, import has either been stalled completely (Syria, since 2012) or reduced (Egypt).

Jordan updated its **Master Strategy for Energy** for the period of 2007 to 2020, which had initially been drafted in 2004. The strategy aims at reducing energy imports through diversification of the energy mix by using local resources such as shale oil, nuclear power and renewable energies.

Street Lighting

The Greater Irbid Municipality will launch a tender for the upgrade of its street lighting system ("LED Investment") and the construction and operation of a solar power plant to produce electricity for its own needs under a long-term concession type of arrangement ("PV Investment"), collectively, the "Project".

The Municipality is also interested in assessing and evaluating options to generate renewable energy as a means to reduce the cost of electricity which it currently pays. It is expected that this will be achieved through the construction and operation of a 16MW photovoltaic plant (the "PV Plant") which will generate electricity exclusively for the City's own needs, including, but not limited to, the street lighting needs of Irbid.

Education

There are around 70,000 registered students in Irbid's 10 universities, community colleges and institutes, of whom 8,000 were international students from 47 countries. This concentration of higher education institutions has played a key role in carving a unique identity of the city.

The largest universities in Irbid are:

- Yarmouk University;
- Jordan University of Science and Technology;
- Irbid National University;
- Al-Balqa` Applied University (Irbid campus);
- Jadara University.

Legal Stand

The CES-MED project has been approved by the Ministry of Planning and the Municipality of Greater Irbid, As a result, the municipality has appointed a technical committee to follow up the preparation and implementation of the city's SECAP.

The following is copy of an internal letter which has been provided as evidence for this support.



Also, meetings with the concerned department to follow up the development of the SECAP have been realized and workshops have been conducted with the support of national authorities and the local community, as well as the participation of NGOs.



Complementary with the national actions

CES-MED in Jordan is coordinated under the Ministry of Planning and International Cooperation, and with the National Coordination Group (NCG). CES-MED partners with three municipalities for the development and implementation of Sustainable Energy and Climate Action Plans:

- Aqaba in the South, falling under the Aqaba Special Economic Zone Authority (ASEZA);
- Irbid in the North, falling under the Ministry of Municipal Affairs (MoMA);
- Kerak in the Middle highlands, falling under MoMA.

EU initiated the Cleaner Energy Saving Mediterranean Cities Project (CES-MED) to support the efforts of local authorities in eight South Mediterranean Partner Countries of the European Neighbourhood and Partnership Instrument (ENPI), including Jordan. The project aims at:

- Developing the local authorities' capacities to formulate and implement sustainable local policies;
- Expanding the use of sustainable policies, such as solutions to renewable energy, measures to reduce CO₂ emissions, efficient water and waste management, and environment-friendly public transport;
- Increasing the awareness and responsiveness of national authorities to the need for and benefits of strong involvement of cities in local sustainable policy issues.

Complementary with the local authority plans and other related actions

CES-MED project has been approved by the Greater Irbid Municipality and the development of a SECAP in the city is in line with the city's vision.

Short description of the Municipality

Greater Irbid Municipal council is elected by local residents for a four-year term. The council consists of 31 members, who represent the city's districts.

The Municipality of Greater Irbid was first formed in 1881 and so far, new elections are held every four years to appoint new elected members.

Vision for the future

Greater Irbid Municipality's vision is drafted by the members of the local committees and is based on their long-term view of the future state of the city, especially from its sustainable perspective. Based on this rationale, the vision is:

"A Municipality that is economically developed, sustained and culturally preserved to invest in the sectors of agriculture, industry and tourism and that stimulates entrepreneurship, empowerment and sustainability for the purposes of employment, capacity building of individuals, and improving the quality of life of all community's groups at present time and in the future, in cooperation with local and international partners."

Organizational and financial aspects

Coordination with national and local authorities

The Municipality Law No.13 (2011) describes the responsibilities of the Municipalities in Art 40. Municipalities are responsible for:

- City Planning;
- Building Permits – Procedures are regulated by JNBC law see Building Sector;
- Commercial Licensing;
- Public Lighting;
- Waste Collection (and licensing);
- Maintenance management.

Furthermore, municipalities can be owners of buildings (Art.43), can charge fees for licensing procedures (Art. 44), and can, in principle, take loans (Art. 45). However, MoPIC indicated to CES-MED that the Government of Jordan (GoJ) is not interested in increasing the financial burden by taking up more loans.

Municipalities are in a legal position to collect fines (Art.50) and set their own budget (Art.55), which is approved on an annual basis by the Prime Minister. During the fiscal year, changes to the approved budget are possible; this has to be approved by the Minister of Municipal Affairs.

Licensing procedures are defined by the Ministry of Trade and Industry; municipalities have to follow these national regulations and cannot make changes.

For procurement, municipalities are bound by the regulations set by MoMA, or by MEMR for energy specific projects. In tendering and procurement procedures, municipalities have to follow the national procedures for tendering (Art.58). Tendering related to buildings runs through the Ministry of Public Works and Housing (MPWH), this is a factor that may result in time delays and should be considered in implementation planning.

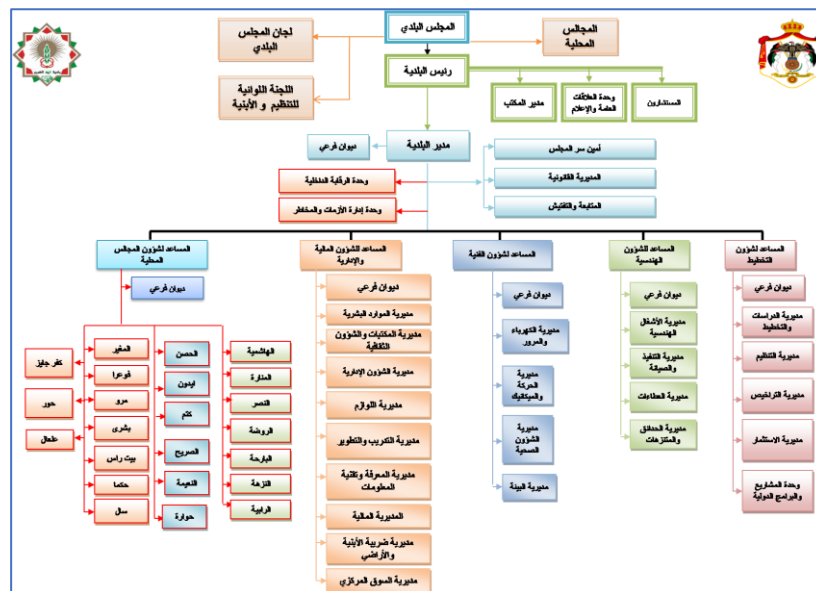
If municipalities are considered as governmental entities (official departments, official public institutions, or public corporations), law No. 73 (2012) on Regulating Procedures and Means of Conserving Energy and Improving its Efficiency (Art.11/a) is applicable and municipalities can develop direct proposals and tendering schemes for RE and EE projects, see below under Energy Sector.

For Public Private Partnership and ESCO projects municipalities need to seek approval by the Minister of Municipal Affairs.

For the purposes of implementing the provisions of this law, municipalities are classified into four categories (Art.4), according to their population size.¹

Adaptation of administrative structure.

Greater Irbid Municipality has an administration structure well described in the Chart below. There are four Assistant Directors for Planning, Engineering, Technical, Financial & Administration and the fourth administration is for Local councils. Each Directorate has a well-developed structure and organised work.



Organizational structures created/assigned to prepare and implement the SECAP

The implementation of the Action Plan requires the participation of all municipal administrations, which in turn requires that these departments work in harmony and avoid collision in the course of implementation. This requires a special department that works independently on the development of the working frameworks and coordinates with each other for good implementation, monitoring and evaluating the results, and re-evaluating the most successful work plan. The existence of a special unit that performs these functions is called the SECAP Unit and should be able to tackle this work and be supported directly by the Mayor.

Involvement of stakeholders and citizens

The involvement of stakeholders and citizens is a key factor in the successful accomplishment of the Sustainable Energy and Climate Action Plan (SECAP). For that reason, a Communication Awareness Promotion Plan (CAPP) with a dedicated strategy for the involvement of stakeholders has been developed and is part of this report, where involving stakeholders in planning is a fundamental duty of local authorities to ensure the legitimacy and quality of decision making.

¹ Florentine Visser, Recommended National Sustainable Urban and Energy Savings Actions Report, CES MED, 2015

The Communication Awareness Promotion Plan (CAPP) is dedicated to a common plan for the involvement of stakeholders in the process and includes an engagement strategy and timeline as well as an overall strategy and activities. It includes proactive information of the public and involvement of the key stakeholder groups throughout the process.

The CAPP will ensure a well-structured involvement of the relevant stakeholders throughout the key stages of the planning and implementation process, so as to improve the quality of life for the citizens, and strengthen the vitality of civil society and local political culture. Also, this will support improving the overall quality, effectiveness, (cost) efficiency, transparency, acceptance and legitimacy of the SECAP.

Budget

The calculated budget for the implementation of SECAP is 212,151,735 JOD (299,226,706 USD) for the SEAP actions and 70,750,000 JOD for the adaptation plan.

Foreseen financing sources for the investments within your action plan

Please refer to the national recommendation report on Jordan Donors and other Funding Initiatives in the Areas of Sustainable Development at the Local Level available at <http://www.ces-med.eu/publications/jordan-report-donors-and-other-funding-initiatives-areas-sustainable-development-local>

Section III: Baseline Emission Inventory

Introduction

The Baseline Emission Inventory (BEI) quantifies the amount of CO₂ emitted due to energy consumption in the territory of the local Authority in the baseline year. It allows to identify the principal anthropogenic sources of CO₂ emissions and to prioritise the reduction measures accordingly.

Elaborating a BEI is of critical importance. This is because the inventory will be the instrument allowing the local authority to measure the impact of its actions related to climate change mitigation. The BEI will demonstrate the local authority's starting point, and the successive monitoring emission inventories will show the progress towards the objective. These emission inventories are very important elements to maintain the motivation of all parties willing to contribute to the local authority's CO₂ reduction objective, allowing them to see the results of their efforts.

Methodology

This section describes the methodological principles of data collection, the emission source categories inventoried, the origin of data for the analysis and the calculation methods used.

The method adopted in the BEI calculation utilizes the 'standard' emission factors' approach, in line with the Intergovernmental Panel on Climate Change (IPCC) principles and complies with the United Nations Framework Convention on Climate Change (UNFCCC) reporting system.

CO₂ emissions from energy consumption within the local authority's territory will be calculated either directly due to fuel combustion in this area, or indirectly via fuel combustion associated with electricity and heat/cold usage within the area.

The emissions of CH₄ and N₂O will not be calculated.

CO₂ emissions from the sustainable use of biomass/biofuels, as well as emissions of certified green electricity, will be considered zero.

The standard emission factors will be based on the IPCC 2006 Guidelines (IPCC, 2006).

Base line year

Baseline year is the year against which the achievements of the emission reductions in 2030 shall be compared. The base line year selected is **2015**.

Per capita target:

The local authority has set the target as 'per capita'.

In this document, the emissions in the baseline year 2015 are divided by the population, and the target for year 2030 is calculated on that basis. This approach has been adopted, although not encouraged by the Guidelines for South signatories, because of the very heavy influx of refugees.

Activity Data

Activity data quantifies the human activity occurring in the territory of the local authority, for example:

- Oil used for transportation [MWhfuel];
- Electricity consumed in buildings [MWhe];
- Heat consumed by buildings [MWhheat].

Sectors for the activity data

- Municipal Buildings, Facilities, Equipment;
- Tertiary Buildings, Facilities, Equipment;
- Residential buildings' Electrical Consumption, Fuel for Heating Consumption;
- Public Lighting;
- Transport within the Municipality's area, Municipal Fleet, Public Fleet, Private and Commercial Transport.

Procedures

The approach requires a set of procedures:

- Interview with data resources employees and evaluation of the data available;
- Collection and processing of quantitative data;
- Establishment of indicators;
- Gathering of qualitative information using review of literature studies and interviews /workshops with the municipal personnel;
- The selection of data sets will be based on criteria agreed with the Municipality, who are then actively involved in contributing these data.

Resources

- Municipality of Greater Irbid;
- Irbid Electric Co.

Methodology line-up

- Identification of the needed data for the baseline emission;
- Interview with data resources' representatives;
- Selection of the relevant data for the inventory;
- Assessment & validation of the collected data;
- Check of the accuracy level of the collected data;
- Sorting the collected data.

Emission factors

Emission factors are coefficients which quantify the emissions per unit of activity. The emissions are estimated by multiplying the emission factor with the corresponding activity data. Examples of emission factors are the following:

- amount of CO₂ emitted per MWh of oil consumed [t CO₂/MWh_{fuel}];
- amount of CO₂ emitted per MWh electricity consumed [t CO₂/MWh_e];
- amount of CO₂ emitted per MWh heat consumed [t CO₂/MWh_{heat}].

Emissions from Kerosene and Diesel fuel

- The power consumption from space heating
- The calculation of GHG emissions for heating fuel consumption can be calculated with the following formula in accordance with the IPCC guidelines and the assumption that the combustion is ideal:

$$EFC = Eff \times Fuel \times NCV \times D \times 10^{-6}$$

Where:

EFC	CO ₂ emissions for fuel combustion in tCO ₂
Fuel	Amount of Fuel (Diesel) in litres consumed in a year
Eff	Emission Factor of Fuel. For Diesel = 74.1 tCO ₂ /TJ and for Kerosen 71.9 tCO ₂ /TJ
NCV	Net Calorific Value. For Diesel it is 43.33TJ/Gg and for Kerosen 43.8TJ/Gg
D	Density of Diesel equals 0.8439 Kg/litre, Density of Kerosen equal 0.795 Kg/litre
10⁻⁶	To convert from Gg to Kg

(Values obtained from Table 1.2, table 1.4, chapter 1, Volume 2, IPCC 2006 inventory guidelines).

The conversion factor between Litres to KWh (EMEP/EEA 2009; IPCC, 2006)

Table 1 Fuel conversion factor KWh/L

Fuel	Conversion factor KWh/L
Gasoline	9.2
Diesel	10
Kerosene	9.7

Emission factor for fuels (IPCC, 2006)

Table 2 Fuel conversion factor t/MWh

Fuel	CO2 Emission factor t/MWh
Gasoline	0.249
Diesel	0.267
Kerosene	0.259
LPG	0.227

Emissions from Electrification in Jordan

The calculation for GHG emission from power consumptions of the tertiary sector are realized in line with the equation below:

$$ECO_2 = ET \times NEFE$$

- ECO₂** CO₂ emissions of Electrical Consumption in year tCO₂
- ET** Actual power consumption for tertiary sector in KWh.
- NEFE** National Emission Factor for electricity [tCO₂/MWh] (0.649).

Emissions from Transportation

In Greater Irbid Municipality, the GHG emission is mostly attributed to the transportation sector. The consumption data will be taken from those provided by the local authority and the Municipal team. The calculation for GHG emissions from fuel combustion in the transport sector can be calculated according to the following formula in accordance with the IPCC guidelines:

$$EFC = Eff \times Fuel \times NCV \times D \times 10^{-6}$$

Where:

- EFC** CO₂ emissions for fuel combustion in tCO₂
- Fuel** Amount of Fuel (Gasoline/Diesel) in litre consumed in a year
- Eff** Emission Factor of Fuel (Gasoline /Diesel) in tCO₂/TJ. Gasoline 69.3 tCO₂/TJ, Diesel 74.1 tCO₂/TJ t
- NCV** Net Calorific Value of gasoline is equal to 43.TJ/Gg, Diesel is 43.TJ/Gg
- D** Density of Gasoline 0.7407 Kg/litre, Diesel 0.8439 Kg/litre
- 10⁻⁶** To convert from Gg to Kg

(Values obtained from Table 1.2, table 1.4, chapter 1, Volume 2, IPCC 2006 inventory guideline)

Building and facilities

Electricity Sector

Summary of Electrification Consumption in Greater Irbid Municipality

The following table indicates the electrification consumption in Greater Irbid Municipality.

Table 3 Electrification consumption per sector in Irbid year 2015- EF: 0.649 tCO₂/MWh

Electrification consumption per sector		Emission In tCO ₂
Irbid	MWh	
Residential Sector	500,188	324,622
Tertiary Sector	571,973	371,210
Municipal	1,296	841
Public lighting	23,837	15,470
Total	1,097,294	712,143

Analysis of Electricity consumption per area

Municipal Buildings and facilities

Municipality Consumption of Electricity	
	MWh
Municipality	1,296

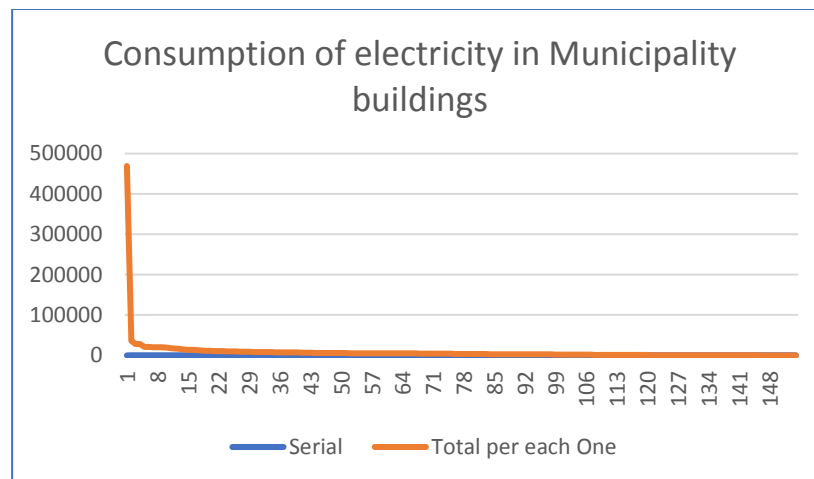


Chart 2 Consumption of electricity in Municipal buildings in 2015

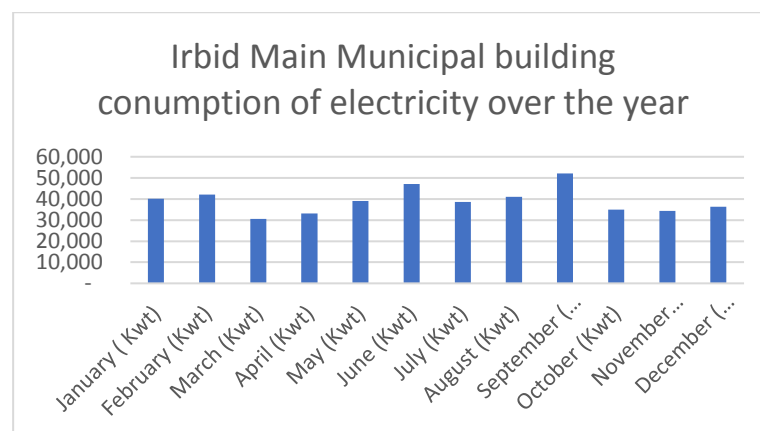


Chart 3 Monthly consumption of electricity in Greater Irbid Municipality in 2015

Tertiary Sector

The tertiary sector comprises from Municipal and commercial buildings and all sectors which do not belong to the residential one. It is noticed that the consumption in the governmental sector reaches 17.64% and in the non-governmental one the rest 82.36% of Irbid consumptions.

Tertiary sector consumption of electricity	Governmental sector	Non-Governmental sector
MWh		
Tertiary Sector	571,973	471,091

Governmental sector

Table 4 Tertiary sector –Municipal electricity consumption in 2015

Tertiary sector – Municipal Electricity Consumption	
MWh	
Hospital and health Centre	6,176
Schools, Institutes and Universities	45,276
Water supply	24,068
Governmental	21526
Mosques and churches	3,836
Total	100,882

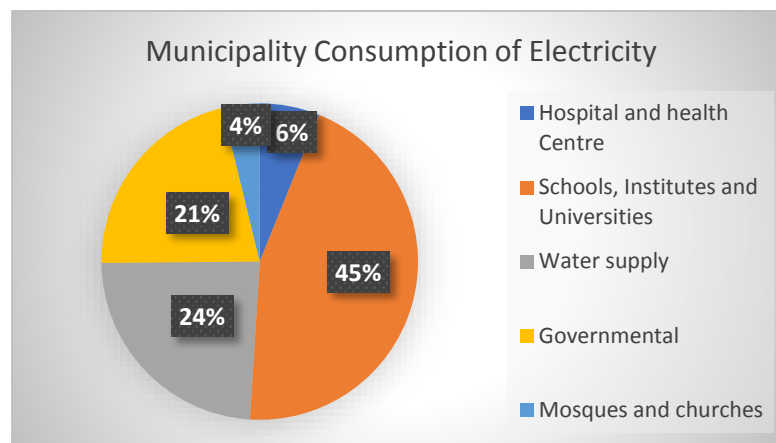


Chart 4 Tertiary sector –Municipal electricity consumption in 2015

Non-governmental

Table 5 Tertiary sector's non-governmental electrification consumption in 2015

Tertiary sector non-governmental Consumption of Electricity	
MWh	
Commercial sector	130,580
Hospitals private	2,806
Universities private	1,527
Banks	4,823
Communication	9,620
Hotel	1,112
Others	317,944
Agriculture	2,679
Total	471,091

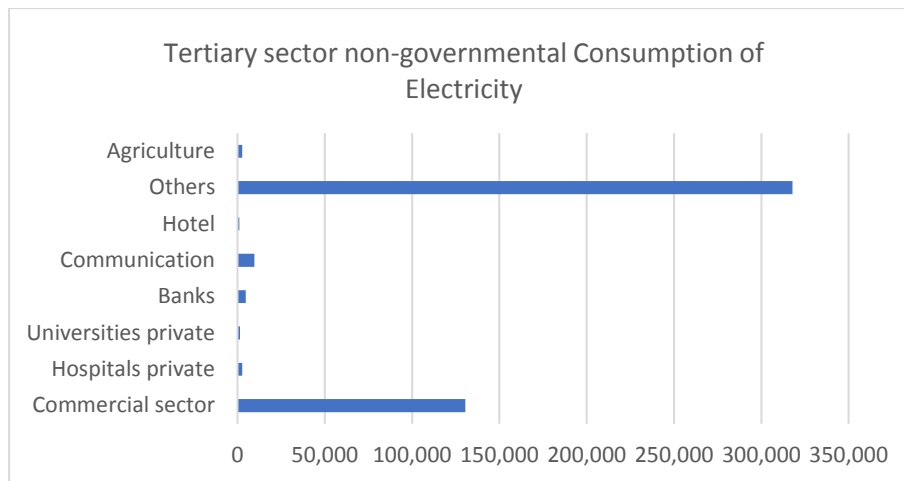


Chart 5 Tertiary sector's electricity consumption in 2015 (MWh)

Comparison between Hospitals, Health centres, Clinics, Schools, Universities, Municipal Sector

Table 6 Comparison between Private and Municipal hospitals and schools in Irbid

Sector	Consumption of Electricity in MWh	
	Municipal	Private
Hospital and Health Centres	6,176	2,806
Schools and Universities	45,276	1,527

As the local authority consumes 21% of the total electricity consumption in Irbid, since all of the governmental buildings are concentrated there and represent an important consumption core, it plays an important role in implementing policies and promoting energy efficiency in Buildings, through leading by example. This will be realized by applying energy efficiency measures in their buildings and promoting the Energy Efficiency (EE) technologies among building owners throughout the community.

Furthermore, the Local Authority can support increased building efficiency by working with community groups and considering voluntary and regulatory policies.

It is very important to provide the Local Authority with tools and resources, such as the Energy Codes to set minimum energy efficiency standards for building technologies and design elements that may include: the building envelope; heating, ventilation, and air conditioning (HVAC) systems; lighting; and service water heating systems etc.

This should be accomplished by developing specific tailored programs to help local officials improve energy efficiency and reduce greenhouse gas emissions for multiple building types in their community. The financial benefits of applying energy efficiency measures on buildings can help the local authority's efforts to reduce energy costs and greenhouse gas emissions.

The role of other groups in the community is very important in supporting awareness raising activities on the environment and promoting behavioural change and energy savings.

For that, it is important to have Building energy codes as regulatory instruments that specify minimum energy efficiency standards for the residential and commercial building sectors, and mandate certain energy efficiency characteristics for building technologies. With their effective implementation, the building energy codes can support energy cost savings and complementary benefits associated with electricity reliability, air quality improvement, greenhouse gas emission reduction, increased comfort, and economic and social development.

Residential Sector

Irbid witnessed a rapid population growth in the latest years which affected their urbanisation, since this increase was a combination of many factors of natural and internal migration from rural communities to the city. But the most significant one is the migration from neighbouring countries due to wars and political conditions.

With the crisis in Syria entering its fifth year, the number of Syrians in Jordan has risen to 1.4 million, including 628,175 registered refugees in various parts of the Kingdom, according to the data of the UNHCR. A total of 240,250 are dispersed

throughout Greater Irbid Municipality, constituting 23.3% of the total number of refugees in the Kingdom (Organization, 2016 – 2018).

Coming to the electricity consumption in the residential sector, the figures show that it consumes 500MWh according to the baseline year of 2015, which represents 44 percent of the city’s total electricity consumption. This consumption covers around 237,000 houses with 1,137,000 inhabitants.

The average consumption per house is 3,216KWh per year, namely 8.8KWh per day.

This need has been definitely recognized at the national level, since Jordan passes new building codes requiring solar water heaters on all new commercial and residential buildings, in an effort to reduce the electricity consumption.

In order to come up with real action and implement policies to sustain energy transition to reach a higher efficiency, there is a need to collect precise information on the factors that influence energy consumption and to **establish Smart grids** to collect some information on consumer behaviour as well.

Studying different types of factors, such as **socio-demographic, economic and dwelling characteristics**, will be useful tools to help policy makers and energy producers set their actions.

Energy conservation measures can potentially lead to substantial reductions in energy demand growth, environmental damages and public expenditures.

The implementation of in depth **study on household appliances** in Jordan would model the effect of mandatory appliance standards on electricity consumption, and support the energy key players to translate the real situation to productive actions in energy mitigation and help in developing the initiatives and programmes contributing to economic development. Introduction of appliance standards, and more specifically **introduction of mandatory standards for energy efficiency** for four different household appliances (refrigerator/freezers, AC split units, washing machines and lighting) would significantly support the reduction of the energy bill.

Therefore, establishment of an **energy labelling system** and setting **Minimum Energy Performance Standards** for household appliances will be important steps that will support maximizing the efficient use of energy and the use of renewable energy.

A lot of important steps need to be addressed, such as:

- Enhanced capacity on the national and local authorities’ level, and for the energy agency units responsible for the appliances’ Energy Efficiency (EE) policy development, implementation and market surveillance;
- Structured verification and enforcement of appliance labels and standards;
- Enhanced consumer awareness of appliance energy efficiency characteristics, standards and labels and the costs and benefits of more efficient products;
- Increased capacity of manufacturers to produce and market Energy Efficient (EE) appliances;
- The usage of electrical water heater and replacement with solar water heater is an important step to be addressed.

Public Lighting Sector

The public lighting consists of street and traffic lights, where the street lights consume the largest proportion of energy due to the usage of High Pressure (HP) lamps. The municipality has successfully converted two percent of the HP lamps to LED. The plan will be continued but it requires technical alignment to improve its achieved results.

Table 7 Public street lighting consumption in 2015

Sector	Lamp Type in watt	Annual Consumptions in KWh	Quantity of Lamps
Street lighting	HPM 125	13,901,184	25,275
	HPS 70	5,792,160	18,806
	HPS 150	2,316,864	3,510
	HPS 250	1,158,432	1,053
	LED 125	550,000	1,000
Traffic Light	LED	118,360	
Total		23,837,000	49,644

By applying the new technology in the LED drivers, the lamp can be dimmed after midnight, contributing in energy savings and extending its life time. The use of astronomical timers helps adjusting street light operation according to the Dusk and Dawn, which could save 365 hours per year and also will avoid worthless functioning at cloudy days and with broken photocells. All those benefits could be achieved through a well-developed, organised and monitored plan.

Table 8 below summarises the possible achievements based on the above suggestion:

Table 8 Proposed development for the public street lighting in Irbid

Sector	Lamp Type in watt	Lumen per watt	Replacement lamp	Equivalent LED lamp	Quantity of Lamp	Annual consumptions with LED lamps in KWh	
Street lighting	HPM	125	50	137	46	25,275	5,073,425
	HPS	70	117	137	60	18,806	4,946,589
	HPS	150	117	137	128	3,510	1,978,636
	HPS	250	117	137	160	1,053	741,396
Total actual consumption						23,718,640	
Estimated consumption with				LED lights		12,740,046	
Estimated consumption with				Dimming control		9,979,703	
Estimated consumption with				Astronomic timer		9,072,457	

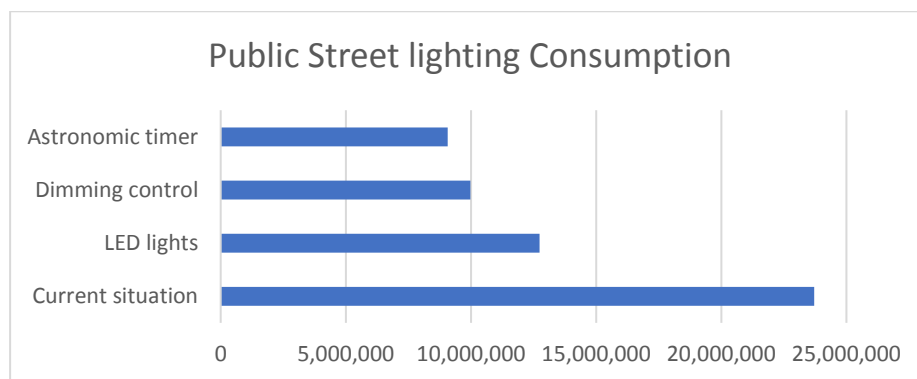


Chart 6 Scenario of reduction in consumption for proposed actions in Irbid (in kWh)

Fuel consumptions

The fuel consumption details were provided by the Ministry of Energy and Mineral Resources for the Governorate of Irbid that counts for 1,770,000 inhabitants, where Greater Irbid Municipality represents around 867,859. The data below have been calculated using per capita consumption indicators from the Governorate level to the Municipal one

Fuel consumption for space heating

Table 9 Kerosene Fuel consumptions in 2015

Fuel type	Kerosene/Governorate	Kerosene/Municipality
In litre	6,432,755	3,154,081
MWH	62,384	30,588
tCO ₂	16,158	7,922

Liquefied Petroleum Gas LPG consumption for heating and cooking

Table 10 LPG fuel consumption in 2015

Fuel type	LPG/Governorate	LPG/Municipality
In KG	102,000,000	50,012,213
MWH	1,336,200	655,160
tCO ₂	303,317	148,721

Fuel consumption for Transportation for all sectors

Table 11 Diesel and Gasoline fuel consumption in Irbid Governorate in 2015

Fuel type	Diesel	Gasoline 90	Gasoline 95
In litre	45,516,860	51,992,364	1,335,162
MWH	455,169	478,330	12,284
tCO ₂	121,530	119,104	3,059

Table 12 Diesel and Gasoline fuel consumption in Greater Irbid Municipality in 2015

Fuel type	Diesel	Gasoline 90	Gasoline 95
In litre	20,017,637	25,192,679	654,651
MWH	200,176	231,773	6,023
tCO ₂	53,447	5,771	1,500

Fuel consumption for Municipal Transportation

Table 13 Fuel consumption in Irbid Municipality in 2015

Fuel type	Diesel	Gasoline 90
In litre	2,300,000	300,000
MWH	23,000	2,760
tCO ₂	6,141	687

Summary of Energy consumption and GHG emission

Table 14 Summary of energy consumption with GHG emissions in Irbid in 2015

Sector	MWH	tCO ₂
Municipal buildings, equipment/facilities	1,474	889
Tertiary buildings, equipment/facilities	571,973	371,210
Residential buildings	1,185,936	481,266
Public lighting	23,837	15,470
Municipal fleet	25,760	6,828
Public transport	-	-
Private and commercial transport	431,949	111,158
Total	2,240,929	986,821

Baseline year: 2015

Greenhouse gas emissions and final energy consumption per capita

Emission factor	t CO ₂ (eq.) /capita	MWh/capita
	1.1	2.6

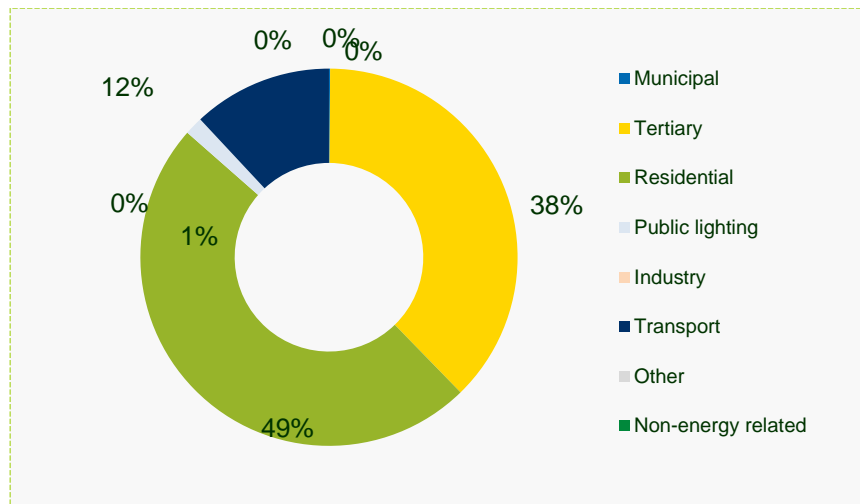


Chart 7 Greenhouse gas emissions per sector

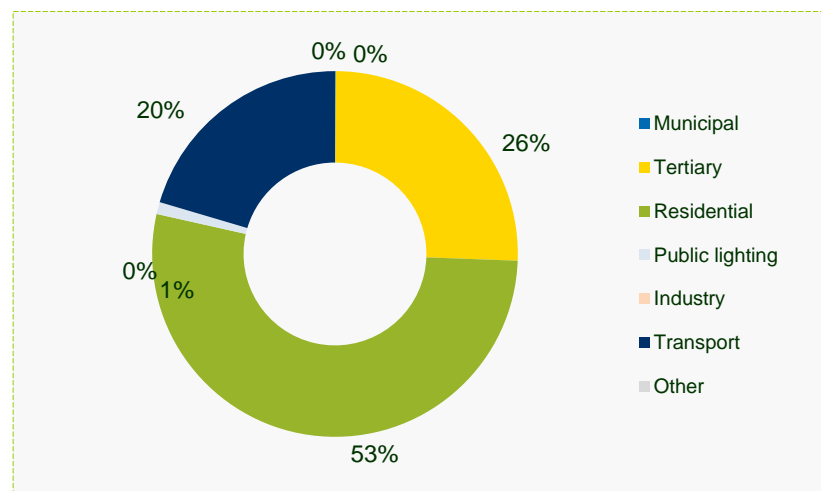


Chart 8 Final energy consumption per sector

Business as usual

The expected increase in consumption for Jordan for the 2030 horizon, according to the JRC report and 2015 as base year is 1.62%. The table below indicates the expected energy consumption if the municipality does not take any action to regulate the consumption of energy in the city.

Table 15 BAU scenario per sector for year 2030

BAU Scenario per sector	MWH	tCO ₂
Municipal buildings, equipment/facilities	2,389	1,440
Tertiary buildings, equipment/facilities	926,596	610,627
Residential buildings	1,921,216	779,651
Public lighting	38,616	25,062
Municipal fleet	41,731	11,061
Public transport	-	-
Private and commercial transport	699,757	180,302
Total	3,630,305	1,608,143

The BEI Tables

Baseline Emission Inventory	
1) Inventory year	2015
2) Number of inhabitants in the inventory year	867859
3) Emission factors	<input checked="" type="checkbox"/> IPCC <input type="checkbox"/> LCA (Life Cycle Assessment)
4) Emission reporting unit	<input checked="" type="checkbox"/> tonnes CO ₂ <input type="checkbox"/> tonnes CO ₂ equivalent

Sector	FINAL ENERGY CONSUMPTION [MWh]															Total	
	Electricity	Heat/cold	Fossil fuels							Renewable energies							
			Natural gas	Liquid gas	Heating oil	Diesel	Gasoline	Lignite	Coal	Kerosen	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal		
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES																	
Municipal buildings, equipment/facilities	1474																1474
Tertiary (non municipal) buildings, equipment/facilities	571973																571973
Residential buildings	500188			655160							30588						1185936
Public lighting	23837																23837
Industry	Non-ETS																0
	ETS (not recommended)																0
Subtotal	1097472	0	0	655160	0	0	0	0	0	0	30588	0	0	0	0	0	1783220
TRANSPORT																	
Municipal fleet							23000	2760									25760
Public transport																	0
Private and commercial transport							200176	231773									431949
Subtotal	0	0	0	0	0	0	223176	234533	0	0	0	0	0	0	0	0	457709
OTHER																	
Agriculture, Forestry, Fisheries																	0
TOTAL	1097472	0	0	655160	0	0	223176	234533	0	0	30588	0	0	0	0	0	2240929

Sector	CO ₂ emissions [t] / CO ₂ eq. emissions [t]															Total	
	Electricity	Heat/cold	Fossil fuels							Renewable energies							
			Natural gas	Liquid gas	Heating Oil	Diesel	Gasoline	Lignite	Coal	Kerosen	Biofuel	Plant oil	Other biomass	Solar thermal	Geothermal		
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES																	
Municipal buildings, equipment/facilities	957	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	957
Tertiary (non municipal) buildings, equipment/facilities	371210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	371210
Residential buildings	324622	0	0	148721	0	0	0	0	0	0	7922	0	0	0	0	0	481266
Public lighting	15470	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15470
Industry	Non-ETS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	ETS (not recommended)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	712259	0	0	148721	0	0	0	0	0	0	7922	0	0	0	0	0	868903
TRANSPORT																	
Municipal fleet	0	0	0	0	0	0	6141	687	0	0	0	0	0	0	0	0	6828
Public transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Private and commercial transport	0	0	0	0	0	0	53447	57711	0	0	0	0	0	0	0	0	111158
Subtotal	0	0	0	0	0	0	59588	58399	0	0	0	0	0	0	0	0	117987
OTHER																	
Agriculture, Forestry, Fisheries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER NON-ENERGY RELATED																	
Waste management																	0
Waste water management																	0
Other non-energy related																	0
TOTAL	712259	0	0	148721	0	0	59588	58399	0	0	7922	0	0	0	0	0	986890

That is achieved through:

Conducting evaluation studies for all procedures, transactions and services in the municipality and identifying all items to implement a computerized information system in all departments and regions of the various municipalities with the decentralization concept. Connecting these departments and regions with an information system enhances the coordination and integration between them to save time and effort on the employee and citizen at work and to access accurate and correct information associated with any transaction or service, as well as reducing potential risks and facilitating the ongoing procedures:

- setting the correct items, material names, organizational structure and job descriptions;
- setting an effective monitoring and evaluation system corresponding each procedure in the new system;
- introducing a management accounting and costs department to identify the causes of the failures and provide the accurate and necessary information to decision makers.

Electronic Management Requirements:

- Strong, fast and secure network infrastructure;
- Strong information structure (robust and compatible information systems);
- Well - trained staff on the use of modern technologies to set up investments in skills;
- A member of the technical staff capable of carrying out continuous technical support and developing various information systems.

General objectives

- Unifying the working procedures in each municipality, to share best practices that could serve the municipality and all parties concerned;
- Clarifying the organizational structure's dimensions in the municipality's regions and departments in accordance with the institutional work and strengthening the organizational context;
- Precise identification of the employment qualifications to ensure quality and unified standards of the working procedures;
- Building and strengthening the supervision and evaluation unit in the municipality to monitor and assess the work of the municipality's departments and regions;
- Training and developing the capacities of the personnel in applying the information system in the municipality;
- Unifying the efforts of all community sectors to effectively engage all partners from the public and private sectors, civil society institutions and municipalities;
- Stimulating the untapped potential of employees and community to help its citizens live a better life;
- Reducing potential fraud by studying the weaknesses and setting effective control measures;
- Developing the procedures and institutional work in the municipality to achieve decentralization in its various departments and regions;
- Improving the municipal financial standards and their ability to provide income, reduce costs and ensure services;
- Raising the institutional capacities of the municipality;
- Enhancing the efficiency and capacity planning, as well as implementing and establishing development strategies and investment planning;
- Implementing projects efficiently and effectively with a focus on the use of available resources and the application of computerized systems, to raise the efficiency of the municipal management.

Objectives of E-management:

- Developing public administration: reducing paperwork and reusing solutions;
- Improving services: reducing transport, improving connectivity of services, and easy accessibility to information;
- Approaching citizens (employees): direct interface for the citizen (employee), and undertaking easy procedures;
- Improving the economic competitiveness: the use of the Internet for global trade, and giving the opportunity for SMEs to enter the competition;
- Reducing costs: systems integration to support the internal and external procedures.

Benefits of e-management:

- Quick implementation of work;
- Enhancing decision-making processes by making information accessible for decision makers;
- Reducing administrative costs while increasing performance;
- Overcoming geographical and temporal barriers;
- Addressing bureaucracy and bribery;
- Developing work mechanism and staying updated on the latest trends;
- Improving the employees' administrative efficiency.

Action NO.	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
1.0	Transition of Municipal work from traditional management to electronic management						
1.1	Automate the Municipality and transfer all municipal and paper-based information to electronic information.						
1.2	Securing the necessary infrastructure to connect all Municipal departments with a single information network and exchange of information between different departments.			1,434	357	24.8%	1,000,000
1.3	Determine all transactions between the citizen and municipal departments and convert them into electronic transactions.						

Transforming the Main building of Greater Irbid Municipality into a Green Building

Background

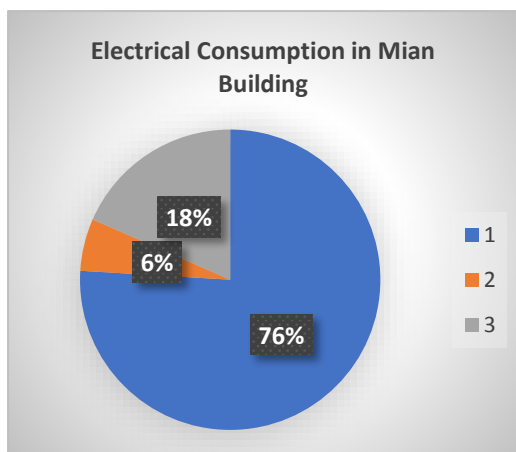
Greater Irbid Municipality has a main building erected for more than twenty years and located in the old city center.

It has several floors housing most of the main municipal departments which are mostly crowded during the working hours. The building has several meeting rooms and a large main hall for big ceremonies and events.

The Schiller system is used for cooling with a thermal capacity of 120 tons and cooling units (2 tons thermal) distributed among the rest of the building, providing an estimate of sixty units. The lighting system in the building is mostly fluorescent with a narrow use of the modern type of LED.

The building contains a central heating system which is often used during the very cold months consuming about 18,000 liters of diesel fuel per year. This rate varies in accordance with the weather conditions and low temperatures. Electric heating units, or electric heaters (candles) at other times, are used for heating.

The building also consumes about 469,223 kWh of electricity per year at a rate of 1,564 kWh per working day. The main building's energy consumption cost is responsible for about 36% of the total municipal buildings, thus the building is imposing an enormous economic burden on the financial cost that reaches JOD 651,780 annually (920,000 USD).



A review of the consumption of electricity throughout the year shows that the lower consumption periods are those when the temperature was at average levels and the use of air conditioning or heating is not required. The monthly consumption rate reaches about 30,544 kWh and increases to 52,064 kWh in the hot summer periods. According to the consumption analysis, it was noted that lighting has the

highest contribution, accounting for 76% of total the consumption.

Mitigation			
MWh/a	t CO2/a		
493.0	307.0		
Contribution for			
21.5%			
Cost of Implementation			
32,000 JOD*			
Involvement of Stake Holders	LA	H	
	External	L	
	Other	L	
Staff Capacity	L	M	H
Years of Implementation			
[Progress bar]			
Key performance Indicator			
Energy consumptions			
Measurement Units			
MWh			
Area of intervention			
Integrated action			
Policy Instrument			
Energy management			
Origin of action			
LA			
Priority of action			
[Progress bar]			

	NO
Fluorescent lamps 36x 2 watt	1,200
Fluorescent lamps 18x 4 watt	48
400 watt light projectors HMI	8
500 WATT LIGHT PROJECTOR	2
1,000 WATT LIGHT PROJECTOR	4
Decorative light pole, each one with 5 Lamps	12
Cooling units (2 tons thermal)	60
The Schiller system is used for cooling with a thermal capacity of 120 tons	1
Central heating system 600 litre	4

Description of the action

The measures to be taken vary between those that help reduce consumption and those that improve energy efficiency and are detailed as follows:

1. **Applying the energy saving methods** in consumption by providing instructions and following-up their implementation and holding an internal awareness campaign on how to carry out the actions that include:
 - Turning off the lights after leaving the place;
 - Depending on natural lighting whenever possible through:
 - o Spreading the idea among employees that natural lighting, when present, can replace artificial lighting;
 - o If the financial cost allows, it is possible to benefit from the natural and artificial lighting to be balanced by using the lighting sensors to detect the need of artificial lighting in the room.
 - While not using the computer, it is better to set it automatically on the energy saving mode;
 - Setting the temperature cooling unit in summer at the rate of 25°C and in winter at 20°C and developing the thermal calendar that clarifies the actions taken and distributing it among the various administrations to be used efficiently.
2. **Replacing the used lighting** by a more efficient type as the LED lighting

The results of measures taken could be summarized as follows:

Description	ACTIONS	ANNUAL CONSUMPTIONS IN KWH	EXPECTED CONSUMPTION AFTER APPLYING THE ACTION IN KWH	MITIGATION %
Replacement of Fluorescent lamps 36x 2 watt	Replacing the used lighting by a more efficient type as the LED lighting	299,520	209,664	30%
Replacement of Fluorescent lamps 18x 4 watt	Replacing the used lighting by a more efficient type as the LED lighting	11,980.8	8,387	30%
400 watt light projectors HMI	Replacing the used lighting by a more efficient type as the LED lighting	17,600	6,600	63%
500 WATT LIGHT PROJECTOR	Replacing the used lighting by a more efficient type as the LED lighting	4,400	1,650	63%
1000 WATT LIGHT PROJECTOR	Replacing the used lighting by a more efficient type as the LED lighting	17,600	5,280	70%
Decorative light pole each one with 5 Lamps	Replacing the used lighting by a more efficient type as the LED lighting	5,280	3,168	40%
The Schiller system is used for cooling with a thermal capacity of 120 tons and cooling units (2 tons thermal) distributed among the rest of the building, which provide an estimate of sixty units	Setting the temperature cooling unit in summer at the rate of 25°C and in winter at 20°C and Activate the role of regular maintenance	86,445	60,512	30%
Other equipment	Applying the energy saving methods	26,474	23,826	10%
Total		469,300	319,087	32%

The Municipal building consumes annually about 18,000 litres of diesel fuel for heating and this rate varies according to the weather conditions and low temperatures. It also consumes approximately 86,445 kWh per year for cooling and heating. The importance of installing thermal insulation for the building shell plays a key role in reducing energy consumption whose objectives can be achieved through:

- The design of external window shading devices extending over a measured distance to prevent unwanted light and heat from entering the offices in the summer and reduce the energy consumption spent on cooling;
- The design of building external insulation or internal wall insulation with a study on how to install them precisely;
- The replacement of windows with energy- efficient ones to reduce heat transfer outwards.

3. Activate the role of regular maintenance in general, for example:

- Regular maintenance of the adaptation units to ensure work efficiency and reduce energy consumption. The regular maintenance is achieved through cleaning the filters on a monthly basis and checking the cooling gas and the efficiency of the cooling compressor on an annual basis, which is of utmost importance in reducing the cost of maintenance, prolonging the life of equipment and reducing energy consumption.
- Cleaning and carrying out the maintenance of lighting units to ensure proper lighting.
- Maintenance and inspection of the ignition quality in the central heating system to ensure that the combustion process is fully completed and that there is no loss of fuel as a result of incomplete combustion. This is done by examining the combustion gases by a combustion specialist.

The proposed stages of implementation are extended over long periods depending on the municipality's capabilities and can be carried out in parallel with the replacement of the lighting during maintenance so as not to affect the cost greatly.

Description	NO	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Fluorescent lamps 36x 2 watt	1200		10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	
Fluorescent lamps 18x 4 watt	48		10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	
400 watt light projectors HMI	8												
500 WATT LIGHT PROJECTOR	2												
1000 WATT LIGHT PROJECTOR	4												
Applying the energy saving methods													
Building Insulation													
Activate the role of regular maintenance													

Some of the measures contribute to the development of environmental awareness, for example:

- Replacing the water faucets in the laundries with a sensor to ensure abundance of water consumption;
- The use of high-efficiency equipment in modern procurement; for example, the use of modern refrigeration units, which consume much less energy than the older ones;
- Closing the windows to ensure that the energy is not lost when using air conditioning through distributing instructions to the relevant departments and following them up to ensure compliance;
- Using environmentally friendly printing inks in local purchases and generalizing the concept of less printing except for essential needs;
- Sort paper waste from others;
- Installation of motion sensors to control lighting in public areas such as bathrooms, stairs and others;
- When utilizing advanced elevators in the future, a system of high efficiency and low energy consumption should be used.

General objectives

The actions undertaken by the municipality could reflect its critical role by participating in implementing such actions and learning from them to explore the strengths and weaknesses and work on overcoming the difficulties.

These actions contribute to raising the municipality's potential through the experiences gained and the capacity building of its team. This does not stop here, but rather it contributes indirectly to an environmental awareness-raising to its members that outreach the family community, in addition to the daily municipal supervisors.

The success of these measures will facilitate the transfer of the expertise to all other municipal departments, which are distributed all over Irbid.

In addition, the actions will contribute to reducing the annual financial cost of the municipality to less than 30% of the current cost, thus providing a new source of funding that can be used to improve community services.



Thus, the aforementioned measures will reduce emissions and the energy bill, improve the municipality's financial proficiencies, strengthen its sustainability expertise, enhance sustainable development opportunities in the short term, and raise awareness among citizens to use such technologies so as the municipality becomes a good example.

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
Main Municipal Building		760	493			0%	
2.0	Transforming the municipal building into an environmental landmark .Publish energy conservation measures in the Municipal building						0
2.1	Switch Off lights after leaving the premises			25	16	1%	0
2.2	More reliance on natural lighting			25	16	1%	0
2.3	Apply green office procedures			4.2	2.7	0%	0
2.4	Thermometer calendars			25	27	2%	0
3.0	Installing eyebrow to the windows (Sun shade)			25	27	2%	
4.0	Design, calculate and visualize light professionally with new efficient lights			197	128	9%	32,000
5.0	Installing heat insulation on the external wall of the building	291	78	87	23	2%	not defined
6.0	Periodic maintenance of equipment			105	68	5%	0

Implementation of the Consumption Saving Measures in the Municipal Buildings

Background

Greater Irbid Municipality has many buildings distributed over the 23 districts, with the electricity bill for these buildings reaching JOD 1,800,000.

The surface rates are relatively high in the municipal areas and electricity consumption is increasing continuously in line with the increase of the oil prices in Jordan as the average annual consumption of these buildings, without the main building, accounts for about 826,316 kWh and represents 64% of the total energy consumption of the municipal buildings which consume up to 1,295,539 kWh/ year.

These buildings are 144 in total, consuming between 1 and 102 kWh/day of electricity. The buildings are classified, according to the amount of electricity consumed, as follows:

Building No	Number of Building	Total KWh	Ave Daily KWh
1	3	92,174	102
2	6	122,872	68
3	3	51,283	57
4	4	55,297	46
5	4	45,301	38
6	4	41,561	35
7	11	94,115	29
8	27	161,120	20
9	13	58,599	15
10	26	74,674	10
11	13	19,786	5
12	9	7,104	3
13	3	1,316	1
14	18	1,114	0
Total	144	826,316	

The buildings vary between the garages and the buildings of the municipality's parking areas, buildings, utilities and slaughterhouse. Each one of these buildings is different in nature from the other, so, as a first step it is better to start studying each one separately, find its commonalities and define its own measures.

Description of the action

The measures to be taken vary between measures that help to reduce consumption and those that improve energy efficiency and are detailed as follows:

- Implementing consumption saving measures** by providing and distributing instructions, following-up their implementation and holding an internal awareness campaign addressed on how to apply them, including but not limited to:
 - Turning off the lights after leaving the place;
 - Depending on natural lighting whenever possible through:
 - o Spreading the idea among employees that natural lighting, when present, can be dispensed with industrial lighting;
 - o If the financial cost allows, it is possible to benefit from the natural and industrial lighting to be balanced by using the lighting sensors to detect the need of industrial lighting in the room;
 - Proper use of the computer. It is better to set it automatically on the energy saving mode;

Mitigation			
MWh/a	t CO2/a		
553	356		
Contribution for			
25%			
Cost of Implementation			
61,365 JOD			
Involvement of Stake Holders	LA	H	
	External	L	
	Other	L	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Energy consumptions			
Measurement Units			
MWh			
Area of intervention			
Integrated action			
Policy Instrument			
Energy management			
Origin of action			
LA			
Priority of action			

- Setting the temperature cooling unit in summer at the rate of 25°C and in winter at 20°C and developing the thermal calendar that clarifies the actions taken and distributing it among the various administrations to be used efficiently;
 - Activating the maintenance role of the adaptation units to ensure work efficiency and reduce energy consumption;
 - Using of high efficiency equipment in modern procurement;
 - Installing motion sensors in public places such as bathrooms and stairs;
 - Replacing the used type of lighting with a more efficient one, such as LED lighting;
2. **Conducting an analytical consumption study** in these buildings or facilities to identify the consumption sources and then devise measures that could help reduce energy consumption;

Description	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Implementing consumption saving measures												
Periodic maintenance of equipment												
Conducting an analytical study of consumption												
Design, calculate and visualize light professionally with new efficient lights			10%	10%	10%	10%	10%	10%	10%	10%	10%	
Other actions												

General objectives

The actions undertaken by the municipality could reflect its critical role by participating in implementing such actions and learning from them to explore the strengths and weaknesses and work on overcoming the difficulties.

These actions contribute to raising the municipality’s potential through the experiences gained and the capacity building of its team. This does not stop here, but rather it contributes indirectly to an environmental awareness-raising to its members that outreach the family community, in addition to the daily municipal supervisors.

The success of these measures will facilitate the transfer of the expertise to all other municipal departments, which are distributed all over Irbid.

In addition, the actions will contribute to reducing the annual financial cost of the municipality to less than 30% of the current cost, thus providing a new source of funding that can be used to improve community services.

Thus, the aforementioned measures will reduce emissions and the energy bill, improve the municipality's financial proficiencies, strengthen its sustainability expertise, enhance sustainable development opportunities in the short term, and raise awareness among citizens to use such technologies so as the municipality becomes a good exemplary.

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
Other Municipal buildings and facilities						0%	
7.0	Publish energy conservation measures in other Municipal buildings	1,338	869				
7.1	Switch Off lights after leaving the premises			44	28	2%	0
7.2	More reliance on natural lighting			44	28	2%	0
7.3	Apply green office procedures			7	4.5	0%	0
7.4	Thermometer calendars			44	28	2%	0

8.0	Design, calculate and visualize light professionally with new efficient lights			347	225	16%	56,365
9.0	Periodic maintenance of equipment			67	43	3%	0
10.0	Conduct an analytical consumption study in Municipal buildings or facilities						5,000

Sustainable Public Procurement

Background

Public procurement is one of the key means by which public money is spent. Public procurement refers to the purchase by governments and state-owned enterprises of goods, services and works. Public procurement was estimated to account for 12% of gross domestic product (GDP) and 29% of general government expenditure in OECD countries in 2013, around EUR 4.2 trillion.²

In Greater Irbid Municipality it counts for approximately 20 million JOD /year, rendering it an important tool for public authorities to implement national energy efficiency policies, by promoting the production and the consumption of energy efficient products and services. This means orientating the use of this money on products and services aimed at the production of renewable energy and energy savings, improving competitiveness and promoting a balanced and sustainable economic growth in the municipality.

Public procurement plays a key role in rationalizing public expenditures and in strengthening accountability, enhances transparency and consequently contributing to sustainable development.

The need for new Sustainable Procurement Regulation with a new legal framework and specific institutional arrangements related to the execution of contracts, development of policies at the central level and ensuring methodical supervision, as well as other provisions that reinforce transparency and accountability, is evident.

The expected obstacle is the difficulty the tendering department will face, since most of the municipality's departments are not well trained on implementation; moreover, the contactors may not be fully aware of the rules of sustainable procurement and how they can implement it.

This brings more pressure on the contracting department which is not fully able to implement it exclusively. Shortly, the obstacles are:

- Unfavourable legislative conditions;
- Institutional hurdles and low skills;
- Uneven available information;
- Low awareness, which causes a lack of perception, demand and acceptance;
- Increased energy demand, due to the growth and urbanization;
- National energy markets with different rules;
- The cites characterized by an inefficient management of energy;
- Market conditions do not allow the formation of a critical mass of suppliers.

Description of the action

- Develop Sustainable Procurement procedures with legislative & regulatory framework according to international legislative models.
- A comprehensive capacity building program on the new Regulation to cover the municipal and private sectors.
 - o Training of Trainers in local authority's boundaries;
 - o Training the Municipality's administration departments and public sector representatives.
- Organize training of private sector representatives aiming to:
 - o qualify the capability to participate in tendering procedures;
 - o removal of the barriers identified during the survey phase;
 - o provide a guidance to energy efficient products and services.
- Implement Sustainable Procurement procedures.

² www.oecd.org

Mitigation			
MWh/a	t CO2/a		
Contribution for			
Cost of Implementation			
40000			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Five steps phase			
Measurement Units			
Completion of phases and start of implementation			
Area of intervention			
Integrated all action			
Policy Instrument			
Public procurement			
Origin of action			
LA			
Priority of action			

General objectives

Building an effective and socially accountable public procurement system will:

- Deliver quality services and support the sustainable development of Irbid;
- Be in line with the Municipality's Vision;
- Be achieving Shared Prosperity and Protecting the Vulnerable;
- Save the local resources;
- Improve the energy efficiency and improve the sustainability;
- Promote the adoption of a transnational approach for the shaping of energy efficient public procurement policies and procedures;
- Exchange best practices on energy efficient public procurement practices;
- Contribute to the re-orientation of suppliers towards the production of energy efficient services and products, through the removal of barriers which prevent enterprises from participation in public tenders requiring energy efficient measures/procedures, thus creating new business opportunities for the economic sector;
- Upgrade the competences of the private sector, increasing their awareness on the economic benefits deriving from a smart use of energy, thus fostering the creation of new enterprises and jobs in energy;
- Enhance the role of public authorities, at all levels, in the diffusion of energy efficient behaviours in the private sector, paving the way for transnational strategies in sustainable development and achieving energy efficiency objectives;
- Increase the awareness of local authorities and professional organizations' representatives on the importance of sustainable procurement and upgrade their competences on the preparation/participation to energy efficient public tenders;
- Seek the optimum combination of whole life costs and quality, instead of the lowest initial price;
- Value for money, to acquire the goods, works or services needed, on the best available terms.
- Consider quality assurance and environmental management systems

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
11.0	Public Procurement						
11.1	Develop Sustainable Procurement procedures with legislative & regulatory framework according to international legislative models.			The results of this action is important for future procurement of the municipality by purchasing efficient equipment and long			10,000
11.2	Training the Municipal administration departments and public sector representatives on Sustainable Procurement procedures						10,000
11.3	Training the private sector on Sustainable Procurement procedures in cooperation with the chamber of commerce and industry						10,000
11.4	Organize training of private sector representatives aiming to: qualify the capability to participate in tendering procedures involving; removal of the barriers identified during the survey phase; provide guidance to energy efficient products and services.						10,000
11.5	Implement Sustainable Procurement procedures						0

Summary of actions related to Municipal building and facilities

Sectoral & field of action		Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
			MWh/a	t CO2/a	MWh/a	t CO2/a		
MUNICIPAL BUILDINGS, EQUIPMENT/FACILITIES			2,389	1,440	2,480	1,021.2	71%	1,133,365
1.0	Transition Municipal work from traditional management to electronic management							
1.1	Automate Municipality and transfer all municipal and paper-based information to electronic information.							
1.2	Securing the necessary infrastructure to connect all Municipal departments with a single information network and exchange of information between different departments.				1,434	357	24.8%	1,000,000
1.3	Determine all transactions between the citizen and municipal departments and convert them into electronic transactions.							
	Main Municipal Building		760	493			0%	
2.0	Transforming the municipal building into an environmental landmark - Publish energy conservation measures in Municipal building							0
2.1	Switch Off lights after leaving the premises				25	16	1%	0
2.2	More reliance on natural lighting				25	16	1%	0
2.3	Apply green office procedures				4.2	2.7	0%	0
2.4	Thermometer calendars				25	27	2%	0
3.0	Installing eyebrow to the windows (Sun shade)				25	27	2%	
4.0	Design, calculate and visualize light professionally with new efficient lights				197	128	9%	32,000
5.0	Installing heat insulation on the external wall of the building		291	78	87	23	2%	not defined
6.0	Periodic maintenance of equipment				105	68	5%	0
	Other Municipal buildings and facilities						0%	
7.0	Publish energy conservation measures in other Municipal building		1,338	869				
7.1	Switch Off lights after leaving the premises				44	28	2%	0
7.2	More reliance on natural lighting				44	28	2%	0
7.3	Apply green office procedures				7	4.5	0%	0
7.4	Thermometer calendars				44	28	2%	0
8.0	Design, calculate and visualize light professionally with new efficient lights				347	225	16%	56,365
9.0	Periodic maintenance of equipment				67	43	3%	0
10.0	Conduct an analytical study of consumption in Municipal buildings or facilities							5,000
11.0	Public Procurement							
11.1	Develop Sustainable Procurement procedures with legislative & regulatory framework according to the international legislative models.		The results of this action are important for future procurement of the municipality by purchasing efficient equipment					10,000

11.2	Training the Municipal administration departments and public sector representatives on Sustainable Procurement procedures			10,000
11.3	Training the private sector on Sustainable Procurement procedures in cooperation with the chamber of commerce and industry			10,000
11.4	Organize training of private sector representatives aiming to: qualify the capability to participate in tendering procedures involving removal of the barriers identified during the survey phase; provide guidance to energy efficient products and services.			10,000
11.5	Implement Sustainable Procurement procedures			0



Residential buildings

Implementing and promoting the Green Building law in new buildings

Background

The Building sector, the leading contributor to energy consumption, represents the main pillar that should be addressed in the SECAP.

Green building practice goes beyond enacting legislations; it requires effective work to avoid any failure in taking actions and implementations that hinder its achievement, mainly after the introduction of the municipalities' new buildings system in Jordan. This system provides incentives for the environmentally friendly green buildings characterized by their ability to conserve energy and rationalize its consumption, the use of renewable energy and the reduction of environmental pollution as attached in Article 23-A of the Building System No. 136 /2016.

Greater Irbid Municipality has recently witnessed rapid population growth that affected urbanization due to the natural internal migration from rural areas to the city. However, much of that increase is comprised of international migrants, who commonly migrate from conflict and for political reasons.

Today, Jordan hosts 1.4 million Syrian refugees, of whom 628,175 have been registered in the entire Kingdom, according to the International Commission (UNCHR) data. 240,240 refugees live in Irbid governorate, making up 23 % of the total refugees in Jordan.

The electricity consumption in the residential sector has reached 500 GWh in 2015, which is 44% of the total electricity consumption in the city, feeding 237,000 households with an average consumption of 8.8 kWh/day.

The suggested measures vary between promoting green building, using renewable energy, and awareness raising of using electricity and water- saving household appliances and abiding by the insulating buildings, that in turn, could save energy.

Other measures include:

1. The need for using water storage tanks in modern buildings during winter, also in seasons when water becomes scarce;
2. Installation of solar water heaters to reduce electricity consumption;
3. Use of thermal insulation to reduce energy consumption in buildings by preventing heat loss;
4. Greening the areas surrounding the buildings and growing plants that don't need much water;
5. Commitment to provide car parking for buildings;
6. Commitment to use surface rebound and construction ratios;
7. Using heat insulated windows.

Description of the action

To activate this law, a series of actions should be taken that include:

1. Inviting not only engineers working in the field, but also developers, investors in the city construction sector, public and private stakeholders and NGOs to attend a discussion panel informing them about the green building laws with recommendations on how to take sustainable initiatives;
2. Issuing detailed instructions on how to implement the system;
3. Issuing legislation and regulations to grant building licenses within the Green Building Code;
4. Providing incentives for developers, building owners and buyers;
5. Imposing a penalty on buildings that abate building conditions;
6. Awareness raising campaigns addressing citizens on the importance of green buildings, aiming not only at protecting the environment but also at reducing the 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 worship

Mitigation			
MWh/a	t CO2/a		
18,965	4,912		
Contribution for			
0.63%			
Cost of Implementation			
129,000 JOD			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Start implementation			
Measurement Units			
Number of new green Licenses			
Area of intervention			
Integrated Action			
Policy Instrument			
Building standards			
Origin of action			
LA			
Priority of action			

places to encourage them use environmentally friendly renewable energy sources and recognize their positive effects on the economic and social levels;

7. Distributing green building certificates among the committed owners that can be placed at the buildings' entrances;
8. An annual review of the progress and the difficulties faced providing solutions to develop the sector;
9. Strict legislative enforcement of the building law.

التفاصيل	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Debate on green building laws												
Issuing detailed instructions on how to implement the system												
Issuing legislations and regulations to grant building licenses within the Green Building Code												
Issuing a package of incentives for developers and building owners as well as buyers												
Imposing fines on buildings that violate building instructions												
Awareness raising among citizens about the importance of green buildings												
Distribution of certificates showing the degree of commitment of green buildings' owners												
An annual progress review in this area												
Application of mandatory green building laws												

General objectives

The objectives of the actions do not only aim at reducing consumption and pollution caused by burning fuel to generate electricity, but also saving consumption costs on citizens and reducing the governmental subsidies to support the energy sector, thus easing the burden on its citizens.

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MW h/a	t CO2/a	MWh/a	t CO2/a		
Residential buildings							
12.0	Implementing and promoting Green Building law in new buildings						
12.1	Conduct a round table to debate on Green Building law with developers, investors, designers, consultants, universities and NGOs in coordination with national authorities						5,000
12.2	Issuing detailed instructions on how to apply, implement and process the Green Building concept with a clear framework supported by national authorities						1,000
12.3	Issuing instructions for granting building licenses within the Green Building Code at a local base level			18,965	4,912	0.63%	1,000
12.4	Promote a package of incentives for developers and owners, as well as buyers in New Green Building Code						1,000
12.5	Imposing fines on buildings that violate building instructions						0
12.6	Awareness raising on Green building code among citizens						100,000
12.7	Issuing certificates for buildings under the Green Building Code						1,000
12.8	Annual progress review and achievement monitoring for new Green building code						20,000
12.9	Strict legislative enforcement of the building law						

Initiatives towards existing buildings, promote installation of Solar Water Heaters (SWH) in buildings through public advertising in collaboration with NGOs & Distribution of SWH for 1,000 low income houses

Background

Greater Irbid's municipality area has grown rapidly in the recent years, during which urbanization has been greatly affected. The electricity consumption in the residential sector has reached 500 GWh in 2015 with an average consumption of 8.8 kWh/day per household. It is noted that Jordan has adopted new building laws with permits; however, it is crucial to analyse the energy consumption of the existing residential buildings to find the proper solutions or measures in the context of reducing consumption and saving energy costs. To this end, there must be an involvement of various sectors such as universities, academic components, government parties and Irbid Electricity Company to ensure its success.

Irbid has more than 300 sunny days and the buildings represent about 44% of the electricity consumption, 30% of which is due to water heating. Therefore, solar water heaters are the alternative solution for the electricity consumption. Their success and distribution at the regional level, will contribute to the generalization of the Renewable Energy concept.

Hence, it is important to help the community in supporting energy solutions through the right model, so as the process is realized in a sustainable way.

Description of the action

1. Installing 1,000 SWH in Irbid;
2. Training the technical staff in the installation and maintenance of the SWH types that can be conveniently installed in Irbid;
3. Issuing a guidance manual to select the appropriate SWH for those wishing to purchase and install it in the future;
4. Issuing an instructions' manual on how to make proper and smooth installation;
5. Conducting a preliminary study on homes and the consumption rate before the installation;
6. Following-up the SWHs' installation and evaluating their quality and results;
7. Evaluating the companies' performance and classifying them according to the follow-up results;
8. Developing the skills and potentials of the technicians throughout their career;
9. Issuing certificates for workers in this field;
10. Awareness raising campaigns to rationalize electricity and water consumption at the regional level;
11. Awareness raising campaigns to rationalize electricity and water consumption for homes benefiting from the project;
12. Promoting SWH in the residential sector;
13. Applying legislative incentives for installation of SWH in each house.

General objectives

The main goal of this action is to motivate the installation of 1,000 SWH in the residential sector through enhancing coordination between the Universities and Private sector under the umbrella of Greater Irbid municipality.

The action involves a sustainable solution that creates new employment opportunities, promotes sustainable development, reduces the burdens on citizens, and helps reduce the annual cost of electricity subsidies, which will improve the government services, increase the opportunities for creating sustainable energy solutions, expand the economic cycle and reduce environmental issues. All these aim at preparing and establishing sound and steady foundations that contribute to sustainable development through:

- Establishing an affordable and reliable sustainable energy market;

Mitigation			
MWh/a	t CO2/a		
145,855	94,660		
Contribution for			
12.3%			
Cost of Implementation			
750,000 JOD			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Installation number and action output			
Measurement Units			
Number of installation and number of trainers and citizen coverage			
Area of intervention			
Integrated all action			
Policy Instrument			
Awareness raising / training			
Origin of action			
LA			
Priority of action			

- Involving stakeholders from the government, universities, consultants, university students, associations and citizens in this work;
- Providing the opportunity for universities to participate in preparing for the work through study, supervision, implementation and evaluation of the results;
- Preparing manuals and technical instructions for proper installation and maintenance procedures;
- Evaluating the experience at the regional level;
- Encouraging the establishment of specialized companies such as Energy Service Companies (ESCOs);
- Creating new job opportunities;
- Training technicians on proper installation and maintenance;
- Reducing financial expenses on citizens;
- Training the technical staff in the municipality on the various stages of installation, maintenance and performance evaluation of SWH;
- Mainstreaming the concept of quality and efficiency as a new measure through local procurement and implementing the sustainability public procurement;
- Expanding the concept of sustainability in the municipality, and giving it a role in leading the community with a sustainable vision.

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
Residential buildings							
13.0	Initiatives towards existing buildings, promote installation of SWHs through public advertising in collaboration with NGOs & Distribution of SWHs for 1,000 low income houses			648	421	0.05%	750,000
13.10	Installation of 1,000 SWH						
13.11	Training the technical staff in the maintenance of the SWH types that can be installed in the area						
13.12	Issuing a guidance manual to select the appropriate SWH for interested buyers						
13.13	Issuing an instructions' manual on how to make proper and smooth installation						
13.14	Conducting a preliminary study on homes and their consumption rate before the SWH installation						
13.15	Following-up the SWHs' installation and evaluating their quality and results						
13.16	Evaluating the companies' performance and classifying them according to the follow-up results						
13.17	Developing the skills and potentials of the technicians throughout their career						
13.18	Issuing certificates for workers in this field						
13.19	Awareness raising campaigns to rationalize electricity and water consumption at the local level						
13.20	Awareness raising campaigns to rationalize electricity and water consumption for homes benefiting from the project						
13.21	Promoting SWH in the residential sector			20,000	13,000	1.67%	
13.22	Applying legislative incentives for installation of SWH in each house			125,207	81,259	10.42%	

Awareness campaigns to reduce energy consumption.

Background

The rapid urbanization growth, accompanied by the population increase, has imposed economic burdens and more responsibilities on the municipality on a daily basis, due to the increased demand for services and the need to create new job opportunities that go along with the municipality's sustainable vision through its awareness- raising role.

The municipality's role should be supportive to its citizens in reducing their energy consumption bills and increase their living standards, thus contributing in securing a higher income for them and investing in economy.

Besides, the awareness campaigns can influence the customer consumption patterns and can modify the purchasing behaviour towards more energy efficient products. Undoubtedly, 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, community sectors and residents.

Description of the action

- Issuing and distributing a booklet to households, free of charge, explaining the procedures that can be used in this framework, and indicating the mechanisms that help in saving water and energy, energy use rationalization and environmental awareness-raising.
- Holding awareness campaigns through the audio-visual communication means, social media, lectures in schools and worship places to motivate citizens to pursue sustainability and clarify its positive effects on economy and society as follows:

Water

- o The importance of rationalizing water consumption;
- o Demonstrating methods to reduce water consumption;
- o Holding campaigns to encourage residents obtain a permit allowing them to build a well to store water within the existing residential retreats that conform with modern buildings principles.

Electricity

- o Encourage residents to install solar water heaters;
- o Encourage people to use energy-efficient lighting such as LED;
- o Setting the Air-conditioners at moderate temperature in summer or winter.

Insulating Buildings

- o The importance of buildings' insulating and the benefits.

Agriculture

- o Greening the areas around private buildings, and growing plants that do not need much water.

Solid Waste

- o Start sorting at the source.

Cooking

- o Promote the use of responsible cooking methods, rationalization of food waste and the use of kitchen utensils, achieving savings in the consumption of oils and fuels such as LPG through the use of pressure cooker.

The action can be summarized as following;

1. Issuing a booklet explaining the procedures to reduce energy consumption in houses;
2. Promoting efficient lighting;
3. Promoting heat insulation for buildings
4. Promoting efficient home appliances;

Mitigation			
MWh/a	t CO2/a		
187,004	54,186		
Contribution for			
6.98%			
Cost of Implementation			
505,000			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Number of awareness campaign			
Measurement Units			
Covered Number of citizen			
Area of intervention			
Behavioural changes			
Policy Instrument			
Awareness raising / training			
Origin of action			
LA			
Priority of action			

5. Promoting the regulation of water use;
6. Promoting Thermometer calendars;
7. Promoting use of pressure cookers.

Description	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
	Issuing a booklet explaining the procedures to reduce energy consumption in houses											
Awareness campaign												

General objectives

- Reducing costs on citizens and residents;
- Reducing the cost of electricity subsidies;
- Reducing the cost of services;
- Maintaining social sustainability;
- Mitigation of pollution and emissions;
- Reducing the health bill;
- Providing job opportunities in sustainable energy;
- Conserving water sources.

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO ₂ /a	MWh/a	t CO ₂ /a		
Residential buildings							
14.0	Awareness campaigns to reduce energy consumption						
14.1	Issuing a booklet explaining the procedures to reduce energy consumption in houses						5,000
14.2	Promote efficient lighting			8,100	5,257	0.7%	100,000
14.3	Promote heat insulation for building						100,000
14.4	Promote efficient home appliances			14,700	9,540	1.22%	100,000
14.5	Promote regulating water use						100,000
14.6	Promote thermometer calendars			5,000	3,250	0.42%	100,000
14.7	Promote the use of pressure cooker			159,204	36,139	4.64%	

Energy consumption analysis and behaviour.

Background

Greater Irbid municipality's area has grown rapidly in the recent years, and thus urbanization has been greatly affected. The electricity consumption in the residential sector reached 500 GWh in 2015 with an average consumption of 8.8 kWh/day per household. It is noted that Jordan has adopted new building laws with permits; however, it is crucial to analyse the energy consumption of the existing residential buildings to identify the proper solutions or measures in the context of reducing consumption and saving energy costs. In this concern, there must be an involvement of various sectors such as universities, academic components, government parties and Irbid Electricity Company to ensure its success.

Description of the action

The action taken should analyse the current situation:

1. Conducting a survey on different households to collect energy consumption data, for at least one year, during which smart meters are installed to demonstrate household energy consumption;
2. Studying the socio-demographic and economic characteristics of the different residential segments as useful tools to help decision-makers and energy producers identify future measures;
3. Conducting a study on the role of household electrical appliances in the energy consumption, such as refrigerators, freezers, air conditioning units, washing machines and lighting;
4. Mandatory enforcement of energy labels in the residential equipment.

General objectives

1. Setting special measures for the provision of energy bills in residential buildings;
2. Developing measures that encourage the reduction of energy consumptions as a first stage, and thus converting it to semi- mandatory in the future, emphasizing on the energy efficiency of basic household appliances such as freezers, fridges, air conditioning units, washing machines and lighting;
3. Adopting the use of energy labels on electrical equipment at stores to generalize the concept of electricity savings while purchasing;
4. Strengthening the local and national units' capacities to develop and implement the energy efficiency policies and monitor the market;
5. Encouraging the use of the clean environmentally and friendly renewable energy sources;
6. Raising citizens' awareness to rationalize energy consumption;
7. Reducing emissions and pollution.

Mitigation			
MWh/a	t CO2/a		
340,326	220,871		
Contribution for			
24%			
Cost of Implementation			
95,000 JOD			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Number of houses covered by study			
Measurement Units			
Action outputs			
Area of intervention			
Behavioural changes			
Policy Instrument			
Awareness raising / training			
Origin of action			
LA			
Priority of action			

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
Residential buildings							
15.0	Energy consumption analysis and behaviour						
15.1	Analysis of household energy consumption data in cooperation with stakeholders to develop indicators that support energy consumption reduction						30,000
15.2	Study the socio-demographic and economic characteristics of the various segments						30,000

15.3	Conducting a study on the role of household electrical appliances in energy consumption						30,000
15.4	Apply the study's recommendations						5,000
15.41	Mandatory enforcement of energy labels in the residential equipment (refrigerators)			113,442	73,624	9%	
15.42	Mandatory enforcement of energy labels in the residential equipment (Air-Conditions)			97,236	63,106	9%	
15.43	Mandatory enforcement of energy labels in the residential equipment (Washing Machines)			48,618	31,553	4%	
15.44	Mandatory enforcement of energy labels in the residential equipment (lights)			81,030	52,588	7%	

Summary of Residential sector actions

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO ₂ /a	MWh/a	t CO ₂ /a		
Residential buildings		1,921,216	779,651	692,150	374,630	48.05%	1,479,000
12.0	Implementing and promoting Green Building law in new buildings			18,965	4,912	0.63%	
12.1	Conduct a round table to debate on Green Building law with developers, investors, designers, consultants, universities and NGOs in coordination with national authorities						5,000
12.2	Issuing detailed instructions on how to apply, implement and process the Green Building concept with a clear framework supported by national authorities						1,000
12.3	Issuing instructions for granting building licenses within the Green Building Code at a local base level						1,000
12.4	Promote a package of incentives for developers and owners, as well as buyers in New Green Building Code						1,000
12.5	Imposing fines on buildings that violate building instructions						0
12.6	Awareness raising on Green building code among citizens						100,000
12.7	Issuing certificates for buildings under the Green Building Code						1,000
12.8	Annual progress review and achievement monitoring for new Green building code						20,000
12.9	Strict legislative enforcement of the building law						
13.0	Initiatives towards existing buildings, promote installation of SWHs through public advertising in collaboration with NGOs & Distribution of SWHs for 1,000 low income houses			648	421	0.05%	750,000
13.10	Installation of 1,000 SWH						
13.11	Training the technical staff in the maintenance of the SWH types that can be installed in the area						
13.12	Issuing a guidance manual to select the appropriate SWH for interested buyers						
13.13	Issuing an instructions' manual on how to make proper and smooth installation						
13.14	Conducting a preliminary study on homes and their consumption rate before the SWH installation						

13.15	Following-up the SWHs' installation and evaluating their quality and results					
13.16	Evaluating the companies' performance and classifying them according to the follow-up results					
13.17	Developing the skills and potentials of the technicians throughout their career					
13.18	Issuing certificates for workers in this field					
13.19	Awareness raising campaigns to rationalize electricity and water consumption at the local level					
13.20	Awareness raising campaigns to rationalize electricity and water consumption for homes benefiting from the project					
13.21	Promoting SWH in the residential sector		20,000	12,980	1.66%	
13.22	Applying legislative incentives for installation of SWH in each house		125,207	81,259	10.42	
14.0	Awareness campaigns to reduce energy consumption					
14.1	Issuing a booklet explaining the procedures to reduce energy consumption in houses					5,000
14.2	Promote efficient lighting		8,100	5,257	0.7%	100,000
14.3	Promote heat insulation for building					100,000
14.4	Promote efficient home appliances		14,700	9,540	1.22%	100,000
14.5	Promote regulating water use					100,000
14.6	Promote thermometer calendars		5,000	3,250	0.42%	100,000
14.7	Promote the use of pressure cooker		159,204	36,139	4.64%	
15.0	Energy consumption analysis and behaviour					
15.1	Analysis of household energy consumption data in cooperation with stakeholders to develop indicators that support energy consumption reduction					30,000
15.2	Study the socio-demographic and economic characteristics of the various segments					30,000
15.3	Conducting a study on the role of household electrical appliances in energy consumption					30,000
15.4	Apply the study's recommendations					5,000
15.41	Mandatory enforcement of energy labels in the residential equipment (refrigerators)		113,442	73,624	9%	
15.42	Mandatory enforcement of energy labels in the residential equipment (Air-Conditions)		97,236	63,106	9%	
15.43	Mandatory enforcement of energy labels in the residential equipment (Washing Machines)		48,618	31,553	4%	
15.44	Mandatory enforcement of energy labels in the residential equipment (lights)		81,030	52,588	7%	

Tertiary buildings

Implementing and promoting the Green Building law in new buildings.

Background

The Building sector, the leading contributor to energy consumption, represents the main pillar that should be addressed in the SECAP's mitigation actions. The green building practice goes beyond enacting legislations; it has been well described in the previous action related to the residential sector, where it requires an effective work plan to avoid any failures that hinder its achievement.

The electricity consumption in the Tertiary sector has reached 571,973 MWh in 2015, which is 50% of the total electricity consumption in the city.

The measures taken vary between promotion of green buildings, using renewable energy, raising awareness among the citizens on the use of electricity and water saving household appliances and abiding by the buildings' insulation practices that in turn, could save energy.

Other measures include:

1. The need for using water storage tanks in modern buildings during winter, also in seasons when water becomes scarce;
2. Installation of solar water heaters to reduce electricity consumption;
3. Use of thermal insulation to reduce energy consumption in buildings by preventing heat loss;
4. Greening the areas surrounding the buildings and growing plants that don't need much water;
5. Commitment to provide car parking for buildings;
6. Commitment to use surface rebound and construction ratios;
7. Using heat insulated windows;
8. Energy Efficient equipment.

Description of the action

To activate this law, a series of actions should be taken, including:

1. Inviting not only engineers working in the field, but also developers, investors in the city construction sector, public and private stakeholders and NGOs to attend a discussion panel informing them about the green building laws with recommendations on how to take sustainable initiatives;
2. Issuing detailed instructions on how to implement the system;
3. Issuing legislation and regulations to grant building licenses within the Green Building Code;
4. Providing incentives for developers, building owners and buyers;
5. Imposing a penalty on buildings that abate building conditions;
6. Awareness raising campaigns addressing the tertiary sector on the importance of green buildings, aiming not only at protecting the environment but also at reducing the 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 worship places to encourage them use environmentally friendly renewable energy sources and recognize their positive effects on the economic and social levels;
7. Distributing green building certificates among the committed owners that can be placed at the buildings' entrances;
8. An annual review of the progress and the difficulties faced providing solutions to develop the sector;
9. Strict legislative enforcement of the building law.

Tertiary sector consumption of electricity	Governmental sector	Non-Governmental sector
MWh		
Tertiary Sector	571,973	100,882
		471,091

Mitigation			
MWh/a	t CO2/a		
Contribution for			
Cost of Implementation			
Part of previous action in Residential sector			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Start implementation			
Measurement Units			
Number of new green Licenses			
Area of intervention			
Integrated Action			
Policy Instrument			
Building standards			
Origin of action			
LA			
Priority of action			

General objectives

The objectives of the actions do not only aim at reducing consumption and pollution caused by burning fuel to generate electricity, but also saving consumption costs on citizens and reducing the governmental subsidies to support the energy sector, thus easing the burden on its citizens.

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
Tertiary Sector							
16.0	Implementing and promoting the Green Building law in new buildings						
16.1	Conduct a roundtable to debate on the Green Building law with developers, investors, designers, consultants, universities and NGOs in coordination with national authorities						
16.2	Issuing detailed instructions on how to apply, implement and process the Green Building concept with a clear framework supported by the national authorities						
16.3	Issuing instructions for granting building licenses within the Green Building Code at a local base level						
16.4	Promote a package of incentives for developers, owners and buyers in the New Green Building Code						
16.5	Imposing fines on buildings that violate building instructions						
16.6	Awareness raising on the green building code among citizens to promote the green culture						
16.7	Issuing certificates for buildings under the Green Building Code						
16.8	Annual review of progress made and achievements' monitoring for the new Green building code						
16.9	Strict legislative enforcement of the building law						

Awareness campaigns to reduce energy consumption.

Background

The rapid urbanization growth, accompanied by the population increase, has imposed economic burdens and more responsibilities on the municipality on a daily basis, due to the increased demand for services and the need to create new job opportunities that go along with the municipality's sustainable vision through its awareness- raising role.

The municipality's role should be supportive to its citizens in reducing their energy consumption bills and increase their living standards, thus contributing in securing a higher income for them and investing in economy.

Besides, the awareness campaigns can influence the customer consumption patterns and can modify the purchasing behaviour towards more energy efficient products. Undoubtedly, 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 and community sectors, targeting the following buildings:

- Hospital and Health Centre;
- Schools, Institutes and Universities;
- Water supply;
- Governmental buildings;
- Mosques and churches;
- Commercial sector;
- Private Hospitals;
- Private Universities;
- Banks;
- Communication;
- Hotels;
- Others;
- Agriculture.

Where they consume the following electricity

Tertiary sector Non-governmental Electricity Consumption	
MWh	
Commercial sector	130,580
Private Hospitals	2,806
Private Universities	1,527
Banks	4,823
Communication	9,620
Hotel	1,112
Others	317,944
Agriculture	2,679
Total	471,091

Tertiary sector Governmental Electricity Consumption	
MWh	
Hospital and Health Centre	6,176
Schools, Institutes and Universities	45,276
Water supply	24,068
Governmental buildings	21526
Mosques and churches	3,836
Total	100,882

Mitigation			
MWh/a	t CO2/a		
23,6471	153,467		
Contribution for			
25.5%			
Cost of Implementation			
Already calculated			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Number of awareness campaign			
Measurement Units			
Covered Number of sector			
Area of intervention			
Behavioural changes			
Policy Instrument			
Awareness raising / training			
Origin of action			
LA			
Priority of action			

Description of the action

- Issuing and distributing a booklet for the tertiary sector, free of charge, explaining the procedures that can be used in this framework, and indicating the mechanisms that help in saving water and energy, energy use rationalization and environmental awareness-raising;

- Holding awareness campaigns through the audio-visual communication means, social media, lectures with different tertiary sectors and worship places to motivate citizens to pursue sustainability and clarify its positive effects on economy and society as follows:

Water

- o The importance of rationalizing water consumption;
- o Demonstrating methods to reduce water consumption;

Electricity

- o Encourage the installation of solar water heaters;
- o Encourage the use of energy-efficient lighting such as LED;
- o Setting the Air-conditioners at moderate temperature in summer or winter.

Insulating Buildings

- o The importance of buildings' insulation and the benefits.

Agriculture

- o Greening the areas around the buildings, and growing plants that do not need much water.

Solid Waste

- o Start sorting at the source;
- o Use of recycled materials.

Renewable ENERGY

- o Promoting use of renewable energy in tertiary building

The above will be supported by the following actions

1. Meeting with the Governmental departments within Greater Irbid Municipality's boundaries to promote energy conservation in the Governmental buildings in coordination with the National Authority;
2. Meeting with the private sector's representatives within Greater Irbid Municipality's boundaries to promote energy conservation in their buildings and facilities in coordination with the National Authority;
3. Promotion of efficient lighting;
4. Promotion of thermometer calendars;
5. Promotion of regulating water use.

General objectives

- Reducing energy costs for buildings;
- Reducing the cost of electricity subsidies;
- Reducing the cost of services;
- Maintaining social sustainability;
- Mitigation of pollution and emissions;
- Reducing the health costs;
- Providing job opportunities in sustainable energy,
- Conserving water sources.

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
Tertiary Sector							
17.0	Awareness campaigns to reduce energy consumption						
17.1	Meeting with Governmental departments within Greater Irbid Municipality's boundaries to promote energy conservation in Governmental buildings in coordination with the National Authority						

17.2	Meeting with private sector's representatives within Greater Irbid Municipality's boundaries to promote energy conservation in their buildings and facilities in coordination with the National Authority						
17.3	Promotion of efficient lighting			50,054	32,485	5.4%	
17.4	Promotion of thermometer calendars			28,521	18,510	3.1%	
17.5	Regulating the water use						
17.6	Apply legislation for replacement of normal lights with LEDs till 2030			80,733	52,396	8.7%	
17.7	Apply legislation for replacement of old A/C unit with efficient one			46,001	29,855	5%	
17.8	Promotion of RE use in Mosques, Shopping centres, Governorate buildings, etc			31,162	20,221	3.36%	

Summary of actions in the Tertiary sector

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
Tertiary building		926,596	601,360	236,471	153,467	25.5%	
16.0	Implementing and promoting the Green Building law in new buildings						already calculate d before
16.1	Conduct a roundtable to debate on the Green Building law with developers, investors, designers, consultants, universities and NGOs in coordination with national authorities						
16.2	Issuing detailed instructions on how to apply, implement and process the Green Building concept with a clear framework supported by the national authorities						
16.3	Issuing instructions for granting building licenses within the Green Building Code at a local base level						
16.4	Promote a package of incentives for developers, owners and buyers in the New Green Building Code						
16.5	Imposing fines on buildings that violate building instructions						
16.6	Awareness raising on the green building code among citizens to promote the green culture						
16.7	Issuing certificates for buildings under the Green Building Code						
16.8	Annual review of progress made and achievements' monitoring for the new Green building code						
16.9	Strict legislative enforcement of the building law						
17.0	Awareness campaigns to reduce energy consumption						
17.1	Meeting with Governmental departments within Greater Irbid Municipality's boundaries to promote energy conservation in Governmental buildings in coordination with the National Authority						
17.2	Meeting with private sector's representatives within Greater Irbid Municipality's boundaries to promote energy conservation in their buildings and facilities in coordination with the National Authority						
17.3	Promotion of efficient lighting			50,054	32,485	5.4%	
17.4	Promotion of thermometer calendars			28,521	18,510	3.1%	
17.5	Regulating the water use						
17.6	Apply legislation for replacement of normal lights with LEDs till 2030			80,733	52,396	8.7%	
17.7	Apply legislation for replacement of old A/C unit with efficient one			46,001	29,855	5%	
17.8	Promotion of RE use in Mosques, Shopping centres, Governorate buildings, etc			31,162	20,221	3.36%	

Public Lighting

Modern street lighting system.

Background

Greater Irbid Municipality is responsible for providing street lighting services to its main streets and sub roads within its organized areas that reach 23 regions. The number of lighting units is around 50,000, while their annual consumption costs are approximately JOD 3,200,000, representing 80% of the energy bill that reaches JOD 4 million. However, the municipality suffers from the continuous rise in the electricity prices and the expansion of the areas it serves, due to the population increase and the numbers of displaced people. This increase in the cost in the coming years is expected to reach approximately JOD 5,184,000.

Sector	Lamp Type in watt	Annual Consumptions in KWh	Quantity of Lamps
Street lighting	HPM 125	13,901,184	25,275
	HPS 70	5,792,160	18,806
	HPS 150	2,316,864	3,510
	HPS 250	1,158,432	1,053
	LED 125	550,000	1,000
Traffic Light	LED	118,360	
Total		23,837,000	49,644

Description of the action

Setting street lighting measures is of great importance as the operational bill grows higher every year; and due to the technological advancements, effective and successful solutions have come to be available. For example, incorporating the advanced and effective LED lighting offers high results in energy efficiency.

Therefore, there are appropriate measures available that would help in reducing energy consumption and costs and improve the offered services. By implementing such measures, the consumption will be reduced from 38,616 MW to 14,771 MW by 2030, and the respective costs will decline from JOD 5,184,000 to JOD 1,983,000, thus saving up to JOD 3,201,000 on an annual basis.

The proposed measures could be summarized as follows:

- Improve energy efficiency in public street lighting by installing an integrated management system:
 - o Realize regular maintenance;
 - o Develop a management and maintenance plan;
 - o Improve the efficiency of street lighting;
 - o Classification of public street lighting according to the region and nature of the street;
 - o Training the maintenance personnel on the new measures.
- Install smart street lighting technologies:
 - o Replace mercury lamps and sodium (HPS) lamps with more efficient ones such as LED;
 - o Replacement of photovoltaic cells with an astronomic timer that switches operation timing with sunrise and sunset;
 - o Installing lightning protection for LED lighting.

Some of the suggested measures have been already partially realized, such as the replacement of mercury lighting with LEDs, which has proved its efficiency in saving energy, an action that needs to be continued when changing or replacing street lighting.

Mitigation			
MWh/a	t CO2/a		
22,835	14,820		
Contribution for			
60%			
Cost of Implementation JOD			
16,129,370			
Involvement of Stake Holders	LA	H	
	External		
	Other		
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Energy Consumption and operation and maintenance cost			
Measurement Units			
MWh / JOD			
Area of intervention			
Energy Efficiency			
Policy Instrument			
Energy Management			
Origin of action			
LA			
Priority of action			

Below is an explanation of the expected reduction results, which shows that the consumption would reach 9,072KWH, and the energy bill would be JOD 1,218,000, thus leading to an annual saving of about JOD 1,982,000.

Sector	Lamp Type	in watt	Lumen per watt	Replacement lamp	Equivalent LED lamp	Quantity of Lamp	Annual consumptions with LED lamps in KWh
Street lighting	HPM	125	50	137	46	25,275	5,073,425
	HPS	70	117	137	60	18,806	4,946,589
	HPS	150	117	137	128	3,510	1,978,636
	HPS	250	117	137	160	1,053	741,396
Total						48,644	23,718,640
Estimated consumption with LED lights							12,740,046
Estimated consumption with Dimming control							9,979,703
Estimated consumption with Astronomic timer							9,072,457

Action can be summarised as follows;

Modern street lighting system

- Replacement of photovoltaic cells with an astronomical timer and installation of lightning protection;
- Replacement of HPS lighting with the novelty of LED;
- Activate the role of periodic maintenance.

General objectives

Saving energy consumption value:

- Improved services;
- Reduced emissions;
- Energy consumption savings and consequent energy bill reductions;
- Clean energy utilization for street lighting;
- Improvement of lighting intensity for streets, parks and buildings;
- Raising citizen’s awareness and encouraging them to replace lighting units with energy efficient ones.

Sectoral & field of action Action NO.	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
Public Street Lighting		38,616	25,062	22,835	14,820	60%	16,129,370
18.0	Modern street lighting system						
18.1	Replacement of photovoltaic cells with an astronomical timer and installation of lightning protection						367,770
18.2	Replacement of HPS lighting with the novelty of LED						15,761,600
18.3	Activate the role of periodic maintenance						

The following are actions related to transportation; they have been developed with the support of the municipality's transportation department

Identify a Single-track Road

Background

The city of Irbid, with its various regions, is witnessing an urban expansion and movement of people that lead to daily traffic congestion. Also, most of the old city has limited capacity roads; for this reason, it is important to identify a single-track road in order to improve the current situation.

Description of the action

This project will assess the direction of the streets in order to identify solutions that contribute to the implementation of a sustainable and environmentally friendly transport system through the following measures:

1. Determine the direction of a single-track road;
2. Have community coordination meetings for promoting the implementation of the project with the support of the Citizen Advisory Committee;
3. Include advertising banners in the respective sites along with the project implementation stages, to show the importance of the project for the community life. This will be considered as awareness raising action on the sustainable transport challenges through enhancing the participation of local community;
4. Set the plan and start implementation:
 - a. Remove the central islands diameters;
 - b. Move trees planted in central islands to pavements or other places and preserve them.

General objectives

The project aims at identifying a single-track road for Irbid's means of transport to activate the sustainable transport system through:

1. Mitigating the increase in CO₂ emissions resulting from traffic congestion;
2. Activating the role of local community's participation in being a partner in the process of setting the sustainable and environmentally friendly future vision;
3. Maintaining a clean and healthy environment for pedestrians moving on the sidewalks adjacent to the main streets.

Mitigation			
MWh/a	t CO ₂ /a		
48,963	12,626		
Contribution for			
7%			
Cost of Implementation			
3,000,000			
Involvement of Stake Holders	LA		
	External		
	Other		
Staff Capacity	L	M	H
Years of Implementation			
[Progress bar]			
Key performance Indicator			
Time consumed for traffic per car			
Measurement Units			
In minutes			
Area of intervention			
System Modification Strategies			
Policy Instrument			
Awareness raising			
Origin of action			
LA			
Priority of action			
[Progress bar]			

Traffic Links Design (West Irbid Mall)

Background

Traffic congestion is among the main issues the city of Irbid is facing, where the main commercial centres, offices and other public facilities are located and the use of vehicles is growing. Thus, it is necessary to design traffic links, within this range, in order to achieve a sustainable and environmentally friendly transport system. The link in west Irbid mall supports 36,000 cars on a daily basis and is characterized by congestion and traffic delays.

Description of the action



This project focuses on identifying the most congested regions and finding solutions of a sustainable and environmentally friendly transport system through the following measures:

1. Designing traffic links;
2. Have community coordination meetings for promoting the implementation of the project with the support of the Citizen Advisory Committee;
3. Set the plan and start implementation;
4. Include advertising banners in the respective sites along with the project implementation stages, to show the importance of the project for the community life. This will be considered as awareness raising action on the sustainable transport challenges through enhancing the participation of local community.

General objectives

The project aims at designing traffic links in specific congested regions in order to:

- Mitigate the increase of CO₂ emissions resulting from traffic congestion;
- Activate the role of local community's participation for being a partner in setting the sustainable and environmentally friendly future vision;
- Maintain a clean and healthy environment within these regions;
- Reduce the stress of drivers and pedestrians;
- Improve the commercial sector.

Mitigation			
MWh/a	t CO ₂ /a		
41,968	10,813		
Contribution for			
6%			
Cost of Implementation			
1,800,000 JOD			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
			
Key performance Indicator			
Implementation of the project			
Measurement Units			
The number of car using the new link			
Area of intervention			
Improvement of logistics and urban freight transport			
Policy Instrument			
Transport / mobility planning regulation			
Origin of action			
LA			
Priority of action			
			



Transport Complex East of Irbid.

Background

Transport complexes in the city of Irbid and its various areas constitute vital points at the city and municipality level. The city of Irbid has a strategic location linked to a network of roads with its national border, and therefore, there are transport complexes to facilitate the movement of citizens at a local and national level. But with the population growth, it became necessary to initiate transport complexes within the city to meet the community's needs and distribute the traffic in accordance with the urban structure of the city of Irbid to avoid the traffic jam resulting from this reality.

It is therefore necessary to find an optimal distribution of transport complexes to meet the growing demand from the surrounding areas of the city for a sustainable and environmentally friendly transport, where more than 229 buses and small buses are driven in Irbid to reach the south complex.

Description of the action

Design and build new transport complex in east of Irbid to serve the connection between Mafraq, Ramtha, International Airlines (Syria, Iraq & Saudi Arabia) in addition to Yellow taxis and shared taxis.

1. Design a new transport complex;
2. Coordination meetings with Citizen Advisory Committee and stakeholders;
3. Set the plan and start implementation.

General objectives

The project represents an assessment of the city's need for transport complexes, with proper distribution within the urban structure, which are part of the challenges of the sustainable and environmentally friendly transport system, through:

1. Enhancing the distribution of transport complexes to reduce the CO₂ emissions caused from the traffic jam;
2. Activating the role of local community participation for being a partner in setting the sustainable and environmentally friendly future vision.

Mitigation			
MWh/a	t CO ₂ /a		
13,989	3,604		
Contribution for			
2%			
Cost of Implementation			
6,000,000 JOD			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Implementation of the project			
Measurement Units			
The traffic number in the complex			
Area of intervention			
Improvement of logistics and urban freight transport			
Policy Instrument			
Transport / mobility planning regulation			
Origin of action			
LA			
Priority of action			

Bicycle sharing Project

Background

Irbid has a number of vital built-up facilities that have strong relation with a specific community sector represented by university students. In the daily transport of the university students, roads become congested at bus stop stations where students wait for. This issue requires the development of alternative transport systems that are sustainable and environmentally friendly. Bicycle sharing would be good solution for such needs.

In early 2014, some 600 cities in 52 countries host advanced bike-sharing programs, with a combined fleet of more than 570,000 bicycles.

- Spain leads the world with 132 separate bike-share programs;
- Italy has 104, and Germany, 43. The world’s largest bike-sharing program is in Wuhan;
- China’s sixth largest city, with 9 million people and 90,000 shared bikes. In 2013, China was home to 82 bike-sharing programs, with a whopping combined fleet of some 380,000 bicycles;
- The United States host 36 modern bike-sharing programs. With a number of new programs in the works and planned expansions of existing programs, the U.S. fleet is set to nearly double to over 37,000 publicly shared bicycles by 2014;
- Since the Vélib system was launched in Paris in 2007, the number of cyclists on the streets has risen by 41 percent. Nearly 24,000 bicycles can be picked up at over 1,700 stations in the city and suburbs;
- London’s Barclays Cycle Hire system was launched in 2010 with 6,000 bikes and has grown beyond 9,000. New bike lanes and designated cycle tracks have helped ridership grow³.

With more than half the world’s population now living in cities, there is tremendous potential for municipal governments and urban planners to increase bicycle use.

Description of the action

The action aims at finding alternative transport systems for university students to facilitate their movement in a sustainable and environmentally friendly way, where safety regulation with regular accommodation of bicycle and pedestrian modes in the project development process is a key issue for the Municipality. The following actions are the minimum required, while further actions should be reviewed and developed when aim to start the execution:

- A first action required is to assess the role of daily transport for the university students, and the traffic congestion caused in order to identify alternative and sustainable means.
- Provide the master plan for the implementation of bicycle sharing system. The master plan should include, but not be limited to, the following:
 - o Assign Bicycle specific lanes;
 - o Design and provide safety infrastructure, improve and increase the street capacity, safety and comfort for riding bicycles by providing minimum the following facility and infrastructure:
 - Provide some level of access to people walking and riding bicycles in all streets;
 - Provide bicycle lane. *It is recommended during regular maintenance. Inexpensive solutions such as bike lane development can be a cost-saving measure;*
 - Provide bicycle sharing stations;
 - Provide pedestrian networks;
 - Audible countdown pedestrian signals at crosswalks;

Mitigation			
MWh/a	t CO2/a		
6,995	1,802		
Contribution for			
1%			
Cost of Implementation			
500,000 JOD			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Number of Bike Sharing			
Measurement Units			
Number of Users			
Area of intervention			
Modal shift to walking & cycling			
Policy Instrument			
Awareness raising/training			
Origin of action			
LA			
Priority of action			

³ http://www.earth-policy.org/images/uploads/press_room/Bicycle_Share.pdf



- Flashing overhead at crossing streets in the middle of a long block;
- Construct sidewalks for closing the gaps in the pedestrian networks;
- In some critical places, building lanes with physical barriers for bicyclists, known as cycle tracks;
- Assign speed limits for cars near the bicycle lanes.
- Provide Smart System for Bicycle sharing which includes the following:
 - Locking system in the bicycle stations;
 - Sharing programme for the University students;
 - Payment system for Bicycle sharing system;
 - Bicycles' tracking system;
 - Bicycle locator and availability in the stations;
 - Anti-theft system.
- Funding partnerships through private and other grant programs can help implement larger projects.
- Awareness raising programme to promote the usage of Bicycle and enhance the participation of university students.
- Provide operation and maintenance procedures for the equipment and facilities to ensure durability and sustainability of the programme and long operation:
 - Assign trained staff to maintain the project;
 - Provide operation and safety instructions sign boards in the stations.

General objectives

The prevalence of bicycles in a community is an indicator of the ability to provide affordable transportation, lower traffic congestion, reduce air pollution, increase mobility, and provide exercise to the users.

Bike-sharing programs are one way to get bicycles to the masses; it also provides viable alternatives to driving in traffic for shorter trips and removing bicycle and pedestrian conflicts from busy streets. It lowers costs for access to jobs and shopping by bicycling and walking.

It also activates the role of the local community and university students, being partners in setting the sustainable and environmentally friendly future vision.

Public Transport Project.

Background

Greater Irbid City is witnessing an urban expansion accompanied by varied use of land areas and population growth. Hence, the public transport system becomes essential to facilitate the citizens' movement within the city. The growth in vehicle ownership and usage leads to major traffic congestion and increase in CO₂ emissions. To avoid this issue, it is crucial to establish a public transport system that is sustainable and environmentally friendly.

Description of the action

Provide public transport in Greater Irbid Municipality to support the traffic congestion's regulation, the low-income citizens and promote a sustainable solution for the traffic in the city:

This will be developed on the following basis:

1. Establishing a public-private partnership based on a license from the Public Transport Authority;
2. Determining optimal routes for public buses;
3. Determining public transport bus stops;
4. Determining scheduled tours;
5. Implement the project and start operation;
6. Set the monitoring and evaluation indicators and ensure the sustainability of the operation;
7. Have community coordination meetings for promoting the implementation of the project with the support of the Citizen Advisory Committee;
8. Set the plan and start implementation;
9. Engage the media and include advertising banners in the respective sites along with the project implementation stages, to show the importance of the project for the community life. This will be considered as awareness raising action on the sustainable transport challenges through enhancing the participation of local community.

General objectives

- The use of the public transport has many advantages, such as health benefits, reduction of the air pollution, driving safely, being physically active, and avoiding excessive stress, few of the well-known steps toward living a healthy life style. Individuals who use the public transportation get over three times the amount of physical activity per day of those who don't by walking to stops and final destinations;
- Public transportation improves access to education and employment, which in turn leads to better long-term economic opportunities;
- "Affordable transportation" generally means that an individual's total travel expenses make up less than 20% of their household finances;
- Public transportation reduces emissions and provides plenty of quality time to people in order to observe, as well as get to know their "neighbours";
- Public transportation allows the passenger to relax, read or nap during that commute instead of fighting and stressing and feeling the road rage;
- Less congestion, the expected users per day will be 7,117 people and around 1,016 less cars per day.

Mitigation			
MWh/a	t CO ₂ /a		
20,984	5,407		
Contribution for			
3%			
Cost of Implementation			
9,000,000 JOD			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Implementation of the project			
Measurement Units			
The number of Buses			
Area of intervention			
Modal shift to public transport			
Policy Instrument			
Transport / mobility planning regulation			
Origin of action			
LA			
Priority of action			

Shuttle bus / Express bus.

Background

Express bus service is a type of fixed route that typically picks up passengers from park-and-ride lots in suburban areas and takes them to a central urban location. This transit service usually operates for longer-distance trips on a Saturday through Thursday basis, peak commuter time schedule.

These commuter routes have limited stops, typically travel non-stop on highways, utilizing any available High-occupancy vehicle (HOV) lanes, and terminate at the central business district in the city. Fares for the service may be comparable to park-and-ride fares, slightly higher than typical local fixed route service.

Adequate planning is the most important thing to consider when implementing an express bus route. Prior to implementation and route planning, the planners should collect demographic and regional data.

Data collection involves origin and destination surveys, mapping of major employment centres, and service attractors, survey the potential users to determine schedules and routing, and should typically offer service in conjunction with one or more park-and-rides.

There required planning should be carefully elaborated, especially in areas of high transit demand during peak periods. Vehicle size should be taken into consideration during planning, and larger vehicles should be assigned to the routes with the highest demand.

Description of the action

The main action concentrates on creating an express bus, but before that, it is recommended to ensure that the action suggested is the right solution. The following basic steps should be taken prior to implementation:

1. **Establish Board committee** to follow up the preparation of the action with local and national level representatives and stakeholders.
2. **Proposal Development**
 - *Service analysis*— collect demographic and regional data prior to route planning and determine whether the express bus service is needed or would be a good fit for the area;
 - *Initial concepts*—provide basic schematics on proposed routing and scheduling. Review of customer and operator input and comments to determine if there has been demand in a specific area for express level service. Based on the comments, refine the design and schedules; develop costs for service based on hours needed to run the route;
 - *Initial proposals*—selection of proposed route(s) and schedule(s) with internal stakeholders (marketing, scheduling, and operations);
 - *Community outreach* (riders, general public, advisory committees, etc.)—take proposals to advisory groups and targeted populations whom the route(s) would serve to gather feedback. Hold meetings in central locations accessible by public transit to gather additional feedback. Then revise proposals based on all information gathered.
3. **Board Process**
 - *Board committee review*—present initial proposals and community feedback received to board work session or board planning committee;
 - *Public hearing*—hold separate public hearing for last-round of comments;
 - *Final recommendations*—present final proposal and recommendations for service to transit board of directors;
 - *Board decision*—transit board of directors approves or disapproves the service.
4. **Implementation Preparation**
 - *Schedule development*—if service is approved, schedules are tested and finalized;
 - *Operator work assignments*—route is presented for operator bidding at the next work assignment period;

Mitigation			
MWh/a	t CO2/a		
13,989	3,604		
Contribution for			
2%			
Cost of Implementation			
600,000			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Number of Buses			
Measurement Units			
Percentage of occupancy			
Area of intervention			
Improvement of logistics and urban freight transport			
Policy Instrument			
Integrated ticketing and charging			
Origin of action			
LA			
Priority of action			

- *Marketing and communication materials*—development and distribution of marketing and communications materials advertising the service offered;
- *Capital upgrades* (vehicles, facilities, stops, etc.)—development and building of accessible stops, benches, shelters, and stations associated with the route. Purchase of new vehicles, if needed;
- *Information technology updates* and upgrades to agency website, automatic vehicle location (if applicable), and operator schedule sheets.

General objectives

Commuters from suburban areas, including state employees, students, and employees working in the central city, are viable users of this service. Typically, commuters who would otherwise utilize freeways to travel to and from work during the week serve as potential users, because this service can use HOV lanes and create a less-stressful commute.

In addition, it will support the following:

- Increased transit usage can reduce the number of single occupancy vehicles on major freeways and highways. This decreases the traffic demand on the major urban freeways and streets;
- Express service can serve as an alternative to personal automobiles. Suburban commuters can depend on this transit service to commute to the urban central business district;
- Passengers can improve their time management by working on the bus, which is typically equipped with Wi-Fi services. Commuters can have more time to handle personal and business matters, rather than wasting time on a congested freeway;
- Express route travel times should be competitive to driving a personal vehicle so they can be a viable solution to mitigate congestion;
- Reduce the emissions in the city.



Intelligent and Smart Control of Traffic Lights.

Background

The traffic signal system becomes an important measure so as to control the traffic flow by providing coordinated green waves between the traffic lights.

Intelligent management of traffic flows can reduce the negative impact of congestion, allows for smooth traffic movement and reduce the frustrating scenario for drivers, when people are stuck in traffic, waiting for the signal to turn green.

Description of the action

Replace the old-fashioned, pre-timed traffic signals that change at consistent intervals with newer technologies that detect the presence of cars and adjust the green time accordingly.

By utilizing more sophisticated equipment to manage the signals, like loops, video cameras and radars to gather data on traffic patterns, along with “adaptive” systems that use algorithms that work in real time, the signals essentially figure out how much traffic is coming their way and adapt automatically to change their timing.

By using smart technology, it will be possible to change the way to handle that information, instead of having a traffic engineer to set and reset a signal’s timing in a control room or having pre-timed control system.

General objectives

Revamping the way signals work will reduce congestion, save fuel costs, cut down on air pollution and make the roads safer, also reducing the number of accidents. Every time a stop is made, there’s a chance of a rear-end collision.

Mitigation			
MWh/a	t CO2/a		
6,995	1,802		
Contribution for			
1%			
Cost of Implementation			
2,500,000			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Average Time waiting in the traffic			
Measurement Units			
Minute			
Area of intervention			
Active Traffic Management Strategies			
Policy Instrument			
Awareness raising			
Origin of action			
LA			
Priority of action			

Provide Car Parking Spaces by applying Park Meters in Side Roads.

Background

The city of Irbid, with its various regions, has a high increase of car ownership that facilitates the movement of people throughout the city. In addition, there are limited parking lots, thus forcing the driver to pass the same route several times to find a position for his car, where most of the side road parking areas are usually full all over the day, with no time limit applied in these parking lots.

This causes traffic congestion and waste of time for people searching for a parking space. Also, it creates issues in the shopping areas. Limiting the time of parking would be a solution for limiting the parking spot's use by one user, and providing alternative parking areas would be good for shop owners or longer parking time needs.



The parking meters would be a solution to reduce the traffic congestion, stimulate commercial and economic traffic in the capital and allow as many cars as possible to stand regularly in the streets.

Description of the action

- Install Parking meters in high demand areas;
- Coordination meetings with the national authority to gain its approval for the implementation. Engagement and partnership with the private sector in financing, installation, operation and maintenance of the system;
- Have community coordination meeting for promoting the implementation of the project with the support of the Citizen Advisory Committee;
- Provide alternative long time parking areas for the shops/offices' owners and employees;
- Prepare the tender document and launch the project with the private sector;
- Install electronic parking meters that accept credit card payment (in addition to pay-by-phone, coins, and parking cards);
- Develop a smart application for mobile phones in order to easily access an empty parking position;
- Make parking even more convenient by making it easier to pay and avoid citations with time limit of at least two hours;
- Assign a company to handle the monitoring and sustainability of the system's operation;
- Assign open free parking after working hours to allow for local citizens to park their cars.

General objectives

The parking meters' project aims at establishing leased car parking spots within Irbid in order to:

- Generate income for the municipality which can be used in improving the roads' quality in these areas;
- Open new job opportunities for citizens and improve the sales for the shops and offices;
- Reduce traffic congestion and facilitate the movement of people throughout the city;
- Mitigate CO₂ emissions resulting from the traffic congestion;
- Keeping a clean and healthy environment for pedestrians.

Mitigation			
MWh/a	t CO ₂ /a		
6,995	1,802		
Contribution for			
%1			
Cost of Implementation			
4,000,000			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Number of Park meters			
Measurement Units			
Percentage of Use			
Area of intervention			
Park Management			
Policy Instrument			
Awareness raising			
Origin of action			
LA			
Priority of action			

Light Train Project.

Background

The road which connects the University of Science and Technology, King Abdullah Hospital and the urban area in Irbid is a vital road, where it is characterized by the daily movement of the citizens who depend on their own cars to reach various places connected with vibrant facilities of universities and hospitals, thus resulting in traffic congestion. Therefore, it is necessary to encourage people use public transport instead of their own cars to avoid environmental pollution, and traffic congestion and apply the sustainable transport system.



Description of the action

The project will assess the use of public transport and its impact on the daily traffic flow on congestion and find alternative solutions such as:

- Using the light rail that connects Irbid with the University of Science and Technology, King Abdullah Hospital and the Development Region;
- Raising awareness of the sustainable transport challenges through enhancing the participation of the community.

General objectives

The project aims at identifying alternative means other than cars and encouraging the use of public transport in order to:

- Mitigate CO₂ emissions resulting from traffic congestion;
- Activate the role of the local community being a partner in setting the sustainable and environmentally friendly future vision;
- Establish new routes that shorten distance and time and reduces diesel use and transportation cost;
- Provide a transportation system that meets the citizens' needs by providing convenient, efficient, safe and affordable travels;
- Modify the current patterns of using private cars to other forms of transport to avoid environmental pollution and traffic congestion.

Mitigation			
MWh/a	t CO ₂ /a		
76,941	19,825		
Contribution for			
11%			
Cost of Implementation			
160,000,000			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Number of users			
Measurement Units			
Number			
Area of intervention			
Public transport			
Policy Instrument			
Integrated ticketing and charging			
Origin of action			
LA			
Priority of action			

Speed-camera and Radar Control Project

Background

The city of Irbid and its various regions are known for the increase in the number of vehicles. These vehicles often exceed the speed limit in the streets, resulting in road accidents that lead to deaths. In order to reach a sustainable transport system, there a speed-camera and radar control system should be established.

Description of the action

Speed measures of vehicles within the city of Irbid and its various regions will help in controlling the emission and reduce the possibility of accidents and street congestion as a result of it.

By installing the speed-camera and radar control system within the city will alert the driver of their speed and help to encourage them to limit it to the optimum level.

General objectives

- Mitigate CO₂ emissions resulting from traffic congestion and high speed;
- Activate the role of the local community being a partner in setting the sustainable and environmentally friendly future vision;
- Keep a clean and healthy environment for pedestrians.

Mitigation			
MWh/a	t CO ₂ /a		
6,995	1,802		
Contribution for			
1%			
Cost of Implementation			
750,000			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Number of Fines			
Measurement Units			
Number			
Area of intervention			
Speed Monitoring			
Policy Instrument			
Awareness raising			
Origin of action			
LA			
Priority of action			



Constructing a Multi-Storey Parking Lot

Background

Irbid city centre suffers from traffic congestion as a result of the increase of population and refugees, the increase in the number of vehicles and lack of parking. The problem grows on Fridays during the summer with the return of the expatriates, and the arrival of tourists, where the expanded street services become limited. Besides, parking cars on either side of the roads adds to the congestion problem.

Description of the action

Constructing of a multi-storey parking lot (could be mechanical parking to increase capacity) which will be lit and serviced using solar panels on the roof of the building, servicing approximately 2,000 vehicles.

General objectives

- Solving the problems of traffic crisis and reducing it by ensuring parking lots;
- Developing and reviving Irbid city centre by encouraging and motivating citizens to walk in the commercial centre and park their vehicles outside it;
- Reducing CO₂ emissions as a result of reducing the traffic congestion in the city centre;
- Giving citizens the opportunity to park in proposed parking lots instead of the sides of the road to increase the traffic capacity and facilitate traffic flow with the introduction of a parking management system (Auto Park); knowing that the municipality has already implemented two successful parking management projects in the city centre.

Mitigation			
MWh/a	t CO ₂ /a		
13,989	3,604		
Contribution for			
2%			
Cost of Implementation			
1,750,000			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Parking Capacity			
Measurement Units			
% of occupancy per day			
Area of intervention			
Increase Parking capacity			
Policy Instrument			
Land use planning regulation			
Origin of action			
LA			
Priority of action			

Replacement of Vehicles Operating in the Municipality with Electric Vehicles.

Background

The number of vehicles operating in the Municipality is about 355 vehicles (Pickup + Diana + Pressing Trucks, etc.) and the amount of fuel consumption was approximately JOD 1,151,000 in 2015. There are also some trucks, such as the cleaning up trucks that work around the clock, 365 days a year.

Description of the action

The municipality will replace its fleet with electric vehicles in several phases:

- In the first phase, about 30 new pressing trucks with electric power switches will be bought.
- In the second phase, small vehicles will be replaced with electric power vehicles.

At each stage, drivers and maintenance personnel will be trained on how to deal with the new machines, providing the necessary equipment in the municipal garage and providing points and freight stations for these vehicles distributed in Greater Irbid areas.

General objectives

- Reducing CO₂ emissions in accordance with the national trend, so that the city would comprise a good example;
- Reducing fuel consumption;
- Awareness-raising on the use of electric vehicles through mass media and social media;
- Maintaining the structure by using clean and environmentally friendly energy.

Mitigation			
MWh/a	t CO ₂ /a		
Contribution for			
Cost of Implementation			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Measurement Units			
Area of intervention			
Policy Instrument			
Origin of action			
LA			
Priority of action			



Summary of actions in the Transportation sector

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
Private and Commercial Transportation		699,466	180,224	265,797	68,485	38%	189,900,000
19	A Traffic Study Project to determine the Direction of One Street			41,968	10,813	6%	3,000,000
20	Design of Traffic Links			34,973	9,011	5%	1,800,000
21	Transport Complex East of Irbid			13,989	3,604	2%	6,000,000
22	Bicycle Sharing Project			6,995	1,802	1%	500,000
23	Public Transport Project			20,984	5,407	3%	9,000,000
24	Shuttle Bus			13,989	3,604	2%	600,000
25	Intelligent Transportation			20,984	5,407	3%	2,500,000
26	Car parking Project of rented premises			6,995	1,802	1%	4,000,000
27	Light Train Project			76,941	19,825	11%	160,000,000
28	Project speed control through cameras and radars			6,995	1,802	1%	750,000
29	Construction of a multi-storey parking lot			13,989	3,604	2%	1,750,000
Municipal Fleet Transportation		18,772	4,976	0	0	0	-
30	Replacement of vehicles operating in the municipality with electric vehicles						

Water supply for Parks and Gardens

Development of Irrigation Methods and Saving Sources closer to Water

Background

The Municipality of Irbid has about 20 parks covering an area of 495,487 dunums. It also has King Abdullah II Bin Al Hussein Park that extends to 177 dunums with administrative offices of 725 square meters, restaurants of 1,675 square meters and other services.

The Municipality suffers from decreased water supply in the summer, where there are no sufficient pipelines in the municipality to deliver water to all the required places.

The difficulty lies in transferring water from the available sources into the city because water sources are very distant and their transport cost is very high, even though the municipality transfers large quantities of water by tankers. Besides, the municipality spends annually about JOD 60,000 to meet the water shortages, especially for parks' irrigation, that is equivalent to 30,000 cubic meters a year to cover the expenses of transporting water tankers to a distance of up to 168,750 km. There is also an increasing need for municipal water because of the expansion of the construction works and population increase within the city.

Description of the action

In Irbid districts, the average water consumption for irrigation is estimated to be 700 cubic meters per day during the summer and autumn seasons. As a result of the expansion of works within Greater Irbid Municipality, there are water shortages. Due to the unavailability of a water resource for the municipality, except that in Ein Al Khraibeh, which is insufficient to cover the municipality's needs, the municipality is working on constructing a shallow well in one of the municipality's lands.

The cost of drilling the well near the parks is estimated to be JOD 70,000 which will help in reducing the long-distance water transfer by one- third and possibly up to the quarter. It is well noted that the operation system of the well would cost about JOD 10,000 per year and the quantity of water produced needs a water tank whose capacity of 3,000 to 4,000 cubic meters would come at an estimated cost of about JOD 100,000. This will result in saving up to JOD 70,000 from the expenses of water and fuel spent for transportation and employment.

To achieve this, additional measures should be adopted to assist in saving water and reducing the consumption in parallel with other works, which are detailed as follows:

- Drilling a water well and setting up a water tank by the Greater Irbid Municipality to meet its needs during the summer period at a rate of 50 m per hour. This amount will solve part of the problem and help reduce the cost of transportation due to the close distance between the water sources and parks intended to be irrigated;
- Development of agricultural and irrigation methods and usage of new ways to save water consumption through:
 - o Replacement of crops that need continuous irrigation with less water-intensive crops;
 - o Replacement of traditional irrigation methods with improved, automated irrigation methods during morning/ evening, where evaporation rates are lower, in order to reduce water consumption;
 - o Replacement of old irrigation operating systems with energy saving ones;
 - o Developing water tanks in the parks to increase the storage capacity and reduce the cost of water transport.
- Holding awareness campaigns to rationalize the use of water in the agricultural sector.

Mitigation			
MWh/a	t CO2/a		
575	154		
Contribution for			
77%			
Cost of Implementation			
390,000 JOD			
Involvement of Stake Holders	LA	H	
	External	H	
	Other		
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Water consumption and operation cost			
Measurement Units			
Litre / JOD			
Area of intervention			
Water consumption			
Policy Instrument			
Regulate water consumption			
Origin of action			
LA			
Priority of action			

Description	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Drill a water well and construct a water tank												
Change the type of plantations Development of irrigation methods												
Awareness campaigns to rationalize the use of water in the agricultural sector												

General objectives

- Providing a nearby water source or water storage source that helps in reducing the costs of water transport, machinery maintenance, labour and fuel savings;
- Reducing environmental pollution and emissions;
- Providing a larger area for work and greening the city as it requires a shorter time to provide water for agriculture and road construction;
- Providing financial input when implementing such a plan which accounts for high costs of water supplies;
- Saving water and energy consumptions.

Sectoral & field of action		Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
			MWh/a	t CO ₂ /a	MWh/a	t CO ₂ /a		
Water supply for Parks and Gardens			751	200	575	154	77%	390,000
31.0	New water sources near the Parks by drilling a water well and equip it with new water tank		751	200	500	134		170,000
32.0	Development of irrigation methods and quality of plantations							100,000
32.1	Replace plants that need continuous irrigation with less water-intensive types				37	10		
32.2	Replacing conventional irrigation methods with innovative ways that rely on automatic irrigation during morning/evening, where there is lower evaporation and reduced water consumption				7.5	2		
32.3	Replacement of traditional operating systems with other energy saving systems				7.5	2		
33.0	Install water tanks in the gardens to increase storage capacity and reduce the cost of water transport				23	6		100,000
34.0	Awareness campaigns to rationalize water use in the agricultural sector							20,000

The above assumption is made for the calculations: If the truck consumes 0.275 l/km and the distance travelled annually is 168,750 km, this is equivalent to consuming 46,406 litres/year and producing about 464 MWh and emissions of 124 t CO₂.

Solid Waste Management

Updating the Solid Waste Management, Collection and Transportation

Background

Some important recommendations have been made through the Master Plan for Municipal Solid Waste in the Greater Irbid Municipality.

It is currently possible to improve the performance of waste collection in anticipation of the governmental strategic plan through the elaboration of the following tasks.

Institutional/Organizational

- Written procedures, description of tasks, and thus assessment of staff performance, specific routes for waste collection and transport, container locations, electronic data processing, and monitoring and evaluation of data;
- Increased level of knowledge and skills of employees and training;
- Identification of clear lines of responsibility of the staff concerned between administrations and informal departments;
- A mentorship program for newly appointed municipal staff and written procedures to assess staff performance;
- The current 23-sector waste collection and transport organization should be reviewed to provide services in a cost-effective manner.

Solid Waste Collection Routes and Container Locations

- Maps should be available for the collection and transport of wastes with their routes and container locations;
- The container location should be planned;
- The optimal movement of waste collection and data optimization should be assessed.

Maintenance and Repair

- Schedule a technical inspection of vehicles and equipment;
- Solid waste is collected by mechanisms from different sources, and therefore many spare parts must be purchased, a task that takes time and additional cost.

The cost of collection and transportation

Greater Irbid Municipality collects more than 600 tons of waste per day that is steadily increasing as a result of the continuously increasing population, affecting the proportion of organic materials (67%) and inorganic recyclable ones (33%, comprising of plastic, glass, metal etc.). The municipality transports these wastes to the landfill, which is about 35 km away from it, thereby costing about JOD 40 per day per ton, amounting at an annual total cost of about JOD 8,760,000. This includes the annual cost of fuel consumption for waste transportation that reaches JOD 700,000.

Summary of Garbage Fleet		
- Garbage vehicles	35	1Km/l
- Garbage vehicles	20	1.5Km/l
- Garbage vehicles	21	2Km/l
- Average consumption Garbage vehicles	76	1.4Km/l
Total distance for municipality's roads in Km	165,000	
Annual distance travelled	81,600 Km/a	
Number of trips per month	2,400	

Mitigation			
MWh/a	t CO2/a		
6,663	1,779		
Contribution for			
30%			
Cost of Implementation			
20,000 JOD			
Involvement of Stake Holders	LA	H	
	External	M	
	Other		
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Cost of operation			
Measurement Units			
In JOD			
Area of intervention			
Waste & wastewater management			
Policy Instrument			
Awareness raising / training			
Origin of action			
LA			
Priority of action			

Average distance travelling per Vehicle	34 Km/ trip/ vehicle
Estimated total distance travelled per month	81,600km/m
Estimated total distance travelled per year	979,200km/a
Estimated consumptions for the Fuel/a	1,370,880 l/a

Description of the action

Solid waste management, collection and transportation consumes a large part of the municipal budget and the development of this sector is of great importance not only to save cost, but also to improve the service, raise its efficiency and transform it into a sustainable sector through the following measures:

1. **Setting written procedures for waste collection and transportation** with:
 - a) description of the task and role of each employee;
 - b) the method applied to assess employees' performance;
 - c) clear responsibility identified to staff concerned between administrations and informal departments;
 - d) standards set to monitor efficiency and quality of service.
2. **Identify the routes for waste collection and transportation**, locate the containers' sites and provide maps with their tracking system, including the following steps:
 - a) Regular review of the containers' site, and assessment of the optimal movement of waste collection and updating the data;
 - b) The use of advanced technologies such as the GPS tracking system;
 - c) Monitoring the weights of the transported waste to the landfill through developing an information system linked with the measurement of weights;
 - d) Creating electronic data processing, monitoring and evaluating data simultaneously;
 - e) Training employees on the use and analysis of data and how to modify plans and increasing the level of the employees' knowledge and skills;
 - f) Reviewing the current 23-sector waste collection and transport organization to provide services in a cost-effective manner;
 - g) Equipping the vehicles with a linked information system to monitor the fuel consumption with the distances covered in a timely manner;
 - h) Upgrading waste collection sites that include health safety standards and locations to post awareness-raising messages.
3. **Implementing an awareness programme for employees**
 - a) to enhance their skills and knowledge of their responsibilities;
 - b) to develop ways to deal with the different types solid wastes in an environmentally friendly manner.
4. **Determining a schedule for a technical inspection of vehicles and equipment**
 - a) Determining the assets of the test and its points through the efficiency of performance in comparison to fuel consumption;
 - b) Identifying the problems and monitoring the users' performance of mechanisms to ensure sound management.
5. **Developing a future plan to sort wastes at the source for**
 - a) specific and confined residential settlements;
 - b) commercial centers;
 - c) universities and schools;
 - d) villages and rural areas, also addressing the villagers on how to compost organic wastes.

Standardizing the types of vehicles/machines that are more fuel saving when buying new ones

التفاصيل	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
وضع إجراءات مكتوبة لعملية جمع ونقل النفايات												
تحديد المسارات لعملية جمع ونقل النفايات وتحديد مواقع الحاويات												
وضع برنامج توعوي للموظفين												

تحديد جدول زمني للمعاينة الفنية للمركبات والمعدات																				
وضع خطة مستقبلية لفرز النفايات من المصدر																				
توحيد أنواع الآليات عند شراء أنواع جديدة																				

General objectives

The general objectives that can be achieved are:

1. Developing waste collection and transport management and raising staff performance;
2. Improving the services provided through waste collection and transportation, its efficiency and the methods taken to monitor them;
3. Developing new routes, reducing distances and saving in fuel consumption and vehicles use;
4. Reducing emissions resulting from lower fuel consumption;
5. Reducing the annual cost of the municipality and transferring the waste transport sector to an environmentally and financially sustainable one to ensure continuity and improvement of service.

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO2/a	MWh/a	t CO2/a		
Solid Waste Management		22,208	5,930	6,663	1,779	30%	20,000
35.0	Develop written procedures for collection and transfer of waste	22,208	5,930				0
36.0	Identification of tracks for collection and removal of waste and location of containers			2,221	593		5,000
37.0	Develop a staff awareness program						10,000
38.0	Schedule a technical inspection of vehicles and equipment			2,221	593		0
39.0	Develop a future plan for sorting waste at the source			2,221	593		5,000
40.0	Standardize types of machinery when buying new types						0

Local Electricity Production

Establishment of a 16 MW Solar/Photovoltaic Cell Station

Background

Jordan bears the highest financial cost to support the internally displaced people whose number reached 1.4 million. This has created financial and economic burden on the local community that has contributed to the displaced people, leading to an increase in its expenditures and inadequacy of the previous development plan due to the sudden and steady population growth. This addresses a higher need to the increased development projects and infrastructure investments resulting from the excessive use and the inability to cover all the needs in the near future.

As a result, the demand for electricity has largely increased because of population increase and growth which is significantly accompanied by the governmental subsidies of the electricity prices, amounting to more than JOD 1.9 billion. The National Electric Power Company is facing a loss of 53 piasters for every dinar of electricity consumed in the Kingdom, on which the government subsidizes 1.9 billion dinars annually.

Because of population increase and migration from neighbouring countries such as Syria - Iraq - Yemen - Libya ... etc., Greater Irbid Municipality suffers greatly from the burden on its energy bill, an increase that reached JOD 4 million per year due to the rising prices for the fuels used and expansion of the Greater Irbid Municipality organizational area. The increase in energy consumption is attributed to the need for additional services, which are steadily growing; thus, reducing energy expenditure, diversifying its sources and reducing harmful emissions are required.

Description of the action

Establishing a power station using the best solar cell systems on a 500 dunum plot of land located in the village of Al-Khanasri. The village is characterized by high brightness and technical appropriateness for the establishment of this station, where the electricity will be transferred through national electricity grid, knowing that:

- A permit for the establishment of a 16 MW solar power plant has been obtained and approved by the Ministry of Environment, Ministry of Energy and Mineral Resources, Ministry of Municipal Affairs, Electricity Regulatory Commission, and the Electric Power Company;
- The approval for transmitting the generated electricity through its grid has been obtained by the National Electricity Power Industry;
- An actuarial study of the energy bill for 2017 has been made;
- The Municipality will train skilled personnel on the maintenance and continuity of the station.

Action	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Establishment of the first phase of the station 4 MW												
Establishment of the second phase of the station 4 MW												
Construction of the third phase of the station 4 MW												
Establishment of the fourth phase of the station 4 MW												
Awareness campaigns to reduce energy consumption												

General objectives

1. Reducing CO₂ emissions;
2. Reducing the energy bill that reaches about JOD 4 million annually;
3. Using renewable energy sources and environmentally friendly clean energy;

Mitigation			
MWh/a	t CO ₂ /a		
31,162	20,221		
Contribution for			
1.26%			
Cost of Implementation			
12,100,000 JOD			
Involvement of Stake Holders	LA	H	
	External	M	
	Other		
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
RE produced			
Measurement Units			
In KWh			
Area of intervention			
Photovoltaics			
Policy Instrument			
Energy suppliers obligations			
Origin of action			
LA			
Priority of action			

4. The generated energy from the photovoltaic cells includes all the activities that require the consumption of electrical energy in all its forms from street lighting, buildings and various facilities, parks, travel agencies and other municipal facilities;
5. Raising citizens' awareness to utilize these techniques so that the photovoltaic cell system will be installed in the commercial, investment and residential buildings, taking the municipality as a good example.

Sectoral & field of action	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Cost in JOD
		MWh/a	t CO ₂ /a	MWh/a	t CO ₂ /a		
Local Renewable energy generation				31,162	20,221	1.26%	12,100,000
41.0	Establishment of a 16 MW solar cell station			31,162	20,221		12,100,000

Action	Energy consumed in year 2015 in MWh	Estimated energy consumed in year 2030 in MWh	Emission in t CO ₂ in year 2030	Energy produced when applying the action in MWh	Amount of reduction in emission in tCO ₂	Cost in JOD
Establishment of the first phase of the station 4 MW	25,133	40,715	26,424	7,738	5,022	3,000,000
Establishment of the second phase of the station 4 MW				7,738	5,022	3,000,000
Construction of the third phase of the station 4 MW				7,738	5,022	3,000,000
Establishment of the fourth phase of the station 4 MW				7,738	5,022	3,000,000
Awareness campaigns to reduce energy consumption				210	136	100,000
Total	25,133	40,715	26,424	31,162	20,224	12,100,000

Summary of actions

Sectoral & field of action Action NO.	Key actions and Measures	BAU Scenario		Mitigation in Energy		Mitigation in %
		MWh/a	t CO2/a	MWh/a	t CO2/a	
MUNICIPAL BUILDINGS, EQUIPMENT/FACILITIES		2,389	1,440	1,480	1021.2	71%
1.0	Transition Municipal work from traditional management to electronic management			1434	357	24.8%
1.1	Automate Municipality and transfer all municipal and paper-based information to electronic information.					
1.2	Securing the necessary infrastructure to connect all Municipal departments with a single information network and exchange of information between different departments.					
1.3	Determine all transactions between the citizen and municipal departments and convert them into electronic transactions.					
	Main Municipal Building	760	493			
2.0	Transforming the municipal building into an environmental landmark - Publish energy conservation measures in Municipal building					
2.1	Switch Off lights after leaving the premises			25	16	1%
2.2	More reliance on natural lighting			25	16	1%
2.3	Apply green office procedures			4.2	2.7	0%
2.4	Thermometer calendars			25	27	2%
3.0	Installing eyebrow to the windows (Sun shade)			25	27	2%
4.0	Design, calculate and visualize light professionally with new efficient lights			197	128	9%
5.0	Installing heat insulation on the external wall of the building	291	78	87	23	2%
6.0	Periodic maintenance of equipment			105	68	5%
	Other Municipal buildings and facilities					0%
7.0	Publish energy conservation measures in other Municipal building	1,338	869			
7.1	Switch Off lights after leaving the premises			44	28	2%

7.2	More reliance on natural lighting			44	28	2%
7.3	Apply green office procedures			7	4.5	0%
7.4	Thermometer calendars			44	28	2%
8.0	Design, calculate and visualize light professionally with new efficient lights			347	225	16%
9.0	Periodic maintenance of equipment			67	43	3%
10.0	Conduct an analytical study of consumption in Municipal buildings or facilities					
11.0	Public Procurement					
11.1	Develop Sustainable Procurement procedures with legislative & regulatory framework according to the international legislative models.	The results of this action is important for future procurement of the municipality by purchasing efficient equipment and long				
11.2	Training the Municipal administration departments and public sector representatives on Sustainable Procurement procedures					
11.3	Training the private sector on Sustainable Procurement procedures in cooperation with the chamber of commerce and industry					
11.4	Organize training of private sector representatives aiming to: qualify the capability to participate in tendering procedures involving removal of the barriers identified during the survey phase; provide guidance to energy efficient products and services.					
11.5	Implement Sustainable Procurement procedures					
Residential buildings		1,921,216	779,651	692,150	374,630	48.05%
12.0	Implementing and promoting Green Building law in new buildings			18,965	4,912	0.63%
12.1	Conduct a round table to debate on Green Building law with developers, investors, designers, consultants, universities and NGOs in coordination with national authorities					
12.2	Issuing detailed instructions on how to apply, implement and process the Green Building concept with a clear framework supported by national authorities					
12.3	Issuing instructions for granting building licenses within the Green Building Code at a local base level					
12.4	Promote a package of incentives for developers and owners, as well as buyers in New Green Building Code					
12.5	Imposing fines on buildings that violate building instructions					
12.6	Awareness raising on Green building code among citizens					

12.7	Issuing certificates for buildings under the Green Building Code					
12.8	Annual progress review and achievement monitoring for new Green building code					
12.9	Strict legislative enforcement of the building law					
13.0	Initiatives towards existing buildings, promote installation of SWHs through public advertising in collaboration with NGOs & Distribution of SWHs for 1,000 low income houses			648	421	0.05%
13.10	Installation of 1,000 SWH					
13.11	Training the technical staff in the maintenance of the SWH types that can be installed in the area					
13.12	Issuing a guidance manual to select the appropriate SWH for interested buyers					
13.13	Issuing an instructions' manual on how to make proper and smooth installation					
13.14	Conducting a preliminary study on homes and their consumption rate before the SWH installation					
13.15	Following-up the SWHs' installation and evaluating their quality and results					
13.16	Evaluating the companies' performance and classifying them according to the follow-up results					
13.17	Developing the skills and potentials of the technicians throughout their career					
13.18	Issuing certificates for workers in this field					
13.19	Awareness raising campaigns to rationalize electricity and water consumption at the local level					
13.20	Awareness raising campaigns to rationalize electricity and water consumption for homes benefiting from the project					
13.21	Promoting SWH in the residential sector			20,000	12,980	1.66%
13.22	Applying legislative incentives for installation of SWH in each house			125,207	81,259	10.42%
14.0	Awareness campaigns to reduce energy consumption			159,204	36,139	4.64%
14.1	Issuing a booklet explaining the procedures to reduce energy consumption in houses					
14.2	Promote efficient lighting					
14.3	Promote heat insulation for building			8,100	5,257	0.7%
14.4	Promote efficient home appliances					
14.5	Promote regulating water use			14,700	9,540	1.22%

14.6	Promote thermometer calendars					
14.7	Promote the use of pressure cooker			5,000	3,250	0.42%
15.0	Energy consumption analysis and behaviour					
15.1	Analysis of household energy consumption data in cooperation with stakeholders to develop indicators that support energy consumption reduction					
15.2	Study the socio-demographic and economic characteristics of the various segments					
15.3	Conducting a study on the role of household electrical appliances in energy consumption					
15.4	Apply the study's recommendations					
15.41	Mandatory enforcement of energy labels in the residential equipment (refrigerators)			113,442	73,624	9%
15.42	Mandatory enforcement of energy labels in the residential equipment (Air-Conditions)			97,236	63,106	8%
15.43	Mandatory enforcement of energy labels in the residential equipment (Washing Machines)			48,618	31,553	4%
15.44	Mandatory enforcement of energy labels in the residential equipment (lights)			81,030	52,588	7%
Tertiary buildings		926,596	601,360	236,471	153,467	25.5%
16.0	Implementing and promoting the Green Building law in new buildings					
16.1	Conduct a roundtable to debate on the Green Building law with developers, investors, designers, consultants, universities and NGOs in coordination with national authorities					
16.2	Issuing detailed instructions on how to apply, implement and process the Green Building concept with a clear framework supported by the national authorities					
16.3	Issuing instructions for granting building licenses within the Green Building Code at a local base level					
16.4	Promote a package of incentives for developers, owners and buyers in the New Green Building Code					
16.5	Imposing fines on buildings that violate building instructions					
16.6	Awareness raising on the green building code among citizens to promote the green culture					
16.7	Issuing certificates for buildings under the Green Building Code					
16.8	Annual review of progress made and achievements' monitoring for the new Green building code					
16.9	Strict legislative enforcement of the building law					

17.0	Awareness campaigns to reduce energy consumption					
17.1	Meeting with Governmental departments within Greater Irbid Municipality's boundaries to promote energy conservation in Governmental buildings in coordination with the National Authority					
17.2	Meeting with private sector's representatives within Greater Irbid Municipality's boundaries to promote energy conservation in their buildings and facilities in coordination with the National Authority					
17.3	Promotion of efficient lighting			50,054	32,485	5.4%
17.4	Promotion of thermometer calendars			28,521	18,510	3.1%
17.5	Regulating the water use					
17.6	Apply legislation for replacement of normal lights with LEDs till 2030			80,733	52,396	8.7%
17.7	Apply legislation for replacement of old A/C unit with efficient one			46,001	29,855	5.0%
17.8	Promotion of RE use in Mosques, Shopping centres, Governorate buildings, etc			31,162	20,221	3.36%
Public Street Lighting		38,616	25,062	22,835	14,820	60%
18.0	Modern street lighting system					
18.1	Replacement of photovoltaic cells with an astronomical timer and installation of lightning protection					
18.2	Replacement of HPS lighting with the novelty of LED					
18.3	Activate the role of periodic maintenance					
Transportation Private and commercial		699,466	180,224	258802	66683	37%
19	A Traffic Study Project to determine the Direction of One Street			48963	12616	7%
20	Design of Traffic Links			41968	10813	6%
21	Transport Complex East of Irbid			13989	3604	2%
22	Bicycle Sharing Project			6995	1802	1%
23	Public Transport Project			20984	5407	3%
24	Shuttle Bus			13989	3604	2%
25	Intelligent Transportation			6995	1802	1%

26	Car parking Project of rented premises			6995	1802	11%
27	Light Train Project			76941	19825	1%
28	Project speed control through cameras and radars			6995	1802	2%
29	Construction of a multi-storey parking lot			13989	3604	7%
Transportation Municipal fleet		18,772	4,976	0	0	0
30	Replacement of vehicles operating in the municipality with electric vehicles					
Water supply for Parks and Gardens		751	200	575	154	77%
31.0	New water sources near the Parks by drilling a water well and equip it with new water tank	751	200	500	134	
32.0	Development of irrigation methods and quality of plantations					
32.1	Replace plants that need continuous irrigation with less water-intensive types			37	10	
32.2	Replacing conventional irrigation methods with innovative ways that rely on automatic irrigation during morning/evening, where there is lower evaporation and reduced water consumption			7.5	2	
32.3	Replacement of traditional operating systems with other energy saving systems			7.5	2	
33.0	Install water tanks in the gardens to increase storage capacity and reduce the cost of water transport			23	6	
34.0	Awareness campaigns to rationalize water use in the agricultural sector					
Solid Waste Management		22,208	5,930	6,663	1,779	30%
35.0	Develop written procedures for collection and transfer of waste	22,208	5,930			
36.0	Identification of tracks for collection and removal of waste and location of containers			2,221	593	
37.0	Develop a staff awareness program					
38.0	Schedule a technical inspection of vehicles and equipment			2,221	593	
39.0	Develop a future plan for sorting waste at the source			2,221	593	
40.0	Standardize types of machinery when buying new types					

Local Renewable energy generation				31,162	20,221	1.26%
41	Establishment of a 16 MW solar cell station			31,162	20,221	
Total		3,630,014	1,598,843	1,252,149	633,430	40.88%

The increase of the projected temperatures in the Mediterranean region in the period 2071 -2100 compared to 1961-1990 is at least 3 degrees in the South countries and could be even higher, depending the season, as presented in the figure below (Giorgi et al., 2008).

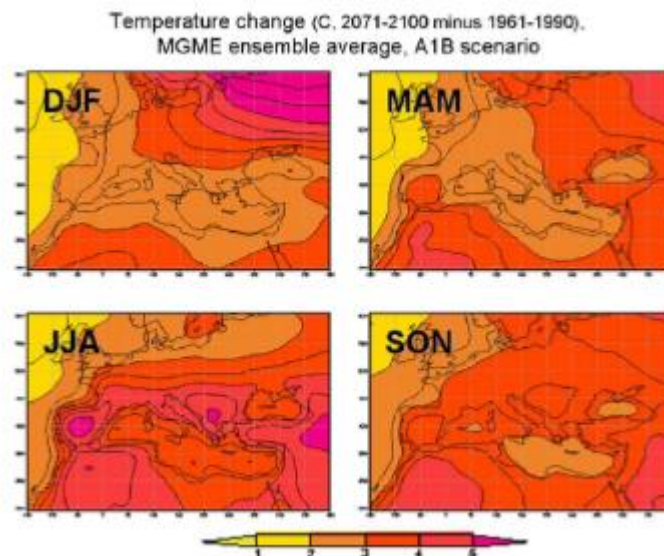


Figure 2 Multi Global Model Ensemble (MGME) average change in surface air temperature for the four seasons, 2071–2100 minus 1961–1990. Units are °C. DJF is December–January–February, MAM is March–April–May, JJA is June–July–August, SON is September–October–November Source: Giorgi et al., 2008

According to an EIB report of 2008, for the Mediterranean region, climate experts anticipate during the 21st 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 with respect to the period 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 %);
- 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;
- An increase of the sea level which, according to some specific studies, could be around 35 cm up to 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 in the 21st century are expected in Eastern Egypt and especially the Nile Delta, Lebanon, Israel 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 the Nile one), 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 in an altitude of less than 10 meters from the sea level, in areas which are vulnerable to sea level rise. In addition to the above, 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 with regard to the issue of 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 northwards and in altitude of certain species, extinction of less mobile or more climate sensitive species, and emergence of new species;
- 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, rise in sea level), human health (heat waves), the energy sector (water needs for power plants, hydropower and increased consumption).

In line to the above, the Southern and Eastern Mediterranean Countries (SEMCs) appear to be more vulnerable to climate change than the Northern Mediterranean Countries (NMCs).

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 technical and financial capacities that are too limited to help implement large-scale adaptation options (EIB, 2008).

The Mediterranean, and more especially the Southern and Eastern rim, is and will be more affected by climate change than most other regions of the world in the course of the 21st century. The impacts of 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, infrastructures, urbanised coastal areas and hydropower production. In order 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 the 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 SEMCs)—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).

National and Regional Strategy on Climate Change Adaptation

The commitments at national level

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

The Kyoto Protocol implemented the objective of the UNFCCC to 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 on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere.

Jordan submitted its INDC with new climate action plan to the UN Framework Convention on Climate Change (UNFCCC). This Intended Nationally Determined Contribution (INDC) comes in advance of a new universal climate change agreement. The agreement will come into effect in 2020, empowering all countries to act to prevent average global temperatures rising above 2 degrees Celsius and to reap the many opportunities that arise from a necessary global transformation to clean and sustainable development.

Jordan's INDC Summary

Jordan nationally determines to reduce its greenhouse gas emissions by a bulk of 14 % until 2030. This contribution of GHGs reduction will be unconditionally fulfilled at, maximally, 1.5 % by the Country's own means compared to a business as usual scenario level.

However, Jordan, conditionally and subject to availability of international financial aid and support to means of implementation, commits to reduce its GHGs emissions by additional, at least, 12.5 % by 2030.

The outcome targets above are accompanied by a diverse combination of numerous GHGs cut-oriented actions in all involved sectors of emissions in addition to the adaptation actions in targeted sectors.

The national strategy, its goals and commitments, sectors affected

In 2009-2013 Jordan conducted a major joint program of water and health sectors' adaptation namely "Adaptation to Climate Change to Sustain Jordan's MDG Achievements". 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 conditions of water scarcity.

After that, Jordan has 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 global 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 CBD-10-year Strategy.

Also, Jordan set its vision "Jordan 2015 national vision and strategy", which represents the long term national vision and strategy. It charts a path for the future and determines the integrated economic and social framework that will govern the economic and social policies based on providing opportunities for all.

In line with the Jordan 2015 vision a **National strategy and action plan for sustainable consumption and production was developed for Jordan for the years 2016 – 2025**, for mainstreaming sustainable consumption and production into Agriculture/Food Production, Transport, and Waste Management Sectors.

Jordan's SCP Strategy and National Action Plan (NAP) addresses key human activities, which have a particular impact on the Jordanian environment including marine and coastal areas and related transversal and crosscutting issues. It defines common objectives and identifies actions guiding the implementation of the SCP at the national level.

As a first step, a shift to sustainable patterns in the three identified 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 (launched in 2015) and the actions and instruments of this SCP 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.

Climate data and Climate projections

According to Jordan's Third National Communication on Climate Change report, there are some Climate Projections and Scenarios identified. Based on long historical data obtained from Jordan Metrology Department (JMD), climatic variables are changing significantly at both national and station level, indicating that climate change is becoming more apparent. Both the Mann-Kendall rank trend test and linear regression trends indicate that the annual precipitation tends to decrease significantly with time at a rate of 1.2mm 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. On the other hand, 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 of decreasing significantly by 0.088mm/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. In addition, the historic data tested in both annual and monthly basis indicated that 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 summer compared to other seasons, more extremely likely heat waves where the analysis of summer temperature, monthly values and the inter-annual variability reveal that some thresholds could be exceeded especially for a summer month where the average of maximum temperature for the whole country could exceed 42-44°C. Drought events were 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 of more than 30 days for the 2070-2100.

Adaptation Scoreboard

The adaptation scoreboard is part of the SECAP template developed by the JRC. The Greater Irbid Municipality has realized a self-assessment of its adaptation status, putting a grade from A to D, in line with its progress.

More specifically:

- "A", corresponds to completion level of 75 - 100%;
- "B", corresponds to completion level of 50-75%;
- "C", corresponds to completion level of 25-50%. Finally,
- "D", corresponds to completion level of 0-25%.

The Greater Irbid Municipality has put one of these four grades to each one of the adaptation cycle specific steps, as presented in the following table.

Table 16 Greater Irbid Municipality score in the adaptation Cycle Specific Steps (SECAP template)

Adaptation Cycle Steps	Actions	Grade
Step 1: Preparing the ground for Adaptation	Adaptation commitments defined/integrated into the local climate policy	C
	Human, technical and financial resources identified	C
	Adaptation team (officer) appointed within the municipal administration and clear responsibilities assigned	C
	Horizontal (e.g. across departments) coordination mechanisms in place	C
	Vertical (e.g. across governance levels) coordination mechanisms in place	C
	Consultative and participatory mechanisms set up, fostering the multi stakeholder engagement in the adaptation process	C
	Continuous communication process in place	C
Step 2: Assessing risks and vulnerabilities to climate change	Mapping of the possible methods and data sources for carrying out a Risk & Vulnerability Assessment conducted	C
	Assessment of climate risks and vulnerabilities undertaken	D
	Possible sectors of actions identified and prioritized	D
	Available knowledge periodically reviewed and new finding integrated	C
Steps 3 and 4 – Identifying, assessing and selecting adaptation options	Full portfolio of adaptation actions compiled, documented and assessed	D
	Possibilities of mainstreaming adaptation in existing policies and plans assessed, possible synergies and conflicts identified	C
	Adaptation actions developed and adopted	C
Step 5: Implementing	Implementation framework set with clear milestones	C
	Adaptation actions implemented and mainstreamed as defined in the SECAP document	C
	Coordinated action between adaptation and mitigation set	C
Step 6: Monitoring and evaluation	Monitoring framework in place for adaptation actions	C
	Appropriate monitoring and evaluation indicators identified	D
	Regular monitoring of the progress and reporting to the relevant decision makers	C
	Adaptation strategy and/or Action Plan updated, revised and readjusted according to the findings of the monitoring and evaluation procedure	C

Section B: Climate Change Risk Assessment and Vulnerability Analysis

Table 17 Vulnerability Analysis

Vulnerability analysis						
Receptors		Extreme weather event	Potential effects	Who/What is affected		
Population	Public Health	Extreme heat	Deaths due to cardiovascular diseases	Everyone, but especially elderly people, babies, children, workers in outdoor environments and sensitive groups of people		
			Spread of vector born and infectious diseases			
			Altered allergic pattern			
			Heat stress			
		Droughts	Asthma and cardiovascular diseases	All people living or working in the area		
			Accumulation of trace elements			
Infrastructure	Transport	Extreme heat	Rail and road network damages	Roads, rail roads, public transport, people mobility		
			Change in behaviour patterns			
			Air quality problems			
			Higher maintenance costs			
			Droughts	Difficult transport of bulk material	Waterways, water management	
	Energy	Extreme heat		Altered electricity peaks/demand	Conventional power plants, electricity providers and consumers	
				Damages		
				Cooling problems		
				Reduction of efficiency yield from conventional power plants and distribution grid		
		Droughts			Higher maintenance costs	
					No/lower production from hydro power plants	Conventional and renewable energy facilities (hydro, PVs, etc)
					Energy supply and demand patterns' shift	
					Higher maintenance costs	
	Water	Extreme heat		Higher water demand	Public health, water infrastructures	
				Water quality issues		
Higher maintenance costs						
Droughts				Water scarcity	Public health, water infrastructures	
				Water quality issues		
				Higher maintenance costs		
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			
			Burdening of the health care facilities due to the increased number of patients in hospitals			
	Droughts			Difficulties in meeting water demand for athletic facilities (e.g. swimming pools) and green public spaces	Hospitals, schools, public places, municipal	

				facilities/infrastructure, athletic facilities
Built Environment	Building stock and material	Extreme heat	Concrete's damages	All building infrastructure
			Increased cooling demands	
			Higher maintenance costs	
			Urban heat island effect	
		Droughts	Higher water demand	All building infrastructure
Economy	Tourist	Extreme heat	Increased demand for cooling	Tourists, tourist infrastructure, tourist related economy
			Lower touristic flows during the impacted seasons	
			Higher water demand	
		Droughts	Increased pressure on water resources, escalating water scarcity issues	Tourists, tourist infrastructure
			Increased water supply costs	Tourists, tourist infrastructure
	Agriculture	Extreme heat	Changes in growth cycle	Farmers, food industry, consumers
			Damages / loss of harvest	
			Livestock loss and impacts on health	
		Droughts	Lower crop yields	Farmers, food industry, consumers
			Damages / loss of harvest	
			Livestock loss and impacts on health	
		Land degradation		
Biodiversity	Green zones/ Forests	Extreme heat	Fires and destruction of the ecosystem, flora and fauna	Ecosystem, fish industry, consumers
		Droughts	Fires and destruction of the ecosystem, flora and fauna	Ecosystem

Table 18 Risk Assessment

Risk Assessment				
Receptors		Weather Sensitivity	Future Risk	Impact
Population	Public Health	Extreme heat	- Increased number of deaths	High
			- Reinforcement of heat stress	
			- Increased infectious diseases	
			- Altered allergic patterns	
		Droughts	- Increased allergic incidents	High
			- Decreased air quality	
		- More respiratory problems		
Infrastructure	Transport	Extreme heat	- Damages on road and rail network	High
			- Modification of transport frequency and means	
			- Air quality problems	
			- Higher maintenance costs	



	Energy	Droughts	- Difficult transport of bulk material	Low	
		Extreme heat	- Blackouts and inability to cover demand load	High	
			- Damages, especially in the thermal power plants		
		Droughts	- Blackouts and inability to cover demand load	High	
			- Higher maintenance costs		
	- Cooling problems in power plants				
	Water	Extreme heat	- Water scarcity	Medium	
			- Water quality issues		
		Droughts	- Water scarcity	High	
	- Water quality issues				
Social	Extreme heat	- Increased needs for air conditioned public spaces	Medium		
		- Increased numbers of people presenting respiratory problems and burdening the health care facilities			
	Droughts	- Inability to cover the water demand	Medium		
		- Difficulties in the operation of certain facilities due to lack of water (e.g. swimming pools)			
Built Environment	Building stock and material	Extreme heat	- Concrete's damages	Low	
			- Increased cooling demands		
			- Higher maintenance costs		
Droughts		- Urban heat island effect	Medium		
	- Higher water demand				
Economy	Tourist	Extreme heat	- Change of the tourism season – lower touristic flows	Medium	
			- Reduction of the tourism related economy		
		Droughts	- Increased water supply costs		Low
			- Potential increase of indirect costs for the tourists (infrastructure related) and reduction of touristic flows		
	Agriculture	Extreme heat	- Changes in growth cycle	High	
			- Damages / loss of harvest		
			- Livestock loss and impacts on health		
			- Lower crop yields		
		Droughts	- Increased fire risks		High
			- Damages / loss of harvest		
Droughts	- Lower crop yields	High			
	- Livestock loss and impacts on health				
	- Land degradation				
	- Increased fire risks				
Biodiversity	Green zones/ Forests	Extreme heat	- Fires and destruction of the ecosystem, flora and fauna	High	
		Droughts	- Fires and destruction of the ecosystem, flora and fauna	High	

Section C – Adaptation Actions

Adaptation actions for population and public health

Extreme heat events can be dangerous to health – even fatal. These events result in increased hospital admissions for heat-related illness, 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 in Jordan is 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 with pathogens that could cause outbreaks like Typhoid fever or Hepatitis A if the water is not well treated;⁴
- In addition, rising temperature due to climate change will increase microorganisms’ growth; leading to increases in water and food-borne diseases, in contrast flooding which is a result of extreme rainfall through concentrating the annual rainfall in a small interval lead to disruption of water purification and contamination with sewage disposal systems, leading to increase the probability of epidemics due to vector borne “VBDs,” water and food-borne diseases;¹
- 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 “COPD”; acute infectious respiratory diseases seems that are not going to be directly affected;
- The sensitivity of the health sector in Jordan is directly or indirectly affected by climate change. The influence scale ranged from insignificant (malnutrition) to catastrophic emerging epidemics (haemorrhagic fevers). Young children and elderly are the most sensitive group mainly to foodborne and waterborne diseases where the admission rate will be increased followed by respiratory diseases where the admission rate and mortality rate will be increased.

Main adaptation measures suggested on national level:

- Establishment of an early warning system;
- Adopt healthy buildings, through formulation building guidelines which include instructions for advanced sanitary installation that separate grey water from black water;
- Sustaining and improving sanitary conditions.

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

Actions’ characteristic	Adaptation Actions	Estimated cost in JOD
Strategic	Health action plan for the extreme events that the municipality is facing e.g. heat etc. (heat health action plan)	100,000
	Provide access to air conditioned public buildings during heat waves or other extreme events, for those citizens that lack the infrastructure to protect themselves (people living in underground apartments during floods, or lacking AC during extreme temperatures etc.)	
	Updating building codes and landscaping laws to increase energy efficiency and improves the ability of buildings to provide protection against extreme heat events, for example green roofs and strategically located shade trees.	

⁴ National report MOE & UNDP TNC



	Reorganize the working hours and to reschedule the working time to avoid the mid-day work	
	Collaboration with the regional medical services to increase preparedness level	
Alert / Communication	Developing an early warning system to alert citizens in the case of extreme weather events or natural disasters such as heat waves, forest fires, floods, tsunami etc.	100,000
Educational	Educational and awareness raising campaigns about health-related effects of heat waves, floods, vector borne diseases etc., and educate residents on the ways to protect their health and prevent infection or impact.	100,000
	Provide instruction for public like staying hydrated and avoiding strenuous outdoor exercise during heat alerts	
	Provide easy access to public drinking fountains, swimming pools, and spray pads, take preventive action like opening cooling centres where the public can gather for relief from the heat	
Technical	Regular cleaning and maintenance of the sewage and drainage system	
	Identification of potential hot spots for the development of vector borne diseases	
	Urban forests, including street and wooded areas	
	Frequent monitoring of water and air quality	



Adaptation actions for infrastructure

Climate change has the potential to impact the safety of existing structures, to increase the frequency of weather-related disasters, to regionally increase premature weathering and to significantly change design criteria and engineering of structures. Because infrastructure built in current times is intended to survive for decades to come, it is critically important that adaptation options to 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 that are available today need to be applied as soon as possible. These 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.⁵

Water Resources:

The main climate hazards that the water sector faces in Jordan are temperature increases, precipitation decreases, increased incidents of drought and increased evaporation. Climate sensitivity indicators in the water sector were determined as reduced groundwater recharge, groundwater quality deterioration, stream flow reduction and increased water demand. Assessment of sensitivity showed that the average sensitivity level is 3.71 (out of 5) and can be classified as high. That indicates how the system can be adversely impacted by the investigated climate change hazards.

Adaptation strategies and measures suggested for the water sector on national level are:

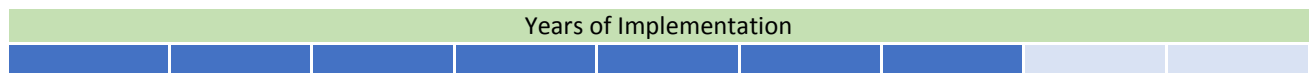
- Rainwater harvesting
- Wastewater treatment
- Desalination
- Increasing Efficiency of irrigation technologies

⁵ <http://ieeexplore.ieee.org/document/4057378/>

- Grey water Reuse
- Public awareness

The following table explains the adaptation action related to infrastructure:

Actions' characteristic	Adaptation Actions	Estimated cost in JOD
Strategic	Water and waste water management plan	
	Modelling predicted supply changes in the electricity from the locally available RES sources that serve the community, as a result of the climate change	
	Frequent monitoring of the infrastructure in order 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.	
Alert / Communication	Issuing alerts in case a part of the infrastructure has been severely damaged and citizens should avoid it	
Educational	Developing guides and awareness raising campaigns for citizens on how to save water and energy, especially during crisis	100,000
Technical	Integration of sustainable drainage systems	
	Establishment of underground water reservoirs	
	Building desalination plants based on the best available technologies	70,000,000 JOD
	Increase the use of renewable energy to decrease pressure on the public grid and would contribute to prevent failure of power plants	
	Development of controlled flood management zones near afflicted	



Adaptation actions for built environment

The importance of adaptation actions in built environment is to improve the resilience of the built environment in the face of climate change and also will aims to protect the wellbeing of communities through targeted policy initiatives and better urban and building design, ensure appropriate institutional arrangements to facilitate adaptation, realise economic benefits from early adaptation through effective strategic planning and risk minimization, advance sustainability through better resource and risk management strategies, and increase community education and awareness about climate change risks and adaptation.

Urban Sector:

The Representative Concentration Pathways (RCP) is the latest generation of scenarios that provide input to climate models. Scenarios have long been used by planners and decision makers to analyse situations in which outcomes are uncertain. In climate research, emissions scenarios are used to explore how much humans could contribute to future climate change given uncertainties in factors such as population growth, economic development, and development of new technologies. Projections and scenarios of future social and environmental conditions are also used to explore how much impact lesser or greater amounts of climate change would have on different possible states of the world, for example futures with greater or lesser amounts of poverty. The purpose of using scenarios is not to predict the future, but to explore both the scientific and real-world implications of different plausible futures.

According to Jordan’s Third National Communication report 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 as Amman and Salt. 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



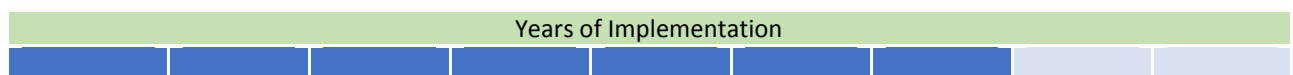
communities, the exposure has been assessed for the pilot area specifically and for the Kingdom to cover the adjacent urban centres; Amman and Salt.

Adaptation measures suggested for the urban sector in the Third National Communication report on Climate Change (TNC) include:

- 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;
- Amendments to 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;
- Zoning and development changes to reflect increased vulnerability of specific locations and/or resources.

The following table explain the adaptation action related to Urban sector:

Actions' characteristic	Adaptation Actions	Estimated cost in JOD
Strategic	Modification of building codes to allow more energy efficient and heat tolerant structures	
	Modification of building codes against seismic activity	
	Provision of reductions on the municipal taxes for those proceeding in adoption of adaptation measures in their houses	
	Integrated land use planning with zoning system depending on the different areas (e.g. red for areas to be heavily afflicted by floods or sea level rise)	
Alert / Communication	Not applicable	
Educational	Educational campaigns on informing the citizens on the benefits of adopting the suggested actions in their premises	100,000
Technical	Greening infrastructure such as buildings' roofs and walls	
	Increasing the amount of shade and green areas in the city by planting trees to reduce the heat island effect	
	Building exemplary districts with adapted urban forms and buildings	
	White roofs (cool colours), shading and bioclimatic design	
	Rainwater collection and use Adoption of methods to reduce water dem	
	Using water resistant construction materials	



Adaptation actions for economy

Agriculture Sector:

Poor in rural areas in Jordan are expected to face the most severe consequences of climate change through disruption of livelihood options that depend on natural resource management. The expected impacts of climate change particularly reduced agricultural productivity and water availability threatens livelihoods and keeps vulnerable people insecure. Poor families and households are the most vulnerable group to the impacts of climate change and deserve the priority in the design of appropriate adaptive measures.

The **major climate exposure risks** associated with agriculture in Jordan were identified as:

1. Temperature increase;
2. Rainfall decrease;
3. Droughts and

4. Shift in rainy season.

The **major sectors of high climate sensitivities** were

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

The key adaptation measure to climate change is **setting and implementing a sustainable agriculture policy**.

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 that are intended to offset either partially or completely the loss of productivity caused by climate change through the application of defence tools with different temporal scales, e.g. short term adjustments and long term adaptations, and spatial scales, e.g. farm, regional or national level adaptation; and
- Socio-economic strategies intended to meet the agricultural costs of climate change.

Generally, the most important adaptation measures in Agriculture are:

- Modification of cropping pattern;
- Modification of crop calendar including planting and harvesting dates;
- Implementation of supplemental irrigation and water harvesting techniques;
- Improve water use efficiency;
- Use of different crops varieties and
- Modification of policies and implementation of 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.

Increase of 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 provision of equipment.

Socio-economic Analysis:

The TNC has developed a socioeconomic analysis to determine expected impacts of Climate Change on local communities and their adaptive capacities by employing socioeconomic and adaptation analysis tools on the pilot area composed of four villages in the Amman- Zarqa Basin, near Irbid.

The study used the income assessment as a 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 the yield agricultural productivity at the study site especially that 54.47% of the community income based on agriculture which was considered the most sensitive sector to climate change.

Main results of the analysis include the following:

- Communities with less agricultural experiences such as Subeihi and Bayoudah will suffer severe effects due to climate change and it is expected that they will lose 10% or 20% of their income due to the decrease of their crop yields' productivity;
- It is well noticed that farmers above 60 years are less affected than others by external factors. This explains the importance of local knowledge and experience in agricultural practices;

- Seehan community will suffer an insignificant impact as the community scored the highest level in agricultural experiences;
- Because of diversification of their income sources Seehan will not suffer major impacts on their livelihoods.
- Al-Irmemeen was an exception among the other communities where younger farmers (between 20- 40 years) have reported higher income level from agriculture compared with older age groups. The reason behind this is that the dominant production system is irrigated agriculture and farmers used modern technology and protected agriculture.

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:

- Increase 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;
- Take measures to increase the labor productivity of rural women through improved access to training, extension services and technology;
- National governments must prioritize inclusive economic growth that, rather than excluding the rural poor, improves their well-being and reduces rural poverty;
- Mainstream the role of media in climate change and support NGOs and community based organizations (CBOs) are well placed to spearhead awareness raising efforts in different community segments, and in their climate change media-targeting activities;
- 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.

The adaptation action to Economy

Actions’ characteristic	Adaptation Actions	Estimated Cost in JOD
Strategic	Elaboration of drought, water and ground water management plan	
	Adoption of integrated land use planning for the touristic activities	
Alert / Communication	-	
Educational	Educating farmers and tourist personnel on ways to conserve natural resources, especially during extreme weather events	100,000
Technical	Use of drought resistant crops	
	Adoption of agroforestry systems	
	Utilization of drip irrigation practices	
	Adoption of energy efficient and water conservation programs at resorts	
	Reducing cooling needs in resorts by installing automations and setting thermostats at given temperature	
	Promotion of RES (SWH, PVs) in resorts	



Adaptation actions for biodiversity
Biodiversity and Ecosystems:

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

The highest exposure to Climate Change impacts is expected to be in the Eastern and Southern areas in Jordan and in the mountainous areas in the North, according to exposure and vulnerability analysis carried by the TNC.

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

For water vegetation, the TNC impact analysis study expects reduced growth and reduced growth range due to lower soil moisture. For evergreen Oak forests and Pine forests it is expected to have lower regeneration rate, change in community composition and shrinkage in geographic range.

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

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

Overall it was noticed that the highest vulnerable ecosystems are **forests** (especially in the north) and **fresh water ecosystems** (especially in Jordan rift valley), that highlights the priority to perform adaptation interventions within these two ecosystems

Adaptation measures and programs that can be adopted on national level in Jordan include:

- Restoration of degraded forests and encouraging the establishment of community forests to control soil erosion;
- National wide, using diverse conservation governance forms including Protected Areas (PAs), Hima and Special Conservation Areas (SCAs) that empowers local communities to conserve their Natural resource sand improves their livelihoods;
- Protecting and enhancing ecosystem services in conservation areas; Improve the access to ecosystem services and the quality of such services empowers 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;
- Restoration and protection of rangelands to reduce the vulnerability of livestock to drought;
- Adopt 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 adaptation for the biodiversity

Actions' characteristic	Adaptation Actions	Estimated cost in JOD
Strategic	Establishment of a fire management plan	50,000
Alert / Communication	Early warning system for flooding or fire hazards	
Educational	Educating the citizens	100,000
Technical	Fragmenting the forest into section to allow better fire management	
	Planning, construction and maintenance of forest roads	
	Trees planting	



A practical exercise was then conducted to specify the SECAP's CAPP actions, whereby the local authority general awareness raising needs and SECAP's priority actions (proposed in the Project Fiches) were looked over and proposed. In doing so, the template tables were "draftly" filled by the participants and the KE.

Following the workshop, the participants have thoroughly reviewed the tables and finalized them with CES-MED KE and the SECAP Consultants, prior to including them in the SECAP (below).

The Communication Info Kit and specially the CAPP Guidelines are to be used as reference work manuals for the subsequent detailed planning and implementation of the CAPP actions proposed in the in the SECAP document and other similar awareness raising actions.



Preparation of a COMMUNITY AWARENESS PROMOTIONAL PLAN (CAPP) Template 1- Situation analysis of Irbid

Aim

The questions in the attached templates cover various areas of actions and levels of awareness linked to behavioral change. It has been used to conduct a quick investigation on the awareness situation and level of perception of the citizens in the city concerning renewable energy and energy saving.

The exercise of filling the templates has identified and assessed the conditions in the municipalities prior to preparing a CAPP and to answers a number of questions, including:

- 1) Who are the target audience of a CAPP?
- 2) What are the priority issues to be addressed by the CAPP (that also could be identified by the SECAP as priority actions)?
- 3) What is the awareness level of key energy problems? And what are the first issues to raise awareness about?
- 4) What are previous awareness raising actions, so that he CAPP can build on them?
- 5) What is the situation as related to public consultation, based on which a public consultation is to be designed?

The exercise of filling the template helped pointing out how raising awareness can be utilized as a tool for improved energy policy to facilitate implementation of its actions; it has allowed initiating discussions in the Communication Workshop and helped identifying appropriate campaigns and actions.

Specific objectives:

- (i) Provide the necessary information about the current conditions and the situation regarding awareness of energy saving and renewable energy,
- (ii) Help to identify the most appropriate a) **awareness raising campaigns** that would accompany the SECAP vision/strategy and b) the **awareness raising actions** that would accompany the priority actions determined in the SECAP.

Steps to follow:

- (i) The SECAP team of the municipality has filled the templates based on their understanding and perception of the of the city's inhabitants. They were free to seek the opinion of a limited number of persons to help fill the answers.
- (ii) The filled in templates were discussed in the "CES-MED Communication Workshops", which were led by CES-MED Communication Expert and attended by the SECAP consultant and the SECAP municipal team. In parallel, the vision/strategy of the city and the proposed pilot actions in the SECAP were reviewed as part of the workshop exercise.

The outcome guided the selection of the most appropriate awareness raising campaigns and actions of the SECAPs including the ones related to priority projects.

I. Identification of the target audience and the importance they give to Sustainable Energy (audience targeted by the awareness raising campaigns and actions)			
Age group	Very important	Important	Not important
Youth	X		
Middle Age	X		
Seniors		X	X
Other		X	

II. Identification of priority issues to be addressed by a sustainable energy action and their level of importance			
Issue	Level of importance		
	Very important	Important	Not important
Expensive oil prices	X		
Availability/lack of energy	X		
Availability of transport		X	
Waste management	X		
Clean environment	X		
Air pollution		X	

III. Identification of level of awareness (energy problems) and education of energy related issues			
	Very aware (through media or research)	Aware but not convinced	Not Aware
Impact on environment		X	
Cost of energy	X		
Waste of energy		X	
Climate change	X		
Ways to save energy consumption	X		
Existence of renewable energy	X		

IV. Previous awareness actions conducted by the city/municipality or by other actors	
Has the city or local authority done previous actions	NO
If yes, who conducted the actions (the city/municipality, NGO, national authority...)	
If yes, describe the action	
If yes, what was the budget and how did you fund it	
If yes, outcome, impact and feedback	

V. Public consultation	
Does the city practice public consultation?	YES
Has the city done public consultations for SEAP/SECAP?	YES
Is it part of the legislative process?	YES
Foreseen consultation(s)	
Does the city liaise with national institutions, stakeholders?	YES



Situation analysis

From this study concerning the target audience and its profile, it appears that the groups that are aware and informed about energy challenges are the middle age and young population of which 38% are below 15. These groups should be identified as our main targets as they are probably well-aware about issues related to the energy sector. On the other hand, Irbid shelters an important number of universities, community colleges and institutes, bringing some 70,000 registered students. It would be recommended to carry out the awareness actions with them and get their full involvement within the academia as opinion sharing people who will disseminate ideas and new behavior. They will be able to influence the policy-making process while reshaping the general public interests and specific constituencies, such as consumers, workers, and households; it is essential to endorse their processes of perception, judgment and reasoning regarding renewable energies information.

The senior target group has very little interest in the topic of sustainable energy and doesn't seem to evaluate its importance. They could also be affected by the internal migration, combined with the influx of refugees. They should be considered as the audience that needs more persuasion; We need to enhance their awareness of appliance energy efficiency characteristics, standards and labels and benefits of more efficient products as costs saving conduct; this might prove to be a very effective way to anticipate the barriers that affect their choices and preferences for their environmental behaviours.

The women population seems to have been disregarded in this survey, even though it constitutes about 52% of the Municipality's population. It should be better considered as an important target to talk to when it comes to energy saving in the household as well as in their working places.

The template shows that the population of Irbid has identified some priorities issues to be addressed; therefore, the main leverages on which we can use and base our communication upon are: The expensive price of oil, the (non) availability of energy, the waste management issue and the cleanliness of the environment. The ambiguity lays in the fact that they don't seem to link the environment matters to transports and air pollution as they don't consider these two issues as very important.

The municipality of Irbid has not conducted any awareness raising actions and campaigns related to sustainable energy towards the civil society; However, it has conducted a public consultation concerning the SECAP of Irbid as it is part of the legislation of the city.

Template 3.1

Identification of CAPP CAMPAIGN TOPIC related to sustainable energy challenges

Once the Sustainable Energy challenges and priorities, general awareness raising priorities, and specific awareness raising needs related to SEAP actions have been identified, the CAPP’s main areas of intervention and activities can be defined. The table below portrays the challenges, priorities and related AR activities.

Challenges:	Priorities:	Awareness Raising Priorities, Topic & Activities of CAPP Campaign
Increase in energy consumption.	<p>Reduce the city’s energy consumption and bills and cost of electricity subsidies</p> <p>Reduce domestic and commercial use of energy, and therefore, costs on citizens and residents’ bills.</p> <p>Mitigate pollution and reduce the greenhouse gas emissions impacts.</p>	<p>Topic: Implementation of simple energy-saving measures that can be applicable by all and beneficial to all.</p> <p>Activities: Hold raising awareness campaigns on how to carry out the proposed actions and follow up their implementation such as issuing a booklet explaining the procedures to reduce energy consumption in houses. Provide practical instructions to citizens, public, private and religious institutions, commercial sector on how to reduce energy consumption. Conduct regular analytical study of monthly consumption per sector.</p>
Public Street Lighting	<p>Reduce energy consumption and costs while relying on alternative energies.</p> <p>Improve services.</p>	<p>Topic: Install smart street lighting technologies</p> <p>Activities: Set a department within the municipality to provide energy advice to the citizens, raise their awareness and encourage them to replace lighting units with energy efficient ones. Train the maintenance personnel on the new measures.</p>
Transportation /Traffic congestion	<p>Encourage further reliance on public transport and car sharing to significantly decrease car’s consumption among all private drivers.</p> <p>Mitigate CO₂ emissions.</p> <p>Promoting the importance of the project for the community life: a clean and healthy environment for people and facilitate their movements.</p>	<p>Topic: Facilitating the movement of residents in a sustainable and environmentally friendly way</p> <p>Activities: Explain the negative effects of traffic congestion on the environment and citizen’s health. Raise citizens’ awareness about decreasing CO₂ emissions through mass media and social media, banners, leaflets, carpooling, a day without cars. Activate the role of local community participation for being a partner in setting the sustainable and environmentally friendly future vision through the “Citizen Advisory Committees”. Create a sticker with a slogan to create a community of people “against CO₂”.</p>

<p>Insufficient water supply</p>	<p>Save water by practicing responsible. Promote and practice responsible and rationalized use of water consumption (to save water and reduce the water bills).</p>	<p><u>Topic:</u> Develop irrigation methods and save sources water</p> <p><u>Activities:</u> Provide practical tips on how to rationalize water in the agricultural sector. Raise awareness, educate and inform users on water resources, and their limitations. Demonstrating methods that can be followed to reduce water consumption. Explain how the methods that will be used in saving water should be followed collectively and the benefits in reducing the consumption to overcome water rarity. Encourage saving of water consumption by religious instructions which aim is to adopt a fair approach in the water distribution. Distribute a water flow restrictor for every home for a better individual water expense calculation.</p>
<p>Solid Waste Management</p>	<p>Improving waste management service and increasing the efficacy of waste collection operations in order to save costs.</p> <p>Raising the efficiency and transforming the sector into a more sustainable one.</p> <p>Reduce waste consumption.</p>	<p><u>Topic:</u> Modernizing solid waste management, collection and transportation.</p> <p><u>Activities:</u> Explain and clarify the measures set to identify the routes and programmes for waste collection and transportation. Provide practical tips on how develop the future plan to sort waste from the source. Hold raising awareness campaigns on section time schedule of collection. Increase the awareness for reducing the thrown amount of waste at the source and efficient ways to re-use and recycle.</p>

Template 3.2

CAPP activities as related to SECAP Priority Actions of Greater Irbid

This template will guide the municipality in the implementation of a strategy and the identification of adequate awareness raising activities according to the target group and its needs and related to the priority actions identified in the SECAP.

SECAP Priority Actions	Related CAPP Activities:
<p>1- Installing a 16MW utility-scale solar PV power plant</p>	<p>Target Audience:</p> <ul style="list-style-type: none"> - Civil society - Private and public operators - Professionals in energy sector and service providers in the private and public sectors <p>Key Message:</p> <ul style="list-style-type: none"> - Green society with Renewable energy reliable and green production of electricity <p>Objectives:</p> <ul style="list-style-type: none"> - Reduce the city's energy bills - Limit the impact of the emission of the greenhouse gas. - Promote the use of renewable energy in buildings. <p>Communication Tools:</p> <p>Create awareness with posters to alert citizens on municipality action. The actions will be accompanied by strong visual campaign in the municipal and local media.</p> <p>Launch campaigns on being an eco-citizen: Explain the side effect of greenhouse gas emission and the usage of renewable energies technologies through messages conveyed by television, the radio and the written press.</p> <p>Create an info centre to inform citizens about new technologies</p> <p>Hold meetings with the community members to promote the municipal action and the usage of renewable energy in the city.</p> <p>Training to the students (primary and secondary schools) on using the energy correctly.</p> <p>Issue and distribute a booklet to households, free of charge, explaining the procedures that can be used in this framework, and indicating the mechanisms that help in saving water and energy, energy rationalization and environmental awareness-raising.</p>
<p>2- Brilliant lighting for Greater Irbid Municipality</p>	<p>Target Audience:</p> <ul style="list-style-type: none"> - Civil society - Private and public operators - Professionals in energy sector <p>Key Message:</p> <ul style="list-style-type: none"> - Reducing electricity consumption will save money for the annual Municipality expenses. - Consuming energy more responsibly will benefit the city at both environment and economic levels <p>Objectives:</p> <ul style="list-style-type: none"> - Reduce the city's energy bills energy consumption in town through smart management and responsible behavior in energy use.

	<ul style="list-style-type: none"> - Promote the use of similar equipment in the households, and other urban common areas - both public and private - Double the benefits of deploying the action for the public street lamps: 1) energy savings and operational savings; 2) Increase the lighting efficiency and reduce the energy consumptions. - Promoting the use of similar installation and equipment in the common urban regions (Public and Private). <p>Communication Tools:</p> <p>Awareness posters nailed on street lamps and electricity exchange boxes to alert citizens on municipality action and to alert on reduction facts about saved consumption. The actions will be accompanied by strong visual campaign in the municipal and local media.</p> <p>Campaign on being an eco-citizen explaining the side effect of greenhouse gas emission and the usage of renewable energies technologies (electricity from natural resources) through messages conveyed by television, the radio and the written press.</p> <p>Meetings with the community members to promote the municipal action and promoting the usage of efficient lighting in households through distribution of LED lamps.</p> <p>Creating an info centre to inform citizens about new technologies.</p> <p>Training to the students (primary and secondary schools) on using the energy correctly.</p>
<p>3- Smart Municipal Services</p>	<p>Target Audience:</p> <ul style="list-style-type: none"> - Civil society - Private and public operators - Municipal staff - Professional organizations representatives, educational institutions and other institutions with high energy consumption. <p>Key Message:</p> <ul style="list-style-type: none"> - Smart service for smart people <p>Objectives:</p> <ul style="list-style-type: none"> - Reduce the city's paper and work bills - Improve the services to the to the public and limit the impact of the emission of the greenhouse gas. <p>Communication Tools:</p> <p>Create awareness with posters. The actions will be accompanied by strong visual campaign in the municipal and local media.</p> <p>Meetings with the community members to promote the municipal action and promoting the usage of new services.</p> <p>Creating an info center to inform citizens about new services.</p> <p>Raising awareness campaigns addressing citizens on the importance of actions that aim at not only protecting the environment but also at reducing the energy costs and encouraging citizens to commit to these actions on all subjects such as green building, using environmentally friendly renewable energy source and recognize its positive effects on the economic and social levels.</p>
<p>4- Smart multi-storey parking lot</p>	<p>Target Audience:</p> <ul style="list-style-type: none"> - Civil society - Private and public operators and all vehicle drivers, specifically young people

	<p><u>Key Message:</u></p> <ul style="list-style-type: none"> - Smart Parking for a Smart City <p><u>Objectives:</u></p> <ul style="list-style-type: none"> - Optimized parking - Reduced traffic and pollution - Enhanced User Experience - New Revenue Streams - Integrated Payments and POS - Increased Safety - Real-Time Data and Trend Insight - Decreased Management Costs <p><u>Communication Tools:</u></p> <p>Create awareness with posters. The actions will be accompanied by strong visual campaign in the municipal and local media.</p> <p>Meetings with the community members to promote the municipal action and promoting the usage of new services.</p> <p>Creating an info center to inform citizens about new services.</p>
<p>5- Shuttle Bus</p>	<p><u>Target Audience:</u></p> <ul style="list-style-type: none"> - Civil society - State employees, students, and employees working in the central city and potential users of this service. <p><u>Key Message:</u></p> <ul style="list-style-type: none"> - Using Shuttle bus will maintain a clean and hygienic atmosphere and will reduce your traveling delays. <p><u>Objectives:</u></p> <ul style="list-style-type: none"> - Reduce fuel consumptions, carbon emissions and congestion in the city and decrease the traffic demand by encouraging the use of public transport. - Commute to the urban central business district. - Have more time to handle personal and business matters - The “Express route” travel times mitigates congestion <p>Practice responsible behavior toward our planet.</p> <p><u>Communication Tools:</u></p> <p>Create awareness with posters with a strong visual campaign in the municipal and local media to encourage people to use public transportation vehicles.</p> <p>Hold awareness campaigns through audio-visual communication means, social media, lectures in schools and worship places to motivate citizens to promote economic, environmental and human benefits of public transports.</p> <p>Raise awareness about decreasing CO2 emissions by introducing citizens to efficient energy technologies through leaflets, carpooling, a day without cars.</p> <p>Hold meetings with the community members through a “Citizens Advisory Committees” to promote the municipal action and promoting the usage of the new services.</p> <p>Promote car sharing and car-pooling through campaigns on municipality website.</p>



Recommendations:

These tables have been thought and prepared by the communes and municipalities. In this approach, they aim to promote in a particularly innovative and ambitious way local communities' response to current challenges identified in the SEAPs and SECAPs, notably in the management of energy and the promotion of renewable energies. They allow us as well to identify the most appropriate communication actions to reach the local community.

In the case of Greater Irbid specifically, the municipality seems to be setting various challenges and aiming at meeting them, despite (and maybe because of) the increase of population, influx of refugees leading to an economic burden and more responsibilities, raised demands for services and the need to create new job opportunities that go along with the municipality's sustainable vision.

More than ever, applying the energy saving methods should be a collective responsibility and commitment conveyed through: targeted and long-term awareness campaigns and actions for the sake of the city; increased awareness towards national authorities to get their responsiveness in local sustainable policy issues; empowerment of the municipality staff through awareness workshops in order to get their exemplary engagement.

Awareness-raising should be carried out on several fronts to encourage, motivate and alert civil society:

Firstly, establish a strong and comprehensive communication methodology adjusted to all stakeholders (Professional, head teachers, youth movements, religious leaders, associations...) to facilitate the planning and implementation of the SECAPs; stick to the vision slogan in every communication; and highlight the goal aimed at and attain it (Fighting climate change for an empowered and sustainable city); On the other hand, a different new target has been added to the city, a weighty population of refugees that needs to be addressed as well in terms of awareness raising.

Therefore, it is essential to give the civil society enough empowerment to get it involved, learn to behave responsibly in relation to the environment, and actually become aware of its adherence to this cause; It is strongly recommended that the municipality of Irbid relies on the role of university students and academia, as partners in setting the sustainable and environmentally friendly future vision.

For that, it is essential to implement and empower a communication cell within the municipality, strengthen its capabilities and its human resources. It can then adopt a comprehensive communication strategy adjusted to all stakeholders (Professional, head teachers, youth movements, religious leaders, associations...) and carry its actions at the level of the municipality, in order to build a sustainable awareness plan adapted to the project of the city and connect with its citizens in regard to specific measures in the policy of the city on how to reduce energy; Build a proper Website of the city as well as social networks, promoting them as communication tools between the municipality and its citizens to create cohesion and therefore persuasion concerning the ongoing projects and the future ones.

Express a clear political commitment to involve individual target groups in future planning procedures to adapt/improve measures according to specific demands; set up a permanent forum with representatives of the various target groups; boost energy rationalization at the municipality level will aim at not only protecting the environment, reducing the costs but also setting the example and encouraging citizens to master their consumption, know about renewable and efficient energy, and encourage their production and use; communicate and promote at the city/authority zone level about actions and measures toward energy saving and energy efficiency that could influence the customer consumption and buying behaviour and improve the quality of life in the city;

Educate the audience by offering helpful energy efficiency tips to reduce cost and usage through entertainment, talk shows, special guests and things happening; This will convey a resonance regarding the populations' own energy consumption (e.g. using energy efficiency to save money in the long term); and will make people aware of the positive effect their actions can have on their global and local environments.

Last but not least, use adequate and well targeted media to deliver its message; Raising awareness should be carried out in an interconnected manner between the municipality and its citizens to create cohesion and therefore persuasion and change in behaviour.

Priority Action Fiche 1

Title: 16MW utility-scale solar PV power plant

Background

Jordan bears the highest financial cost to support the internally displaced people whose number reached 1.4 millions. This has created a financial and economic burden on the local community that has been dealing with this displacement that led to an increase in expenditures and inadequacy of the previous development plan due to the sudden and steady population growth. This imposes a higher need for development projects and infrastructure investments resulting from the excessive use and the inability to cover all the needs in the near future. As a result, the demand for electricity has largely increased because of the population increase. This has also led to an increase of the governmental subsidies in the electricity sector, amounting to more than JOD 1.9 billion. The National Electric Power Company is facing a loss of 53 piasters for every dinar of electricity consumed in the Kingdom, while the government subsidies reach 1.9 billion dinars annually.

Electricity Prices

The electricity tariff structure in Jordan takes into account social aspects as well as the economic capacities of consumers. In 2014, the electricity prices for the end consumer ranged from JOD 0.033 per kWh for small residential consumers with less than 150 kWh per month demand to JOD 0.292 per kWh for the banking sector. In 2012, the generation and distribution costs were JOD 0.146 per kWh, whereas the average selling price was JOD 0.0636 per kWh. The price difference had to be covered by the state-owned National Electric Power Company (NEPCO), thereby creating a substantial deficit of JOD 2.3 billion by the end of 2012⁶.

Greater Irbid Municipality suffers greatly from the burden of its energy bill's increase that reached JOD 4 million per year due to the rising prices for the fuels used and the expansion of the Greater Irbid Municipality organizational area. The increase in energy consumption is attributed to the need for additional services, which are steadily growing; thus, reducing energy expenditures, diversifying its sources and reducing harmful emissions are required. The recorded electricity consumption in Irbid for year 2015 was 1,145 GWh and is expected to reach 1,855 GWh by 2030. Increasing demand and scarcity in conventional sources have triggered the Greater Irbid Municipality to look into renewable energy sources especially solar energy. Knowing that Jordan has tremendous potential of generating solar energy, since it receives solar radiation almost throughout the year, this is an option to be further exploited by the municipality. Irbid receives an average of 5.19 kWh solar radiation per square meters per day.

Climate data location: Irbid (Met)								
Show data								
	Unit	Climate data location	Project location	Source				
Latitude	'N	32.6	32.6					
Longitude	'E	35.9	35.9					
Elevation	m	616	616	Ground				
Heating design temperature	°C	3.5		Ground				
Cooling design temperature	°C	32.9		Ground				
Earth temperature amplitude	°C	22.5		NASA				
Month	Air temperature °C	Relative humidity %	Daily solar radiation - horizontal kWh/m ² /d	Atmospheric pressure kPa	Wind speed m/s	Earth temperature °C	Heating degree-days 18 °C °C-d	Cooling degree-days 10 °C °C-d
January	9.2	72.8%	2.71	97.1	2.5	11.3	273	0
February	9.7	70.4%	3.43	96.9	2.6	12.7	232	0
March	11.9	65.2%	4.72	96.8	2.9	16.7	189	59
April	16.0	57.8%	6.04	96.6	2.6	23.1	60	180
May	21.4	46.4%	7.19	96.5	2.9	27.9	0	353
June	23.3	52.4%	7.79	96.4	3.5	31.3	0	399
July	25.1	58.4%	7.62	96.1	3.9	34.0	0	468
August	25.1	62.6%	6.88	96.2	3.5	34.2	0	468
September	23.7	60.7%	5.85	96.5	2.8	31.5	0	411
October	20.4	58.4%	4.36	96.8	1.9	25.7	0	322
November	15.1	61.3%	3.15	97.0	1.9	18.7	87	153
December	10.7	70.1%	2.49	97.1	2.1	13.2	226	22
Annual	17.7	61.3%	5.19	96.7	2.8	23.4	1,068	2,836
Source	Ground	Ground	NASA	NASA	Ground	NASA	Ground	Ground
Measured at					m	10		0

According to these facts, Greater Irbid Municipality has an ambitious plan to build large PV grid-connected solar power plants in the territory, with a cumulative installed capacity of 16MW by 2026. Photovoltaic modules or panels are made of semiconductors that allow sunlight to be converted directly into electricity and can provide a safe, reliable, maintenance-free and environmentally friendly source of power for long years.

⁶ https://www.solarwirtschaft.de/fileadmin/media/pdf/ENABLING_PV_Jordan_web.pdf
<http://www.memr.gov.jo/LinkClick.aspx?fileticket=PHxs463H8U0%3d&tabid=255>, 14 June 2014
<http://www.edama.jo/Content/Events/Presentations/ea3d28cc-e94f-40d5-8ba1-e98135c95800/08ce47f6-15a8-490a-9715-e640e06ed5f2.pdf>, 14 July 2014
<http://www.memr.gov.jo/LinkClick.aspx?fileticket=PHxs463H8U0%3d&tabid=255>, 14 July 2014

The action framework is obtained from the publication of International Finance Corporation (IFC)-2015. More details are available at the full report, accessible through the following link.

http://www.ifc.org/wps/wcm/connect/f05d3e00498e0841bb6fbbe54d141794/IFC+Solar+Report_Web+_08+05.pdf?MOD=AJPERES

It is very important to **successfully develop, finance, construct and operate** utility-scale solar PV power plants. The project development process should be the action's first part including site identification, plant design, energy yield, permits/licenses, contractual arrangements and financing ⁷.

Key elements of the project

According to the IFC-2015 report this process should cover the following:

1. **Optimum power plant design:** A key project development challenge is to design a PV power plant that is optimally balanced in terms of cost and performance for a specific site.
2. **Project implementation:** Achieving project completion on time and within budget with a power plant that operates efficiently and reliably, and generates the expected energy and revenue, is another key concern for developers. Key aspects of project implementation include: permits and licensing, selection and contracting of the Engineering, Procurement and Construction (EPC) Company, power plant construction, and operations and maintenance (O&M).
3. **Commercial and financing aspects:** PV regulatory frameworks and specific types of incentives/support mechanisms for the development of PV projects, such as preferential tariffs and other direct and indirect financial supports, have an important impact on the financial viability of the project, as they affect the revenue stream.

Power Purchase Agreements (PPAs) specify the terms under which the off-taker purchases the power produced by the PV plant; this is the most important document to obtain financing.

Description of the action

The action summarised is to develop, finance, construct, operate and maintain 16 MW utility-scale solar PV power plants in Irbid.

Establishing a power station using photovoltaic cells and using the best solar cell systems on a 500 dunum plot of land located in the village of Al-Khanasri.

The village is characterized by high brightness and technical appropriateness for the establishment of this station, where the electricity will be transferred through national electricity grid, knowing that:

- A permit for the establishment of a 16 MW solar power plant has been obtained and approved by the Ministry of Environment, Ministry of Energy and Mineral Resources, Ministry of Municipal Affairs, Electricity Regulatory Commission, and the Electric Power Company;
- The approval for transmitting the generated electricity through its grid has been obtained from the National Electric Power Industry;
- An actuarial study of the energy bill for 2017 has been made;
- The Municipality will train skilled personnel on the maintenance and continuity of the station.

Before starting, it is essential for a successful project to have suitable expertise within the project team.

This does not only apply to **technical** expertise **but also to financial, legal and other relevant fields**. Suitable expertise can be incorporated in a variety of ways: by hiring staff, using consultants or partnering with other organisations⁸.

PROJECT DEVELOPMENT OVERVIEW -refer to Annex for more details

STAGE 1 – CONCEPT DEVELOPMENT AND SITE IDENTIFICATION

1. Identification of potential site(s)
2. Funding of project development
3. Development of rough technical concept

STAGE 2 – PREFEASIBILITY STUDY

1. Assessment of different technical options

⁷ http://www.ifc.org/wps/wcm/connect/f05d3e00498e0841bb6fbbe54d141794/IFC+Solar+Report_Web+_08+05.pdf?MOD=AJPERES

⁸ http://www.ifc.org/wps/wcm/connect/f05d3e00498e0841bb6fbbe54d141794/IFC+Solar+Report_Web+_08+05.pdf?MOD=AJPERES

2. Approximate cost/benefits
3. Permitting needs
4. Market assessment

STAGE 3 – FEASIBILITY STUDY

1. Technical and financial evaluation of preferred option
2. Assessment of financing options
3. Initiation of permitting process
4. Development of rough technical concept

STAGE 4 – PERMITTING, CONTRACTS AND FINANCING

1. Permitting
2. Contracting strategy
3. Supplier selection and contract negotiation
4. Financing of project

STAGE 5 – ENGINEERING, PROCUREMENT, CONSTRUCTION AND COMMERCIAL OPERATION

1. Preparation of detailed design for all relevant lots
2. Preparation of project implementation schedule
3. Finalization of permitting process
4. Construction supervision
5. Performance testing
6. Preparation of as build design (if required)

General objectives

1. Reducing CO₂ emissions;
2. Reducing the energy bill that reaches about JOD 4 million annually;
3. Using renewable energy sources and environmentally friendly clean energy;
4. The generated energy from the photovoltaic cells includes all the activities that require the electricity consumption for all sectors such as street lighting, buildings and various facilities, parks, travel agencies and other municipal facilities;
5. Raising citizens' awareness to utilize these techniques so that the photovoltaic cell system will be installed in the commercial, investment and residential buildings, taking the municipality as a good example.

Action	Energy consumed in year 2015 in MWh	Estimated energy consumed in year 2030 in MWh	Emission in t CO ₂ in year 2030	Energy produced when applying the action in MWh	Amount of reduction in emission in tCO ₂	Cost in JOD
Establishment of the first phase of the station 4 MW	25,133	40,715	26,424	7,738	5,022	3,000,000
Establishment of the second phase of the station 4 MW				7,738	5,022	3,000,000
Construction of the third phase of the station 4 MW				7,738	5,022	3,000,000
Establishment of the fourth phase of the station 4 MW				7,738	5,022	3,000,000
Awareness campaigns to reduce energy consumption				210	136	100,000
الإجمالي	25,133	40,715	26,424	31,162	20,224	12,100,000

Technical description

- *Main Technology to implement and equipment to use*

SOLAR PV TECHNOLOGY OVERVIEW

This section discusses module technologies, mounting systems, inverters and methods of quantifying plant performance. It provides an overview of current commercially available technologies used in utility-scale solar PV projects. The purpose is to provide a framework of understanding for developers and investors before they commit to a specific technology.

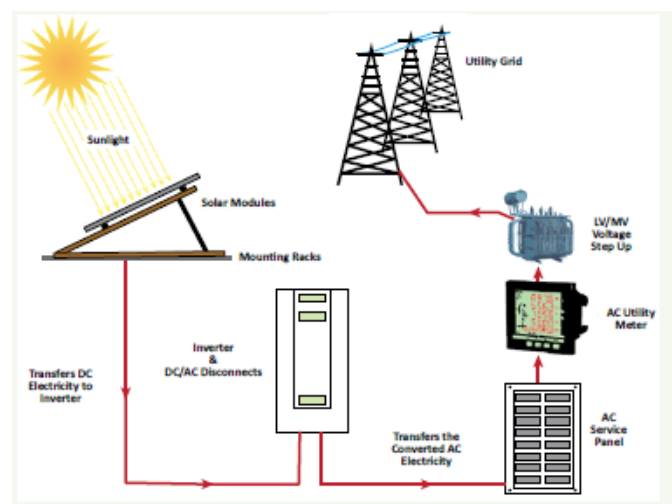
PV cell technologies are broadly categorised as either crystalline or thin-film. Crystalline silicon (c-Si) cells provide high efficiency modules. They are sub-divided into mono-crystalline silicon (mono-c-Si) or multi-crystalline silicon (multi-c-Si). Mono-c-Si cells are generally the most efficient, but are also more costly than multi-c-Si. Thin-film cells provide a cheaper alternative, but are less efficient.

There are three main types of thin-film cells: Cadmium Telluride (CdTe), Copper Indium (Gallium) Di-Selenide (CIGS/CIS), and Amorphous Silicon (a-Si).

The performance of a PV module will decrease over time due to a process known as degradation. The degradation rate depends on the environmental conditions and the technology of the module.

Modules are either mounted on fixed-angle frames or on sun tracking frames. Fixed frames are simpler to install, cheaper and require less maintenance. However, tracking systems can increase yield by up to 45 percent.

Tracking, particularly for areas with a high direct/diffuse irradiation ratio also enables a smoother power output. Inverters convert direct current (DC) electricity generated by the PV modules into AC electricity, ideally conforming to the local grid requirements. They are arranged either in string or central configurations. Central configuration inverters are considered to be more suitable for multi-MW plants.



String inverters enable individual string Maximum Power Point Tracking (MPPT) and require less specialised maintenance skills. String configurations offer more design flexibility.

PV modules and inverters are all subject to certification, predominantly by the International Electro technical Commission (IEC). New standards are currently under development for evaluating PV module components and materials.

The performance ratio (PR) of a well-designed PV power plant will typically be in the region of 77 percent to 86 percent (with an annual average PR of 82 percent), degrading over the lifetime of the plant. In general, good quality PV modules may be expected to have a useful life of 25 to 30 years⁹.

- *Previous or linked studies*

The PV installation had proven successful implementation all over the world and in Jordan a 10 MW utility-scale solar PV power plant has been installed in Muffrek for around 5 years and it has proven stability and good results which can be taken as example to lessons learned in order to cover the weak points and improve the new design.

- *Project Life time exploitation or use duration*

PV systems are generally designed for a 25–30 year lifetime.

- *Engineering Studies*

The action includes five stages of preparation and implementation where in all these stages a precise successful achievement is expected

⁹ http://www.ifc.org/wps/wcm/connect/f05d3e00498e0841bb6fbbe54d141794/IFC+Solar+Report_Web+_08+05.pdf?MOD=AJPERES

Implementation plan or construction plans necessary for the implementation and their availability

PROJECT DEVELOPMENT OVERVIEW -refer to Annex for more details

STAGE 1 – CONCEPT DEVELOPMENT AND SITE IDENTIFICATION

STAGE 2 – PREFEASIBILITY STUDY

STAGE 3 – FEASIBILITY STUDY

STAGE 4 – PERMITTING, CONTRACTS AND FINANCING

STAGE 5 – ENGINEERING, PROCUREMENT, CONSTRUCTION AND COMMERCIAL OPERATION

Availability of environmental impact assessment or mitigating measures to protect environment if any

Already included in the project preparation stages

Summary of related Awareness Raising (AR) actions

AR related to the action

Target Audience:

- Civil society;
- Private and public operators;
- Professionals in energy sector;

Key Message:

- Green society with Renewable energy reliable and green production of electricity.

Objectives:

- Reduce the city's energy bills;
- Limit the impact of the emission of the greenhouse gas;
- Promote the use of renewable energy in buildings.

AR related to community

- Meetings with the community members to promote the municipal action and the usage of renewable energy in the city;
- Create awareness with posters to alert citizens on municipality action. The actions will be accompanied by strong visual campaign in the municipal and local media;
- AR campaign on being an eco-citizen: Explain the side effect of greenhouse gas emission and the usage of renewable energies technologies (electricity from natural resources) through messages conveyed by television, the radio and the written press;
- Creating an info centre to inform citizens about new technologies;
- Training students (primary and secondary schools) on using the energy correctly.

Assumptions and risks

According to IFC-2015 report "The Key risks associated with the PV projects":

- Completion risks affected by permitting/licensing and construction delays;
- Energy yield: how much energy the facility will be producing depends on the energy resource and the design of the PV plant. An incorrect estimation of the energy resource, an unforeseen change in weather patterns and performance degradation of the PV plant could significantly affect the revenue of the project;
- Regulatory environment: Changes impacting the amount of power the off-taker is obligated to purchase and the price they pay can clearly impact the project, especially when applied retroactively;
- Off-taker creditworthiness: A thorough due diligence of the off-taker is an essential step before financing is finalized;
- The appropriate financing arrangement depends on the specifics of each PV project, including investor risk appetite. The most common arrangement for such projects generally is to use a project finance type arrangement, typically with at least 30 percent equity and the remainder as debt.

Key success factors

Establishing a power station using photovoltaic cells and using the best solar cell systems on a 500 dunum plot of land located in the village of Al-Khanasri.

The village is characterized by high brightness and technical appropriateness for the establishment of this station, where the electricity will be transferred through the national electricity grid, knowing that:

- A permit for the establishment of a 16 MW solar power plant has been obtained and approved by the Ministry of Environment, Ministry of Energy and Mineral Resources, Ministry of Municipal Affairs, Electric Regulatory Commission, and the Electric Power Company;
- The approval for transmitting the generated electricity by its grid has been obtained from the National Electric Power Industry;
- An actuarial study of the energy bill for 2017 has been made;
- The Municipality will train skilled personnel on the maintenance and continuity of the station

Next steps

Annexes

STAGE 1 – CONCEPT DEVELOPMENT AND SITE IDENTIFICATION

STAGE 2 – PREFEASIBILITY STUDY

STAGE 3 – FEASIBILITY STUDY

STAGE 4 – PERMITTING, CONTRACTS AND FINANCING

STAGE 5 – ENGINEERING, PROCUREMENT, CONSTRUCTION AND COMMERCIAL OPERATION

Projected Energy Estimates in 2030		Cost of Implementation										Available and foreseen sources of funding		
Mitigation		All cost		12,100,000 JOD		Local authority's own resources		20%						
MWh/a	t CO ₂ /a	Initial and start-up expenses		3,000,000 JOD		National Funds and Programmes		20%						
31,162	20,224	Approximate operational Costs (including maintenance)		300,000 JOD		International Financial Institutions		10%						
Per capita calculated reduction		Approximate annual income for energy producing projects		4,549,652 JOD (0.146 JOD/Kwh)		EU Funds & Programmes and other external funds		30%						
MWh/c	t CO ₂ /c	Draft calculation of the NPV.		JOD 47,908,747		Public-Private Partnerships amount/share (available or to raise)		20%						
0.0359	0.0233	Key performance Indicator		Production capacity KWh/a		Lined up private investments								
Contribution for		Reduction as related to BAU scenario		Measurement Units		Loans and potential borrower								
1.98%	1.26%	Years of Implementation		Expected annual cost savings to the City budget		4,549,652 JOD (0.146 JOD/Kwh)								
		1		2		3		4		5		6		
		7		8		9		10		Other				
Organisation and procedures														
Area of intervention		Photovoltaics			Involvement of Stake Holders		LA		H					
Policy Instrument		Energy suppliers' obligations			Involvement of Stake Holders		External		H		Municipality of Greater Irbid / Electricity Sector Regulatory Commission / Electricity Company / assigned Company to tender implementation			
Origin of action		LA					Other		H					
Staff Capacity		L	M	H	Technical assistance needs									
					The action required technical expertise, financial, legal and other relevant fields. The SECAP UNIT will follow the project along with Chief Electrical Engineer of the Greater Irbid Municipality and with assigned consultant for the project Such project need coordination with following public partners Municipality of Greater Irbid, Ministry of Environment, Ministry of Energy and Mineral Resources, Ministry of Municipal Affairs, Electricity Sector Regulatory Authority, Electricity Company, Ministry of Planning, Ministry of Finance									

Annex for Priority action 1

STAGE 1 – CONCEPT DEVELOPMENT AND SITE IDENTIFICATION

Concept development stage includes identification of the investment opportunity at a specific site and the formulation of a strategy for project development.

These require a detailed assessment that carefully considers the risk–reward appetite of the project developer (Municipality) and potential investors.

1. SITE IDENTIFICATION
2. THE PV PROJECT
3. OUTLINE OF PROJECT STRUCTURE
4. THE REGULATORY FRAMEWORK AND SUPPORT MECHANISMS
5. OFF-TAKER DUE DILIGENCE
6. FINANCING STRATEGY

Concept Stage Checklist

The checklist below covers key questions and factors the developer should consider when deciding whether to proceed to the next stage, which is to conduct a prefeasibility study.

- Project structure outlined.
- Does the country and power sector provide adequate risk-reward benefits to private investors?
- Regulatory support and tariffs, especially the duration and timeline for any incentives for solar power.
- Suitable site identified taking account of site constraints.
- Grid access (proximity, capacity, and policy provisions for access).
- Appropriate funds available to carry out the feasibility assessments.
- Identification of off-taker and available infrastructure to take the power generated

STAGE 2 – PREFEASIBILITY STUDY

Develop a preliminary plant design and investment requirements, which allow further assessment of the financial viability of a project. This assessment involves more detail than the previous stage and determines whether to proceed further with the project and commit additional financial resources.

A prefeasibility study should, at a minimum, include an assessment of:

- The project site and boundary area, ensuring access to the site is possible, both legally and technically.
- A conceptual design of the project giving different options of technology (if applicable) and the financial impacts, including estimation of installed capacity.
- The approximate costs for land, equipment, development, construction and operation of the project, as well as predicted revenue.
- Estimated energy yield of the project. While site specific analysis should be performed at a later stage, for prefeasibility purposes, published, high-level solar resource data and estimates of plant losses, or an assumed performance ratio (based on nominal values seen in existing projects) can be used. Seasonal production estimates should be taken into account.

Prefeasibility Checklist

Below is a checklist of key considerations for the developer during the prefeasibility stage:

- Assessment of the site and boundary areas including access permissions and restrictions.
- Conceptual design completed including consideration of technology options and their financial impacts.
- Approximate costs for land, equipment, delivery, construction, and operation identified along with predicted revenue.
- Indicative energy yield completed.
- Identification of anticipated electricity tariff to be received, and review of expected terms/conditions of PPAs in the relevant market.
- High-level financial analysis completed.
- Cost and likelihood of achieving grid connection in the required timescales identified.
- Main environmental constraints identified along with other potential “deal breakers.”
- Assessment of current and potential future regulatory environment completed.
- An initial concept of the project’s legal/corporate structure.
- Solutions to project challenges.
- Permitting requirements/costs identified.
- Preliminary project timeline/workflow showing spacing of key activities drafted

- The anticipated electricity tariff to be received based on market analysis in a deregulated market, a published Fit in a market with specific incentives for renewables, or the relevant components of the tariff in a market under consideration.
- A financial model to determine the commercial viability of the project for further investment purposes.
- Grid connection cost and likelihood of achieving a connection within the required timeline.
- Identification of key environmental and social considerations and other potential “deal-breakers.”
- Permitting requirements, costs, and likelihood of achieving consent. Assessment of the current regulatory environment, stability assessment and possible risk of future changes (for example, likelihood of changes during upcoming regional/national elections).
- An initial concept of the project’s legal/corporate structure; this should be formulated to take advantage of existing/future incentives. At the prefeasibility stage, the developer may begin making assumptions about the project company which, if the project moves ahead, would be set up to develop and own the specific project or portfolio.
- Solutions to specific challenges; as challenges to the project arise, possible solutions will begin to be identified. For example, if the power off-taker does not have a strong credit rating, the developer may want to explore the possibility of a sovereign guarantee, and/or support from an export credit agency or a multilateral institution – for example, a partial risk guarantee from the World Bank.
- Preliminary timeline for project activities; while the scheduled workflow will inevitably change significantly, it is important to begin to understand the spacing and timing of key required activities at an early stage.

STAGE 3 – FEASIBILITY STUDY

The feasibility phase will build on the work undertaken at the prefeasibility stage by repeating the assessment in more detail using site-specific data, such as solar resource measurements, and should consider any previously identified constraints in more detail.

If multiple sites are being assessed, then the preferred site needs to be selected. The objective of the feasibility study is to provide more detailed information on the potential project design, the investment requirements, and to plan for financing and implementation. If the results of the study are favourable, the Municipality should be prepared to invest more to advance the project to the financing stage.

1. TECHNICAL SYSTEM DESIGN

Outline system design. Essentially, this is a plan for the project’s physical development, including the lay-out, identification of equipment, and costs, etc. The system design is often required to obtain permits/consents.

To select an initial conceptual design, it is worthwhile to evaluate various design configurations and module sizes, so that a design can be selected that is optimised for the site.

- Assessment of shading and initial solar PV plant layout. Enables optimisation and typically takes into account:
 - o Shading angles.
 - o Operations and maintenance (O&M) requirements
 - o Module cleaning strategy.
 - o Tilt angle, orientation, and tracking.
 - o Temperature and wind profiles of the site.
 - o Cable runs and electrical loss minimisation.
- Production of a detailed site plan, including site surveys, topographic contours, depiction of access routes, and other civil works requirements.
- Calculation of solar resource and environmental characteristics,

Feasibility Checklist

Below is a checklist for developers with the key considerations that must be addressed during the feasibility stage.

- Detailed site plan produced.
- Solar resource assessed including assessment of shading.
- Environmental characteristics that may affect performance identified.
- Detailed review of environmental and social considerations conducted.
- Detailed review of required permits and licences undertaken.
- Assessment of Capex for technology and supplier options; cost/benefit for options and project location completed.
- Pre-application discussions with relevant consenting authority undertaken.
- Initial consultations with key stakeholders including from the community completed.
- Grid connection assessment completed.
- Predicted energy yields established.

especially those that will impact performance of technical requirements (temperature, wind speed, and geological hazards).

- Further assessment of anticipated electricity tariff undertaken.
- Financial analysis carried out. Preliminary financing planned.
- Project implementation plan developed.
- Options agreements for land access (where required) secured.
- Evaluation and concept of the commercial structure of the project and project company(s) carried out.

- While the accuracy of satellite data is increasing and is acceptable in many cases, it is often desirable to implement site-specific measurements of irradiation³ as early in the project planning process as possible; the feasibility study stage is a good time to bring such data into the planning process. Note that irradiation levels often vary across seasons, and this needs to be accounted for in the financing model.
- Electrical cabling design and single line diagrams.
- Electrical connections and monitoring equipment.
- Grid connection design, including transformers and metering, etc.
- Full energy yield analysis using screened solar data and the optimised layout.
- Assessment of all technology options and cost/benefit analysis of potential suppliers given the project location, including:
 - o Module selection. This is an optimized selection based on the feasibility phase output, current availability, and pricing in the market place. Note that in countries where the solar industry is still in its infancy, there may be challenges when importing solar modules and other critical components of plant infrastructure. Examples include delays at customs and difficult negotiations on the terms of sale with manufacturers lacking a local sales representative or distributor.
 - o Inverter selection. Manufacturers are predominately based in Europe and North America, though others are emerging in China and Japan. As above, importation can result in delays to project schedules.
 - o Mounting frame or tracking system selection, including consideration of site specific conditions.

1. **PERMITTING AND ENVIRONMENTAL, HEALTH AND SAFETY (EHS) REQUIREMENTS**

- Detailed review and inventory of all necessary permits and licences needed for constructing and operating the power plant. Examples are environmental permits, land use permits, and generator licences.
- Pre-application discussions with the relevant consenting authority about the schedule for permitting, to understand the financial implications.
- Detailed review of environmental and social considerations, such as wildlife conservation or other designations that may affect permissible activities at the project sites; this is usually performed with a desk based assessment and if possible supplemented by an initial site survey.
- Initial consultation with key stakeholders, including local community stakeholders, as relevant.
- Grid connection issues. This should be a more detailed assessment of likelihood, cost, and timing of grid connection, as well as transmission line capacities and constraints. This may also include submission of an initial application into the grid interconnection queue or achieving a “feasibility stage tariff” approval from the regulator

2. **FINANCIAL FEASIBILITY OF PROJECT**

- Financial modelling to determine commercial viability and attractiveness of the project. Such modelling includes all costs and revenues. It should also involve a sensitivity analysis to start assessing the project risks.
- Further assessment of the anticipated electricity tariff. This is especially pertinent in markets where the tariff is expected to fluctuate, either by:
 - o Deliberate design, such as in a power market where the developer is an Independent Power Producer (IPP) selling power in a wholesale or spot exchange;
 - o Market forces, such as use of Renewable Energy Credits (RECs) or another market-based instrument, which could contribute to the developer’s revenue; or
 - o Potential for revision of negotiated tariffs, such as if the government decides to revise the tariffs retroactively (uncommon but has occurred) or the off-taker asks for re-negotiation.

3. PROJECT DEVELOPMENT/COMMERCIAL ASPECTS

- Project implementation plan – Level 1 (minimum) including a Gantt chart laying out the project timeline, resource requirements, project development budget, procurement concept (e.g., full turnkey or multi contracting approach), and O&M concept.
- Option agreements for land access for all privately held land or access roads, or a concession agreement with the relevant authority.
- Evaluation of the commercial structure of the project. This includes evaluating the project company or companies, which may involve a Special Purpose Vehicle (SPV), depending on company structures allowed under local law. This also includes evaluating any off-shore parent-company structures and incorporation location based on legal, financial and tax criteria corresponding to the project.
- Investment and funding requirements and the investment concept. This should include equity contribution amounts and sources, equity partner requirements and financing assumptions to be included in the financial model.
- A project structure and risk-mitigation strategy. In many emerging markets, to make a project “bankable” (i.e., able to attract reasonably-priced debt financing) it is typically necessary to secure credit enhancements, which can be either private (letters of credit, escrow accounts) or governmental (sovereign guarantees).
- Procurement of Owner’s Engineer. As the intention to proceed with the project grows, so too the technical scope for the EPC or other technical tendering procurement contracts needs to be drafted and reviewed by the Owner’s Engineer. The EPC’s Owner’s Engineer scope of work may also include support for the technical procurement (e.g., PV plant components) and technical design review. The same firm usually follows through as the Owner’s Engineer during the construction phase.
- Tender and award of Owner’s Counsel to support contracts development and negotiation as well as any relevant legal-structuring needs and company set-up during the development phase.

STAGE 4 – PERMITTING, CONTRACTS AND FINANCING

After the feasibility stage and assuming that the project still seems to be financially viable, the project moves to the next stage. This includes obtaining final permits, securing project finance and pre-implementation activities (commercial contracts). The timing and sequencing of this stage will vary significantly by project, but this phase usually includes the following activities:

1. Engagement of relevant community or stakeholders.
2. Preparation and submission of relevant permit and licence applications and associated documents for the proposed project.
3. Environmental and social assessments (agreed in consultation with permitting authority and other statutory bodies), which may include a full Environmental and Social Impact Assessment (ESIA).
4. Preparation and submission of a grid connection application.
5. Review of the design and any permit/consent conditions; revision of design or consents as needed.
6. Contractor prequalification, ranking, and short list selection.
7. Decision on the financing approach (e.g., sources and proportions of equity and debt, including construction financing).
8. Securing financing for the project.
9. Decision on contracting strategy (i.e., EPC contract or multi-contract).
10. Preparation of solar PV module tender documentation. Supplier/contractor selection and contract negotiations.
11. Preparation of construction or balance of plant tender documentation.
12. Preparation of PPA documentation and final negotiations.
13. Preparation of O&M concept and contracts, as relevant.
14. Preparation of Owner’s Engineer tender (if technical advisor is not continued into construction).
15. Contracting and procurement of relevant insurances (i.e., construction, operation, etc.).
16. Preparation of Lender’s Engineers and Lender’s Council tenders.
17. Finalisation of grid interconnection agreement with grid operator or relevant authority.
18. Preparation of detailed, bankable financial model covering the full lifecycle of the plant. Typically this will only be completed after negotiating the EPC or equipment and Balance of Plant (BoP) contracts, as well as O&M contracts, so that the financial model can incorporate final costs of capital and O&M.
19. Completion of a project risk analysis.

20. Transportation analysis as necessary for difficult-to reach project locations.
21. Finalisation of all land, surface area, and access agreements— and trigger land agreement options to convert to long-term leases or easements, as necessary.
22. Finalisation of the detailed project implementation plan.

1. PERMITTING

An approved permit must be obtained before construction of a project commences. Permit requirements vary widely between different countries and regions. In general, the type of permits may include, but are not limited to:

1. Land lease agreement(s).
2. Access agreements.
3. Planning/land use consents.
4. Building/construction permits.
5. Environmental permits (forestry, endangered species, EIA, etc.).
6. Social impacts (i.e., cultural heritage/archaeological sites, stakeholder consultations).
7. Energy permit.
8. Grid connection application.
9. Operator/generation licences.

2. FINANCING

Financing a solar PV project is similar in principle to financing other types of power projects; however, certain risks that are unique to solar PV must be accounted for in the financing plan. Risks associated specifically with solar

PV projects are related to the energy resource (irradiation), project siting and permitting, solar technology (relatively new), potential degradation of PV modules, and reliability of long-term plant performance, as well as potential uncertainty of the tariff and revenue collection

3. CONTRACTS

Contract Strategy

Contracts present developers with several important considerations. Perhaps foremost is establishing a project company or SPV (special purpose vehicle); if not already initiated, an SPV should be formally established. The developer typically creates and owns the project company, potentially with equity co-investment from another financial backer (sponsor), such as an infrastructure fund.

All contracts, land agreements, financing and secured project permits and licenses need to be issued in the name of the SPV; transferring these later to the SPV can be very difficult and time consuming. Also, lenders often insist upon the rights of assignability (e.g., the right for project assets and liabilities to be assigned to them in the event of default). Considering assignability at early stages of incorporation can save significant time later in the development process.

Coordination of Contract Signing

It is critical that the developer or project sponsor closely coordinates the structure, terms and timelines for execution of key strategic documents. Without close coordination, there are likely to be conflicts or contradictions between documents, or worse, the developer can create financial obligations that cannot be met. Critical path analysis is essential to identify

Checklist for Permitting, Financing, and Contracts

Below is a checklist of critical issues that a developer needs to consider during the stage of project development that involves securing permitting, contracts, and financing.

- Preparation and submission of relevant permit and license applications.
- Environmental and social assessments (as required) completed.
- Grid connection application prepared and submitted. Grid connection agreement signed.
- Review of design and permit/consent conditions completed.
- Contracting strategy approach determined.
- Financing structure decided. Financing secured for the project.
- Community or stakeholder engagement completed.
- Solar PV tender documentation prepared.
- Supplier selection and ranking undertaken.
- PPA documentation prepared.
- O&M concept and contracts prepared.
- Owner's Engineer tender prepared.
- Relevant insurance procured and contracted.
- Lender's Engineer and Lender's Council tenders prepared.
- Tendering and evaluation of bidders for all contracts carried out.
- Contract negotiations completed.
- Bank-grade energy yield completed.
- Detailed bankable financial model completed.
- Transportation analysis (if required) carried out.
- All land and access agreements finalised.
- Project risk analysis completed.
- PPA finalised with off-taker.
- Detailed project implementation plan finalised.
- Technical and legal due diligence completed (if required).

interdependencies and key activities that require close monitoring to avoid project delays. Project timelines and corresponding contractual signing should be coordinated to avoid sub-optimal bargaining positions in reaching financial close. Examples of poor coordination include:

- The signing of a PPA without knowing the requirements of the grid interconnection agency and/or without having a grid connection agreement.
- Signing of an EPC contract without the necessary financial commitment from investors. If the financing is not yet in place, a developer should commit only to an EPC agreement that is not binding until financial close is reached.
- Signing of an EPC contract before all permits and licenses are obtained.

STAGE 5 – ENGINEERING, PROCUREMENT, CONSTRUCTION AND COMMERCIAL OPERATION

2.6.1 ENGINEERING AND PROCUREMENT

2.6.1.1 Development of Detailed PV Design

The EPC contractor will prepare the necessary detail documentation for the solar PV plant to be tendered and constructed. The following documentation will be prepared:

- Detailed layout design.
- Detailed civil design (buildings, foundations, drainage, access roads).
- Detailed electrical design.
- Revised energy yield.
- Construction plans.
- Project schedule.
- Interface matrix.
- Commissioning plans.

Key electrical systems must be designed in rigorous detail.

This will include equipment required for protection, earthing and interconnection to the grid. The following designs and specifications should be prepared:

- Overall single line diagrams.
- Medium voltage (MV) and low voltage (LV) switch gear line diagrams.
- Protection systems.
- Interconnection systems and design.
- Auxiliary power requirements.
- Control systems.

2.6.1.2 Energy Yield

The energy yield should include:

- An assessment of the inter-annual variation and yield confidence levels.
- Consideration of site-specific factors, including soiling or snow, and the cleaning regime specified in the O&M contract.
- Full shading review of the PV generator including near and far shading.
- Detailed losses and performance degradation over time.
- A review of the proposed design to ensure that parameters are within design tolerances.

2.6.1.3 Detailed Project Documentation

The information that should be included are detailed below:

- Site layout showing the location of modules, inverters, and buildings.
- Indicative plans showing
 - o Mounting frame and module layout.
 - o Inverter locations and foundations/housings.
 - o Security measures.
- Initial electrical layouts:
 - o Schematics of module connections through to the inverter.
 - o Single line diagrams showing anticipated cable routes.
 - o Grid connection and potential substation requirements.
- Bill of materials for major equipment.

- Energy yield analysis.
 - o Losses assumed with regard to the energy yield forecast.
- Financial model inputs including:
 - o Long term O&M costs and contingencies (up to the end of the design life and/or debt term).
 - o Availability assumptions.
 - o Degradation of module performance assumptions.
 - o Spare parts inventory cost.
 - o Connection cost for electricity and services.
 - o Cash flow model including maintenance of a specified debt service coverage ratio (DSCR) 5 if applicable, and contingency reserve to be used for inverter replacement, weather damage, and other unexpected costs associated with plant operation.
- Copies of all contracts negotiated:
 - o PPA.
 - o EPC Contract.
 - o Equity subscription agreement and incorporation documents for project SPV.
 - o Copies of applicable insurance and other risk mitigation.
 - o Other documents, such as currency hedging agreements, etc., as applicable.
- Details of the permitting and planning status.
- Environmental impact, restrictions, and mitigation plans.

2.6.2 CONSTRUCTION AND COMMERCIAL OPERATION

After the contract(s) have been awarded (whether multiple or a single EPC), the role of the developer is to oversee the implementation of the project. This can be done using the developer's own staff, if they have the expertise and experience, or by hiring an Owner's Engineer. Each contractor designs, procures, and installs the components of the PV plant under the terms of its contract. If multiple contracts are awarded, coordination of schedule and interfaces is critical.

Critical tasks that need to be carried out independently for each type of contract include:

- Planning and sequencing of tasks.
- Cost management
- Risk management.
- Coordination among all organizations involved in the project

Priority Action Fiche #2

Title: Brilliant lighting for Greater Irbid Municipality

Background

Greater Irbid municipality is responsible for providing street lighting services to its main streets and sub roads within its organized areas that reach 23 regions.

The number of lighting units in the baseline year of 2015 was around 50,000 on which the annual consumption costs were approximately JOD 3,200,000 representing 80% of the energy bill that reached JOD 4 million. However, the municipality suffers from the continuous rise in the electricity tariff and expansion of its served areas due to the increase in population and displaced people. This increase in the cost will continue growing in the coming years to about JOD 5,184,000 annually for the business as usual scenario for 2030, without applying measure and actions related to energy reduction.

Description of the action

The main measures could be summed as follows:

- **Develop measures and technical specifications for the Public Street Lighting** meeting the international standard and ensure the reliability and feasibility of the new LED products with support of national standards and lighting consultants;
- **Develop and set the recycling programme for replacement of HPS with efficient LED lamps**, that should be properly recycled to prevent mercury exposure;
- **Develop operation and maintenance procedures to Improve energy efficiency in public street lighting** by installing integrated management procedures and measures:
 - o Activate the role of regular maintenance;
 - o Develop a management and maintenance plan;
 - o Improving the efficiency of street lighting;
 - o Classification of public street lighting according to the area and classification of the street;
 - o Training the maintenance personnel on the new measures.
- **Install smart street lighting technologies**
 - o Replace mercury lamps and sodium (HPS) lamps with more efficient ones such as LED;
 - o Replacement of photovoltaic cells with an Astronomic timer that switches operation timing with sunrise and sunset; Astronomical timer helps adjusting street light operation according to the Dusk and Dawn which could save 365 hours per year, also will avoid worthless functioning at cloudy days and with broken Photocell. All those benefits could be achieved with a well-developed, organised and monitored plan;
 - o Installing lightning protection for LED lighting;
 - o By applying new technology in the LED Drivers, the lamp can be dimmed after midnight. This will contribute in energy saving and will extend the life time of the LED lamp.

Part of the required measures have been worked on by replacing mercury lighting with that of LED, which has proved its efficiency in saving energy, an aspect that needs to be continued when changing or replacing street lights.

Below is an explanation of the expected reduction results, which shows that the consumption would reach 9,072 MWh, and the energy bill would be JOD 1,218,000, thus leading to an annual saving of about JOD 1,982,000.

In the chart below the estimated LED lamp to be used will be calculated on the following basis:

For HPM lamp 125, Equivalent LED lamp is equal to type of lamp in watt (125) x Lumen per watt (50) divided by led lumen per watt (137) = 46 led lamp equivalent.

Mitigation			
MWh/a	t CO2/a		
22,835	14,820		
Contribution for			
60%			
Cost of Implementation JOD			
16,129,370			
Involvement of Stake Holders	LA	H	
	External		
	Other		
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Energy Consumption and operation and maintenance cost			
Measurement Units			
MWh / JOD			
Area of intervention			
Energy Efficiency			
Policy Instrument			
Energy Management			
Origin of action			
LA			
Priority of action			

The annual consumptions with LED lamps in KWh= Equivalent led lamp in watt * Quantity of Lamp * annual operation hours (4,400 average 12 hours of daily operation) divided by 1,000 (to convert to KWh).

The calculated reduction in consumptions by applying the actions is presented in the table below

Sector	Lamp Type in watt	Lumen per watt	LED lumen per watt	Equivalent LED lamp in watt	Quantity of Lamp	Annual consumptions with LED lamps in KWh
Street lighting	HPM	125	50	137	46	5,073,425
	HPS	70	117	137	60	4,946,589
	HPS	150	117	137	128	1,978,636
	HPS	250	117	137	160	741,396
Estimated consumption with				LED lights		12,740,046
Estimated consumption with				Dimming control		9,979,703
Estimated consumption with				Astronomic timer		9,072,457

The current situation

Sector	Lamp Type in watt	Annual Consumptions in KWh	Quantity of Lamp	
Street lighting	HPM	125	13,901,184	25,275
	HPS	70	5,792,160	18,806
	HPS	150	2,316,864	3,510
	HPS	250	1,158,432	1,053
Total		23,168,640	48,644	

The estimated saving is $23,168,640 - 9,071,457 = 14,097,183$

The estimated saving in year 2030 will be $14,097,183 * 1.62 = 22,837,436$ KWh.

Action can be summarised as follows

Modern street lighting system

- Replacement of photovoltaic cells with an Astronomical time delay and the installation of lightning protection;
- Replacement HPS lighting is a novelty of LED (with smart drivers);
- Activate the role of periodic maintenance.

General objectives

Setting street lighting measures is of great importance as the operational bill is becoming high; and due to the technological advancement, effective and successful solutions have come to be available. For example, incorporating the advanced and effective LED lighting offers high results in energy efficiency.

Therefore, there should be appropriate measures that would help in reducing energy consumption and costs and improve services. By implementing such measures, consumption will be reduced from 37,533 MW to 14,097 MW by 2030, and costs from JOD 5,479,818 to JOD 2,058,162, thus saving an annual rate up to JOD 3,421,656.

Saving energy consumption value

- Improving services;
- Reducing emissions;
- Saving energy consumption values in street lighting and energy bill;
- Utilizing clean energy for street lighting;
- Improving the intensity of street, parks and building lighting;
- Raising citizen's awareness and encouraging them to replace lighting units with energy efficient ones.

Technical description

- Main Technology to implement and equipment to use

LED technology is relatively new and there is a lot of progress in improving its efficiency and durability. Astronomical timers help in adjusting street light operation according to the Dusk and Dawn which could save 365 hours per year, also will avoid worthless functioning at cloudy days and with broken Photocell. All those benefits could be achieved with well-developed, organised and monitored plan. With this new technology in the LED Drivers, the lamp can be dimmed after midnight. This will contribute in energy saving and will extend the life time of the LED lamp.

- *Previous or linked studies*

The municipality has successfully converted two percent of the HP street lamps to LED as fruitful project in energy mitigation. The plan will be continued but it requires technical alignment to improve the efficient results and measures.

- *Project Life time exploitation or use duration*

The LED life time is 50,000 hours of operation.

- *Engineering Studies*

The LED technologies are still new for Jordan and the municipality's technical staff need the knowledge on how to set the specification of the LED public street lighting with evaluation and monitoring measures.

It is recommended to set the technical specification for the Public street lighting like LED Luminaires, Light emitting Diodes (LEDs) minimum efficacy in lm/W, standard to be followed, Mac Adam Ellipse Step Bins, The CRI, Whole Luminaire Efficacy, standard of comparison, Luminaire Maximum % Direct Up light, Optical Control, Thermal Management, Ingress Protection Copper Content etc...

Availability of environmental impact assessment or mitigating measures to protect environment if any

Since the HPS lamps and Mercury lamps partly contain Mercury, a safety procedure should be followed to ensure that defective lamps should not go back to the ground which may affect the underground water and pollute the soils.

A special programme should be created on how to deal with situation knowing that there are around 50,000 lamps in the city which need to be replaced in the future.

Also as part of using the LED technologies, the electronic parts are the majority in use which also need to have special procedure for recycling.

Summary of related Awareness Raising (AR) actions

AR related to the action

- Target Audience:
 - o Civil society;
 - o Private and public operators;
 - o Professionals in energy sector;
- Key Message:
 - o Reduce energy consumption in town through smart management and consume it more responsibly;
- Objectives:
 - o Reduce the city's energy bills;
 - o Limit the impact of the emission of the greenhouse gas;
 - o Promote the use of similar equipment in the households, and other or private buildings.

AR related to community

- Create awareness with posters nailed on street lamps and electricity exchange boxes to alert citizens on the municipality's action and to alert on reduction facts about saved consumption. The actions will be accompanied by strong visual campaign in the municipal and local media;
- Meetings with the community members to promote the municipal action and promoting the usage of efficient lighting in households through distribution of led lamps;
- AR campaign on being an eco-citizen: Explain the side effect of greenhouse gas emission and the usage of renewable energy technologies (electricity from natural resources) through messages conveyed by television, radio and written press;
- Training students (primary and secondary schools) on using the energy correctly;
- Creating an info centre to inform citizens about new technologies.

Assumptions and risks

- The Assumptions:
 - o The availability of Finance;
 - o The capacity of the Municipality's technical staff.



- The Risks:
 - o Implementation without developing measures and technical specifications for the Public Street;
 - o Non-availability of the recycling programme for replacement of HPS with efficient LED lamps;
 - o Low product quality and maintenance.

Key success factors

- The successful stories for LED implementation in the city;
- The reduction on cost for energy consumption would bring more finance to the city.

Next steps

- Looking for finance to start developing the actions

Projected Energy Estimates in 2030		Cost of Implementation		Available and foreseen sources of funding									
Mitigation		All cost	16,129,370	Local authority's own resources	20%								
MWh/a	t CO2/a	Initial and start-up expenses	367770 JOD	National Funds and Programmes	10%								
22,835	14,820	Approximate operational Costs (including maintenance)	To be developed	International Financial Institutions	70%								
Per capita calculated reduction		Approximate annual income for energy producing projects	JOD (0.146 JOD/Kwh)	EU Funds & Programmes and other external funds									
MWh/c	t CO2/c	Draft calculation of the NPV.	JOD 26,882,216	Public-Private Partnerships amount/share (available or to raise)									
0.0274	0.0178	Key performance Indicator	Energy consumption	Lined up private investments									
Contribution for	Reduction as related to BAU scenario	Measurement Units	KWh/a	Loans and potential borrower									
	0,96%	Years of Implementation		Expected annual cost savings to the City budget	3481370 JOD (0.146 JOD/Kwh)								
		1	2	3	4	5	6	7	8	9	10	Other	
Organisation and procedures													
Area of intervention	Energy Efficiency			Involvement of Stake Holders	LA	H	Municipality of Greater Irbid / Electricity Sector Regulatory Commission / Electricity Company / Company assigned to tender implementation						
Policy Instrument	Energy Management				External	H							
Origin of action	LA				Other	H							
Staff Capacity	L	M	H	Technical assistance needs									
Person in charge	Head of Electrical and street lighting department			Greater Irbid Municipality									
Person in charge	Lighting Consultant			Consultant office									

Priority Action Fiche #3

Title: Smart Municipal services

Background

The information technology revolution linked to the technical advancement drives rapid increase in the spread and exchange of information achieved by the communication means. The institutional framework in the Greater Irbid Municipality needs a strong, fast, reliable and flexible IT system capable of facilitating the work that could serve the local community interests. However, in the absence of clear, strategic plans, there has been a marked decline in the institutional performance, in the municipality's interactive role with its various departments and regions, as well as a decline in the interactive role with citizens and community institutions, which has led to an increase in the financial burden rate and operating expenses, time consumption, lack in the process speed measures and citizens' dissatisfaction.

Building on these facts, there must be an integrated, secure and reliable information technology system that links the municipality's departments and regions to a common database capable of facilitating the work, strengthening the partnership between the municipality and the local community sectors, meeting their needs and enhancing an effective monitoring role that could have a positive impact on the public service and other institutions.

The current situation

The number of daily visitors to the municipality is around 300;

The number of departments in the municipality is around 70;

The paper consumption with Ink cost annually around JOD 40,000;

The average distance the visitor travels is around 13Km to reach the municipality;

The visitor consumes around 1 to 14 days in following up the municipal paper work.

Description of the action

E-management is an organizational and functional electronic system aiming at transforming the normal management process from manual to computer-based management, relying on strong information systems that help in administrative decision-making in faster time and at the lowest costs.

The Internal and external communications are key factors in e-management that contribute to fully introduce transparency and accountability within any administration leading to an improved and well-developed e-management. The implementation of the e-management solution should be customer centric rather than organizational, should remove dependence on specific individuals and introduce transparent system of working.

Evolving from Traditional Management to E-management:

In order to move from traditional management to e-management, the following stages must be followed:

- Automating the internal management system and converting all paperwork management information into electronic information;
- Providing the essential infrastructure to link all departments to a network system and exchanging information between different parties;
- Identifying all transactions/contacts between the citizen and each institution and converting them into electronic ones.

That is achieved through:

- Conducting evaluation studies for all procedures, transactions and services in the municipality and identifying all items to implement a computerized information system in all departments and regions of the various municipalities with the decentralization concept. Connecting these departments and regions with an information system enhances the coordination and integration between them to save time and effort on the employee and citizen at work and to access

Mitigation			
MWh/a	t CO2/a		
1434	357		
Contribution for			
24.8%			
Cost of Implementation			
1,000,000			
Involvement of Stake Holders	LA	H	
	External	M	
	Other	M	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Time consume for municipal operations			
Measurement Units			
days			
Area of intervention			
Information and Communication Technologies			
Policy Instrument			
Awareness raising / training			
Origin of action			
Local authority			
Priority of action			

accurate and correct information associated with any transaction or service, as well as reducing potential risks and facilitating the ongoing procedures;

- Setting the correct items, material names, organizational structure and job descriptions;
- Setting an effective monitoring and evaluation system corresponding each procedure in the new system;
- Introducing a management accounting and costs department to identify the causes of the failures and provide the accurate and necessary information to decision makers.

Electronic Management Requirements:

- Strong, fast and secure network infrastructure;
- Strong information structure (robust and compatible information systems);
- Well - trained staff on the use of modern technologies to set up investments in skills;
- Technical staff capable of carrying out continuous technical support and developing various information systems.

General objectives

- Unifying the working procedures in each municipality, each in its major, to share best practices that could serve the municipality and all parties concerned;
- Clarifying the organizational structure dimensions in the municipality's regions and departments in accordance with the institutional work and strengthening the organizational context;
- Precise identification of the employment qualifications to ensure quality and unified standards of the working procedures;
- Building and strengthening the supervision and evaluation unit in the municipality to monitor and assess the work of the municipality departments and regions;
- Training and developing the capacities of the personnel in applying the information system in the municipality;
- Unifying the efforts of all community sectors to effectively engage all partners from the public and private sectors, civil society institutions and municipalities;
- Stimulating the potential of employees and untapped community to help its citizens live a better life;
- Reducing potential fraud by studying the weaknesses and setting effective control measures;
- Developing the procedures and institutional work in the municipality to achieve decentralization in its various departments and regions;
- Improving the municipal financial standards and its ability to provide income, reduce costs and ensure services;
- Raising the institutional capacities of the municipality;
- Enhancing the efficiency and capacity planning, as well as implementing and establishing development strategies and investment planning;
- Implementing projects efficiently and effectively with a focus on the use of available resources and the application of computerized systems, to raise the efficiency of the municipal management.

Objectives of E-management:

- Developing public administration: reducing paperwork and reusing solutions;
- Improving services: reducing transport, connectivity services anytime and anywhere, and easy accessibility to information;
- Approaching citizens (employees): direct interface for the citizen (employee), one look for the citizen (employee), and undertaking easy procedures;
- Improving the economic competitiveness: the use of the Internet for global trade, and giving the opportunity for SMEs to enter the competition;
- Reducing costs: systems integration to support the internal and external procedures.

Benefits of e-management:

- Quick implementation of work;
- Enhancing decision-making processes by making information accessible for decision makers;
- Reducing administrative costs while increasing performance;
- Overcoming geographical and temporal barriers;
- Addressing bureaucracy and bribery;
- Developing work mechanism and staying updated on the latest trends;
- Improving the employees' administrative efficiency.

Technical description

- Main Technology to implement and equipment to use
E-governorate is will established all over the world and using the national methodologies will be much easy on local level
- *Previous or linked studies*
NA
- *Project Life time exploitation or use duration*
Life time of
- *Engineering Studies*

NA

Availability of environmental impact assessment or mitigating measures to protect environment if any

NA

Summary of related Awareness Raising (AR) actions

AR related to the action

- Target Audience:
 - o Civil society;
 - o Private and public operators.
- Key Message:
 - o Smart service for smart people.
- Objectives:
 - o Reduce the city's paper and work bills;
 - o Improve the services;
 - o Limit the impact of the emission of the greenhouse gas.

AR related to community

- Create awareness with posters. The actions will be accompanied by strong visual campaign in the municipal and local media.
- Meetings with the community members to promote the municipal action and the usage of new services.
- Creating an info centre to inform citizens about new services.

Assumptions and risks

- The Assumptions:
 - o The availability of Finance;
 - o The technical staff capacity of the Municipality.
- The Risks:
 - o Insuring the Security for the platform;
 - o Poor infrastructure and internet connection;
 - o Poor technical and maintenance support.
 - o Poor payment process.

Key success factors

- The number of visitors reduced;
- The time consumption will be less;
- The service will be well monitored.

Next steps

- Looking for finance to start developing the actions

Annexes

Projected Energy Estimates in 2030		Cost of Implementation		Available and foreseen sources of funding	
Mitigation		All cost	1,000,000	Local authority's own resources	20%
MWh/a	t CO2/a	Initial and start-up expenses	300,000 JOD	National Funds and Programmes	10%
1434	357	Approximate operational Costs (including maintenance)	To be developed	International Financial Institutions	70%
Per capita calculated reduction		Approximate annual income for energy producing projects		EU Funds & Programmes and other external funds	
MWh/c	t CO2/c	Draft calculation of the NPV.	2,700,000	Public-Private Partnerships amount/share (available or to raise)	
0.001	0.000253	Key performance Indicator	Number of Users for the On line services	Lined up private investments	
Contribution for	Reduction as related to BAU scenario	Measurement Units	Number	Loans and potential borrower	
	0,022%	Years of Implementation		Expected annual cost savings to the City budget	350,000 JOD*
		1	2	3	4
		5	6	7	8
		9	10	Other	
Organisation and procedures					
Area of intervention	Information and Communication Technologies		Involvement of Stake Holders	LA	H
Policy Instrument	Awareness raising / training			External	H
Origin of action	LA			Other	H
Staff Capacity	L	M	H	Technical assistance needs	
				Technical assistance needs	
Person in charge	Head of IT department		Greater Irbid Municipality		
Person in charge	Head of accountant department		Greater Irbid Municipality		
Person in charge	E-governorate consultant		Consultant office		

The assumptions for cost savings rely on better management of Organizing and controlling financial permits and guaranteeing financial revenues and not losing them through procrastination of the base for calculation of energy saving elaborated in the following method.

The average number of daily visitors to the municipality is 300 with average travel per day 13 Km for each one. The total travel distance over the year is 300 (visitors) x 300 (working days over year) x 13 km (daily distance travel per visitor) = 1170000 km / year.

The average fuel consumption per car is assumed 12.16 Km per litre of Gasoline, which brings the total fuel consumption to 96,217 litres per year

To convert Litre to MWh x 9.2/1000= 885 MWh in year 2015, to convert to year 2030 x 1.62= 1,434 MWh

To convert MWh to t CO2 x 0.249 = 357 t CO2

Priority Action Fiche #4

Title: Smart multi-storey parking lot

Background

Irbid city centre suffers from traffic congestion as a result of the increase of population and refugees, the increase in the number of vehicles and lack of parking. The problem grows on Fridays during the summer with the return of the expatriates, and the arrival of tourists on which expanding street services become limited. Besides, parking cars on either side of the roads adds to the congestion problem.

Description of the action

There will be a construction of a multi-storey parking lot (could be mechanical parking to increase capacity), with a capacity of 2,000 vehicles.

The parking will be Smart Multi storey parking and can connect, analyse and automate data gathered from devices, powered by and described as the Internet of Things, is what makes smart parking possible.

Smart Parking involves the use of low cost sensors, real-time data and applications that allow users to monitor available and unavailable parking spots.

The goal is to automate and decrease time spent manually searching for the optimal parking floor, spot with online payments, parking time notifications and even car searching functionalities. A parking solution can greatly benefit both the user and the lot owner.

General objectives

The implementation of a smart parking solution would surely be a great investment for any city government or company. As the current parking inefficiencies with city population continue to grow and urbanize, it is vital to implement a well-planned and convenience-driven parking solution in the city.

Here are some of the top benefits:

- Optimized parking** – Users find the best spot available, saving time, resources and effort. The parking lot fills up efficiently and space can be utilized properly by commercial and corporate entities;
- Reduced traffic** – Traffic flow increases as fewer cars are required to drive around in search of an open parking space;
- Reduced pollution** – Searching for parking burns lot of oil a day. An optimal parking solution will significantly decrease driving time, thus lowering the amount of daily vehicle emissions and ultimately reducing the global environmental footprint;
- Enhanced User Experience** – A smart parking solution will integrate the entire user experience into a unified action. Driver’s payment, spot identification, location search and time notifications all seamlessly become part of the destination arrival process;
- New Revenue Streams** – Many new revenue streams are possible with smart parking technology. For example, lots of owners can enable tiered payment options dependent on parking space location. Also, reward programs can be integrated into existing models to encourage repeated users;
- Integrated Payments and POS** – Returning users can replace daily, manual cash payments with account invoicing and application payments from their phone. This could also enable customer loyalty programs and valuable user feedback;
- Increased Safety** – Parking lot employees and security guards contain real-time lot data that can help prevent parking violations and suspicious activity. License plate recognition cameras can gather pertinent footage. Also, decreased spot-searching traffic on the streets can reduce accidents caused by the distraction of searching for parking;
- Real-Time Data and Trend Insight** – Over time, a smart parking solution can produce data that uncovers correlations and trends of users and lots. These trends can prove to be invaluable to lot owners as to how to make adjustments and improvements to drivers;
- Decreased Management Costs** – More automation and less manual activity saves on labour cost and resource exhaustion;

Mitigation			
MWh/a	t CO2/a		
13,989	3,604		
Contribution for			
2%			
Cost of Implementation			
1,750,000			
Involvement of Stake Holders	LA	H	
	External	M	
	Other	M	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Parking Capacity			
Measurement Units			
% of occupancy per day			
Area of intervention			
Increase Parking capacity			
Policy Instrument			
Land use planning regulation			
Origin of action			
Local authority			
Priority of action			

10. **Increased Service and Brand Image** – A seamless experience can really skyrocket a corporate or commercial entities brand image to the user. Whether the destination is a retail store, an airport or a corporate business office, visitors will surely be impressed with the cutting-edge technology and convenience factors.

Technical description

- **Main Technology to implement and equipment to use**
The main technology is using Smart Parking system which involves the use of low cost sensors, real-time data and applications that allow users to monitor available and unavailable parking spots. The goal is to automate and decrease time spent manually searching for the optimal parking floor, spot and even lot. This is supported with additional solutions to encompass a complete suite of services such as online payments.
- **Previous or linked studies**
The municipality can obtain the expertise in such implementation by other cities like Amman.
- **Project Life time exploitation or use duration**
30 years life time
- **Engineering Studies**
The design department in the municipality have sufficient expense in developing such project, they can use of special consultant to help them in developing the:
 - o Safety regulation;
 - o Smart system solution;
 - o Efficient management, maintenance and operation.

Availability of environmental impact assessment or mitigating measures to protect environment if any

The car parking will be a good solution to avoid congestion in the main roads and reduce the emission in the city due to time and fuel consumed looking for empty parking in the city

Summary of related Awareness Raising (AR) actions

AR related to the action

- Target Audience:
 - o Civil society;
- Key Message:
 - o Smart Parking for Smart City

AR related to community

- Create awareness with posters. The actions will be accompanied by strong visual campaign in the municipal and local media;
- Meetings with the community members to promote the municipal action and promoting the usage of new services;
- Creating an info centre to inform citizens about new services.

Assumptions and risks

- The Assumptions:
 - o The availability of Finance;
 - o The capacity of the Municipality's technical staff.
- The Risks:
 - o Poor infrastructure and internet connection;
 - o Poor technical and maintenance support;
 - o Poor payment process;
 - o Location of parking away from main souk;
 - o The outdoor services provided to support the Parking.

Key success factors

- The time savings for the citizen;
- Clean city with less congestion;
- Smart services provided;
- Safe places for parking.

Next steps

- Looking for finance to start developing the actions

Annexes

Projected Energy Estimates in 2030		Cost of Implementation		Available and foreseen sources of funding	
Mitigation		All cost	1,750,000	Local authority's own resources	20%
MWh/a	t CO2/a	Initial and start-up expenses	500,000 JOD	National Funds and Programmes	10%
13,989	3,604	Approximate operational Costs (including maintenance)	To be developed	International Financial Institutions	70%
Per capita calculated reduction		Approximate annual income for energy producing projects		EU Funds & Programmes and other external funds	
MWh/c	t CO2/c	Draft calculation of the NPV.	7,477,326 JOD	Public-Private Partnerships amount/share (available or to raise)	
0.016	0.00415	Key performance Indicator	Parking Capacity	Lined up private investments	
Contribution for	Reduction as related to BAU scenario	Measurement Units	% of occupancy per day	Loans and potential borrower	
	0,22%	Years of Implementation		Expected annual cost savings to the City budget	600,000 JOD
		1	2	3	4
		5	6	7	8
		9	10	Other	
Organisation and procedures					
Area of intervention	Information and Communication Technologies	Involvement of Stake Holders	LA	H	
Policy Instrument	Awareness raising / training		External	H	Citizen
Origin of action	LA		Other	H	
Staff Capacity	L	M	H	Technical assistance needs	
Person in charge	Head of traffic department		Greater Irbid Municipality		
Person in charge	Head of design department		Greater Irbid Municipality		
Person in charge	consultant for design and construction sustainable car park		Consultant office		

The consumption's calculation was made according to the following assumptions:

Assume a 2L engine, idling at 700 rpm, and throttled to 25% of outside air pressure, which is what the typical in an idling engine.

The amount of fuel consumed depends on the amount of air consumed. The amount of air consumed is going to depend on:
Engine displacement (2L)

Engine speed (700 rpm, which is 350 cycles/min for a 4-stroke)

Volumetric efficiency - how efficiently the engine exchanges air

Manifold air pressure - how much is the engine being throttled?

For the sake of argument, let's assume the volumetric efficiency is 100%.

*Let's also assume the engine is running at sea level on a standard 15C day, so the manifold air pressure is equivalent to the air density at sea level * 25% (because it's throttled to idle)*

Air consumed will be:

*displacement * cycles * volumetric efficiency * manifold air pressure*

2L = 0.002 m³

*Air density is 1.225 kg/m³ * 0.25*

This gives us:

*0.002 m³ * 350/min * 100% * 1.225 kg/m³ * 0.25 = 0.214 kg/min*

Fuel used would be 1/15 of that (actually 1/14.7 in stoichiometric conditions), or 0.0143 kg/min

at 719.7 kg/m³, that works out to 0.02 L/min

0.02 L/min is 1.2 L/hr (ref: <https://www.quora.com/How-much-gas-does-a-4-cylinder-use-while-idling>)

The number of cars car park capacity will be 2,000 with assumption od % use is 70.39%

With ideal current waiting time is one hour per car and with three times full per day

=6,000 cars per day x 1.2 L saving x 300 days in year x 9.2 KWh convert fuel in litre to KWh / 1000 to convert to MWh x

70.39% of use = 13,989 MWh x 0.246 to tCO₂

Priority Action Fiche #5

Title: Shuttle Bus

Background

Express bus service is a type of fixed route that typically picks up passengers from park-and-ride lots in suburban areas and takes them to a central urban location. This transit service usually operates for longer-distance trips on a Saturday through Thursday, peak commuter time schedule.

These commuter routes have limited stops, typically travel non-stop on highways (utilizing any available High-occupancy vehicle (HOV) lanes), and terminate at the central business district in the city. Fares for the service may be comparable to park-and-ride fares, slightly higher than typical local fixed route service

Adequate planning is the most important thing to consider when implementing an express bus route. Before implementation, planners should collect demographic and regional data prior to route planning.

Data collection involves origin and destination surveys, mapping of major employment centres, and service attractors, survey the potential users to determine schedules and routing, and should typically offer service in conjunction with one or more park-and-rides.

Careful required planning, especially in areas of high transit demand during peak periods. Vehicle size should be taken into consideration during planning; larger vehicles should be assigned to the routes with the highest demand.

Description of the action

The main action concentrates on creating Express bus, wraps around Irbid hill and downtown.

But before that, it is recommended to ensure the action will be the right solution. Thus the following basic steps of actions should be taken prior to implementation:

1. **Establish Board committee** to follow up the preparation for the action with representative of local and national level with stakeholders.
2. **Proposal Development**
 - *Service analysis*— collect demographic and regional data prior to route planning and determine whether express bus service is needed or would be a good fit for the area;
 - *Initial concepts*—provide basic schematics on proposed routing and scheduling. Review of customer and operator input and comments to determine if there has been demand in a specific area for express level service. Based on the comments, refine the design and schedules; develop costs for service based on hours of service needed to run route.
 - *Initial proposals*—selection of proposed route(s) and schedule(s) with internal stakeholders (marketing, scheduling, and operations).
 - *Community outreach* (riders, general public, advisory committees, etc.)—take proposals to advisory groups and targeted populations the route(s) would serve to gather feedback. Hold meetings in central locations accessible by public transit to gather additional feedback. Then revise proposals based on all information gathered.
3. **Board Process**
 - *Board committee review*—present initial proposals and community feedback received to board work session or board planning committee.
 - *Public hearing*—hold separate public hearing for last-round of comments.
 - *Final recommendations*—present final proposal and recommendations for service to transit board of directors.
 - *Board decision*—transit board of directors approves or disapproves service.
4. **Implementation Preparation**
 - *Schedule development*—if service is approved, schedules are tested and finalized.
 - *Operator work assignments*—route is presented for operator bidding at the next work assignment period.

Mitigation			
MWh/a	t CO2/a		
13,989	3,604		
Contribution for			
2%			
Cost of Implementation			
1,750,000			
Involvement of Stake Holders	LA	H	
	External	H	
	Other	H	
Staff Capacity	L	M	H
Years of Implementation			
Key performance Indicator			
Number of Buses			
Measurement Units			
Percentage of occupancy			
Area of intervention			
Improvement of logistics and urban freight transport			
Policy Instrument			
Integrated ticketing and charging			
Origin of action			
LA			
Priority of action			

- *Marketing and communication materials*—development and distribution of marketing and communications materials advertising the service offered.
- *Capital upgrades* (vehicles, facilities, stops, etc.)—development and building of accessible stops, benches, shelters, and stations associated with the route. Purchase of new vehicles, if needed.
- *Information technology updates* and upgrades to agency website, automatic vehicle location (if applicable), and operator schedule sheets.

General objectives

Commuters from suburban areas, including state employees, students, and employees working in the central city are viable users of this service. Typically, commuters who would otherwise utilize freeways to travel to and from work during the week serve as potential users, because this service can use HOV lanes and create a less-stressful commute.

In addition, it will support the following:

- Increased transit usage can reduce the number of single occupancy vehicles on major freeways and highways. This decreases the traffic demand on the major urban freeways and streets.
- Express service can serve as an alternative to personal automobiles. Suburban commuters can depend on this transit service to commute to the urban central business district.
- Passengers can improve their time management by working on the bus, which is typically equipped with Wi-Fi services. Commuters can have more time to handle personal and business matters, rather than wasting time on a congested freeway.
- Express route travel times should be competitive to driving a personal vehicle so they can be a viable solution to mitigate congestion.
- Reduce the emission in the city



Technical description

- **Main Technology to implement and equipment to use**
The information technologies can help in providing more information for users, prepaid cards and payment through mobile etc...
The bus station will be provided with timing and more details for users
- **Previous or linked studies**
The municipality needs to apply prior to implementation the study for the project as explained above.
- **Project Life time exploitation or use duration**
Long life
- **Engineering Studies**
The design department in the municipality doesn't have sufficient experience in developing such project, they can use of special consultant to help them in developing the:
 - o Safety regulation.
 - o Smart system solution
 - o Efficient management, maintenance and operation

Availability of environmental impact assessment or mitigating measures to protect environment if any

The shuttle bus will be good solution to avoid congestion in the main roads and reduce the emission in the city by reducing the number of cars in the roads and provide on time services for the city.

Summary of related Awareness Raising (AR) actions

AR related to the action

- Target Audience:
 - o Civil society
- Key Message:
 - o Using Shuttle bus will maintain a clean and hygienic atmosphere

AR related to community

- Create awareness with posters. The actions will be accompanied by strong visual campaign in the municipal and local media.
- Meetings with the community members to promote the municipal action and promoting the usage of new services.
- Creating an info centre to inform citizens about new services.

Assumptions and risks

- The Assumptions:
 - o The availability of Finance
 - o The Municipality staff capacity
 - o Partner with private sector to ensure sustainability of the action
 - o Providing specific lane for the shuttle Buses
- The Risks:
 - o Poor planning
 - o Road space limitation
 - o Poor operation and maintenance
 - o Poor payment process.
 - o Unavailability of support services for the Shuttle bus and Location of parking away from main areas

Key success factors

- o The project have national approval from Transportation Management Authority
- o The time saving for the citizen
- o Clean city with less congestion
- o Smart services provided

Next steps

- o Looking for finance to start developing the actions

Annexes



Projected Energy Estimates in 2030		Cost of Implementation										Available and foreseen sources of funding			
Mitigation		All cost		1,750,000										Local authority's own resources	20%
MWh/a	t CO2/a	Initial and start-up expenses		500,000 JOD										National Funds and Programmes	10%
13,989	3,604	Approximate operational Costs (including maintenance)		To be developed										International Financial Institutions	70%
Per capita calculated reduction		Approximate annual income for energy producing projects												EU Funds & Programmes and other external funds	
MWh/c	t CO2/c	Draft calculation of the NPV.		JOD										Public-Private Partnerships amount/share (available or to raise)	
0.016	0.00415	Key performance Indicator		Number of Buses										Lined up private investments	
Contribution for	Reduction as related to BAU scenario	Measurement Units		Percentage of occupancy										Loans and potential borrower	
	0,22%	Years of Implementation												Expected annual cost savings to the City budget	600,000 JOD
		1	2	3	4	5	6	7	8	9	10	Other			
Organisation and procedures															
Area of intervention	Improvement of logistics and urban freight transport			Involvement of Stake Holders	LA	H									
Policy Instrument	Integrated ticketing and charging				External	H	Citizen								
Origin of action	LA				Other	H									
Staff Capacity	L	M	H	Technical assistance needs											
Person in charge	Head of traffic department			Greater Irbid Municipality											
Person in charge	Head of design department			Greater Irbid Municipality											
Person in charge	consultant in shuttle bus requirement and sustainable specification for them			Consultant office											

References:

1. Municipality of Greater Irbid Book year 2015-2016
2. The Covenant of Mayors for Climate and Energy SECAP Reporting Guidelines, <http://www.ces-med.eu/publications/covenant-mayors-climate-and-energy-secap-reporting-guidelines>
3. SEAP Guidebook, <http://www.ces-med.eu/publications/seap-guidebook>
4. CES-MED Internal Guidelines on the Climate Adaptation Chapter, <http://www.ces-med.eu/publications/ces-med-internal-guidelines-climate-adaptation-chapter>
5. SECAP Template, <http://www.ces-med.eu/publications/secap-template>
6. The publication of International Finance Corporation (IFC)-2015, http://www.ifc.org/wps/wcm/connect/f05d3e00498e0841bb6fbb54d141794/IFC+Solar+Report_Web+08+05.pdf?MOD=AJPERES
7. National report MOE & UNDP TNC
8. <http://ieeexplore.ieee.org/document/4057378/>
9. [Energy policy: Introducing mandatory standard for select household appliances in Lebanon: a cost-benefit analysis y Isabella Ruble and Sami Karaki](#)
10. Lebanon's market for domestic solar water heaters: Achievements and barriers by: Isabella Ruble , Pierre El Khoury
11. <https://en.wikipedia.org/wiki/Irbid>
12. www.irbid.gov.jo
13. http://www.covenantofmayors.eu/index_en.html



The European Union is made up of 28 Member States who have decided to gradually link together their know-how, resources and destinies.

Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms.

The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders.

Disclaimer

The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Union. The European Commission is not responsible for any use that may be made of the information contained therein.