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CES-MED

CLEANER ENERGY SAVING MEDITERRANEAN CITIES

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Lebanon Municipality of Kab Elias – Wadi El Delm Sustainable energy action plan (SEAP)

This 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 Dynamics KG, with the active participation of the National Authorities in Lebanon and the municipality of Kab Elias – Wadi El Delm. It was prepared by a Consortium of consultants from VIA-HABILIS Ingénierie – V. MEYRAND- France; Georges B. Tabet – Lebanon, Oussama Kassamani – Lebanon, with the direct support of CES-MED's experts.

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Sustainable Energy Action Plan (SEAP)

Municipality of Kab Elias – Wadi El Delm

- Lebanon -

Integral document of the Sustainable Energy Action Plan

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BEI Baseline Emissions Inventory

BDG Backup Diesel Generators

CAS Central Administration for Statistics

CCU Climate Change Unit

CEDRO Country Energy Efficiency and Renewable Energy Demonstration Project for the Recovery of Lebanon

CES-MED Cleaner Energy Saving Mediterranean Cities project

CoM Covenant of Mayors

EDL Electricité Du Liban

GHG Green House Gas

LCEC Lebanese Center for Energy Conservation

LCPS Lebanese Center for Policy Studies

MoE Ministry of Environment

MoEW Ministry of Energy and Water

MoIM Ministry of Interior and Municipalities

NCG National Coordination Group

NEEAP National Energy Efficiency Action Plan

NEEREA National Energy Efficiency and Renewable Energy Account

SEAP Sustainable Energy Action Plan

SWH Solar Water Heater

UNDP United Nations Development Program

WB World Bank

IPCC Intergovernmental Panel on Climate Change

UNFCCC United Nations Framework Convention on Climate Change

Acknowledgements

This report has been prepared for the Municipality of Kab Elias – Wadi El Delm through its participation in the CES-MED project, which is financed through EU. One of the main objectives of the CES-MED project is to support the local and national authorities in joining the Covenant of Mayors, as well as preparing Sustainable Energy Action Plans. The preparation was undertaken to support the local authority through several trainings and technical assistance in formulating and applying sustainable policies in the city.

The CES-MED project 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 CO_2 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 project 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 Interior and Municipalities.

The report was drafted by the Consortium Georges B. Tabet and Vincent Meyrand from Via Habilis Ingénierie and Oussama Kassamani, the SEAP Consultant, with the support from the Municipality of Kab Elias and under the guidance of Dr. Naguib Amin, the Team Leader for CES-MED project and Dr. Alexandra Papadopoulou, the CES MED Energy Expert.

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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.

Executive Summary

There has been a substantial progress across Lebanon, with a range of energy and low carbon projects, supported and acknowledged by the Ministry of Interior and Municipalities in Lebanon. The Ministry is collaborating with CES-MED to support municipalities in their mission to deliver significant economic growth and contribute towards Lebanon's carbon reduction targets.

The Municipality of Kab Elias – Wadi El Delm, with a population of 50,000 residents, is one of the Lebanese regions committed to the Covenant of Mayors on energy sustainability. It is supported by the CES-MED project that develops the capacities of the local authorities to formulate and implement sustainable energy action plan and contributes for making them more aware of and responsive to the need for a strong involvement of the city in policy issues which have direct impact on them such as water and solid waste treatment, transportation, local energy, tertiary and residential sectors.

The Mayor of Kab Elias – Wadi El Delm Municipality, inspired by the CoM, is very keen to see the city developing towards sustainability, actively reducing its GHG emission and shifting into a low carbon economy.

Kab Elias has set out its ambition to transform its energy system and infrastructure to improve the economic efficiency and enable social and environmental development. This will be attained with a close collaboration and cooperation with other municipalities that are committed to meet the CoM declaration.

Working in partnership with local authorities and stakeholders, organizations and companies is crucial to implement the SEAP and achieve its main objectives. It is important for the all parties to promote joining efforts to implement actions that aim at achieving a smart, sustainable and environmentally responsible city.

The total target of SEAP implementation is to mitigate carbon emission by 26% with a total reduction of 17,269t CO_2 by 2020.The total budget is approximately € 7,562,350.

Starting with the year 2013 as the baseline year, the data collected is considered complete and reliable. The Municipality of Kab Elias has included in the Baseline Emission Inventory all the following sectors:

- Municipality buildings/equipment/facilities
- Drinking Water
- Public Street Lighting
- Solid Waste Treatment
- Water Waste Treatment
- Local Renewable Energy Production
- Residential Buildings
- Tertiary Buildings
- Transportation (Municipality Fleet/Public/Private)

Based on the Baseline for GHG Emission Inventory, the following report presents the municipality road map to mitigate the GHG emission and to prioritize its actions towards a clean environment to fit in line with the municipality's vision to be a sustainable pilot city.

The main objectives of this report lie in:

- Creating the base for building up a strategic framework to enhance and better coordinate the energy and climate policies
- Defining, creating and translating short- and long term solutions for the main trends and the biggest challenges in terms of CO_2 emission reduction
- Making sustainable energy policy part of all key activities of the local authority

The method used in BEI calculation will be considered as 'standard' emission factors in line with the Intergovernmental Panel on Climate Change (IPCC) principles and comply with United Nations Framework Convention on Climate Change (UNFCCC) reporting system.
CO_2 emissions from energy consumption within the territory of the local authority will be calculated either directly due to fuel combustion within the local authority or indirectly via fuel combustion associated with electricity and heat/cold usage within the area. The emissions of CH_4 and N_2O will not be calculated. CO_2 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). The base line year is 2013.
Chart 1 below shows the energy consumption in the city, which indicates the majority of **Residential Buildings** and the **Private and Commercial Transportation** in consumption.

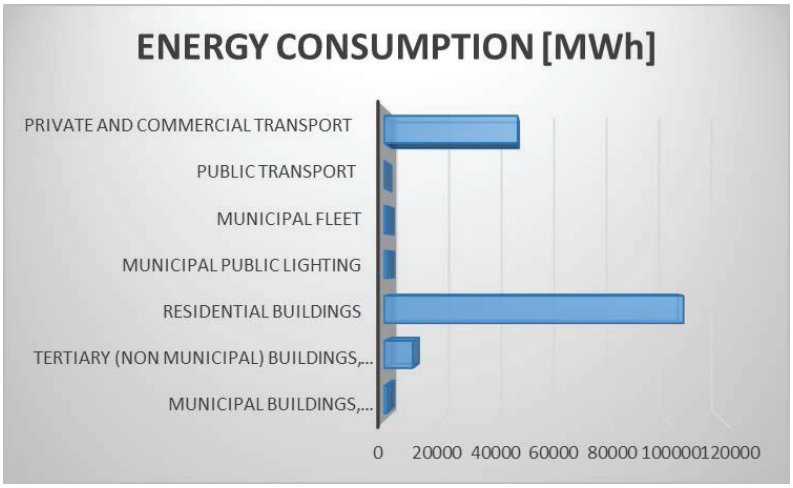


CHART 1: ENERGY CONSUMPTION IN MWH- MUNICIPALITY OF KAB ELIAS

The total energy consumption & emissions for Kab Elias are presented in table 1 below.

TABLE 1: ENERGY CONSUMPTION & BASELINE EMISSION INVENTORY SUMMARY (t CO_2)

	GHG emissions in t CO_2/year
BUILDINGS,EQUIPMENT/ FACILITIES& TRANSPORTATION	**Base 2013**
Municipal buildings, equipment/facilities	716
Tertiary (non-municipal) buildings, equipment/facilities	4304
Residential buildings	34997
Municipal public lighting	742
Municipal fleet	230
Public transport	0
Private and commercial transport	11965
Total GHG emission in 2013 in t CO_2/year	**52954**

The municipality's representatives, through the BEI identification, acknowledged the most significant sectors affecting the Municipality's carbon footprint. The residential sector contributes the most, with almost (66%) of the total emissions, followed largely behind by the Private and Commercial Transportation (22.5%) and the Tertiary sectors (8%).

According to the Baseline Emissions Inventory and the JRC Guidelines for the Southern Municipalities, the projection of the emissions for the 2020 in the Municipality of Kab Elias was realized according to the **Business as Usual (BAU)** scenario.

For the Municipality of Kab Elias, the total emissions for the baseline year (2013) were 52,954 t CO_2 and the national coefficient K for 2013 in Lebanon is (1.27). Therefore, the forecasted emissions for 2020 are:

Emissions CO_2 (2020) = 52,954 x 1.27 = 67251.6 t CO_2

The actual reduction target undertaken by the municipality fulfils the CoM requirements and is set to 26% corresponding to an overall reduction of 17,272 t CO_2 by 2020. The emissions reduction targets are different for each sector included in the BEI. Each sector's contribution, in line with the adopted actions, is presented in the chart below.

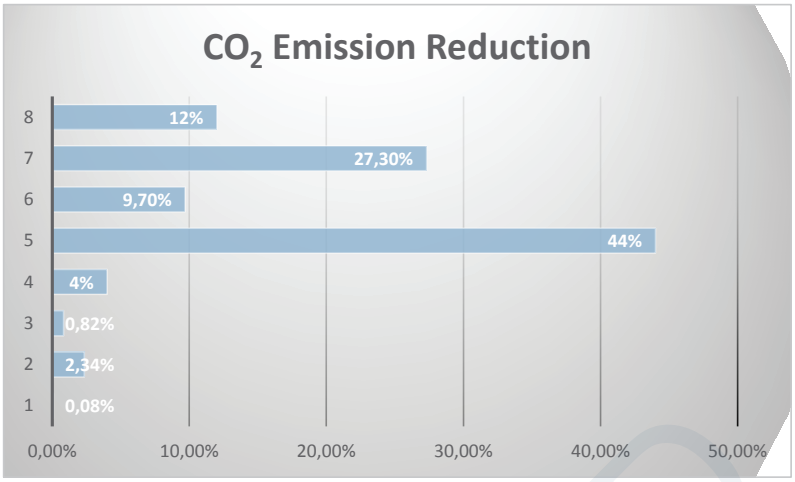


CHART 2: CO_2 EMISSIONS REDUCTIONS IN KAB ELIAS MUNICIPALITY

The municipality of Kab Elias – Wadi El Delm has planned a set of actions for each sector. The actions consist of both awareness raising activities for the different stakeholders and the public, and of actions related to energy efficiency and energy production. The awareness raising activities are expected to have a significant contribution to the reduction of the carbon footprint, while promotion of recycling among the residents is a priority for the municipality.

As far as the energy efficiency is concerned, substitution of old electrical devices is included in the proposed actions for the Municipal and Residential Buildings. In addition, the installation of Solar water heaters & photovoltaic on the rooftops of the Municipal, Residential and Commercial Buildings will be promoted, in order to reduce the electricity consumed from the grid and take advantage of the high solar potential the southern municipalities have.

The total list of actions is provided in the Table 2 below.

TABLE 2: TOTAL LIST OF ACTIONS IN MUNCIPALITY OF KAB ELIAS – WADI EL DELM

SECTORS & FIELDS OF ACTION	Action No.	KEY actions/measures	Mitigation in Energy		Mitigation in %	Costing in €
			MWh/a	t CO_2 /a		
Municipal buildings, *equipment/facilities*			**25.94**	**17.03**	**0.0253%**	**77,600.00**
Short Term Action	1	SEAP unit				5,600
	2	Setup a Website other social media				5,000
	3	Announce on the local media like local TV channel				1,000
	4	Energy Saving Instruction	0.9	0.6	0.001%	1,000
	5	Monitoring Mechanism	0.9	0.6	0.001%	8,000
	6	Awareness and Training Campaign	0.9	0.6	0.001%	10,000
Long Term Action	7	Start replacing the FCL lamps with LED lamps.	1.7	1.1	0.002%	5,000
	8	Replace the Water pumping driver with VFD driver for Central heating system	0.3	0.2	0.000%	3,000
	9	Replace the Air Condition with A+++ Inverter type.	0.7	0.5	0.001%	7,500
	10	Install lighting motion sensors in building.	0.2	0.1	0.000%	1,500

	11	Renewable Energy	18	11.7	0.017%	25,000
	12	Public procurement	2.34	1.63	0.002%	5,000
Water supply and waste water treatment			**570**	**404**	**0.601%**	**301,000.00**
Short Term Action	13	Conduct awareness campaign	61	43	0.06%	**20,000**
	14	Distribute water saving tools for the faucet (Tap).	58	41	0.06%	**10,000**
	15	Encourage citizens to collect rain water in the winter season	33	23	0.03%	**1,000**
	16	Conduct routine maintenance and check the water leak in main feeder piping and fix the leaks	107	76	0.11%	**50,000**
	17	Update the municipality policy to include a standalone water treatment plant. in every new construction	52	37	0.06%	**10,000**
	18	Install water meters on the main water supply and main branches to monitor water consumptions.	107	76	0.11%	**50,000**
	19	Include in new construction the reuse of treated water to feed the flush water supply in separate piping	52	37	0.06%	**10,000**
Long Term Action	20	Prepare strategic plan for waste water treatment	to be defined			
	21	Install water treatment plant	to be defined			
	22	Install PV solar station on one of the water pumping stations	100	71	0.106%	150,000
Solid waste Management			**528**	**141**	**0.210%**	**838,000**
Short Term Action	23	Ensuring capacity development and enhancing public awareness				**10,000**
	24	Preparation of marketing materials for the sorting process				**5,000**
	25	Dividing the city to different sectors and selecting volunteers for each sector				**3,000**
	26	Conducting seminars to volunteer groups				**5,000**
	27	Distributing different coloured dustbins with clear sign on each one,				**30,000**
	28	Developing and implementing plans for sorting solid waste from source	203	54	0.08%	**5,000**
	29	Developing waste strategy plan				**20,000**
	30	Implementing waste power generation from solid waste				**to be defined**
Long Term Action	31	Purchasing new 4 fuel saving trucks with recommended spare parts	325	87	0.129%	740,000
	32	Rehabilitation of the existing landfill				10,000
	33	Conducting feasibility study to build new solid waste treatment plant				10,000
	34	Executing the result from the above study; the new landfill and solid waste treatment plant				To be defined
Urban Development						**400,000**
Municipal public lighting			**965**	**688**	**1.023%**	**1,209,750**
Short Term Action	35	Public lighting unit				**7,000**
	36	master street lighting drawing assign number for each pole				**5,000**
	37	Identify each feeder pillar by number and install new KWh meters				**5,000**
	38	maintenance check form	136	97	0.14%	**1,000**
	39	master plan drawing for the Public lighting unit				**1,000**
	40	technical training				**3,000**
	41	Monitoring process				**2,000**
Long Term Action	42	New Smart Feeder pillars this could be done before or after replacing the lamps with LED	60	43	0.064%	120,000
	43	Replace HPS by Intelligent LED Lights	554	395	0.587%	710,500

	44	Remote monitoring and control	215	153	0.228%	355,250
RENEWABLE ENERGY				**2074**	**3.084%**	**4,000,000**
Long Term Action	45	MAIN VEGETABLE MARKET		2074	3.084%	4,000,000
BUILDING:						
Residential buildings			**15531**	**7563**	**11.247%**	**296,000**
Short Term Action	46	Workshop with mosques / churches	1690	1144	1.70%	**3,000**
	47	Workshop with local NGO'S			0.00%	**3,000**
	48	Open Solar Day	2110	1429	2.13%	**30,000**
	49	Yearly Contests through local TV channel	2533	1715	2.55%	**30,000**
	50	Increase the initiatives for solar water heater	1100	745	1.11%	**200,000**
Long Term Action	51	New Building Code	7200	1923	2.860%	15,000
	52	Solar water Heater	898	607	0.903%	15,000
Tertiary buildings, *equipment/facilities*			**2420**	**1674**	**2.489%**	**45,000**
Short Term Action	53	Public awareness campaign	1917	1326	1.97%	**30,000**
Long Term Action	54	Implementing building codes in new buildings	503	348	0.518%	15,000
TRANSPORT:			**18549**	**4711**	**7.005%**	**395,000**
Short Term Action	55	Promotion of eco driving	598	152	0.23%	10,000
	56	Assign speed signs limit	2992	760	1.13%	20,000
	57	Marathon Day	299	76	0.11%	10,000
	58	Bike to Park Day	299	76	0.11%	10,000
Long Term Action	59	Promote the Public transportation	5984	1520	2.260%	180,000
	60	Creating special initiative payment programme	1197	304	0.452%	5,000
	61	Allocating the bus station	5984	1520	2.260%	150,000
	62	Conducting awareness campaign linked to the launching of the service	1196.72	303.92	0.452%	10,000
Total			38,588.94	17,272.03	26%	7,562,350

Section I: Overall Strategy

1.1 Kab Elias- Wadi El Delm 2020 Targets

The table 3 below shows the amount of emissions that the country contributes to, which is considerably low compared with the global one; however, Climate Change forecasts for Lebanon suggest the country will see more intense rainfall and unprecedented flash floods. More extreme weather conditions including longer periods of dryness are also expected to severely affect the country's third biggest industry-agriculture- which employs 15% of its population.

TABLE 3: LEBANON KEY INDICATORS FOR 2014

United Nations
Climate Change Secretariat

UNFCCC Country Brief 2014:
Lebanon

A. Key Country Indicators

	Global Rank	Global share	
CO2 emissions from fuel combustion[1] (2012)	78	0.07%	21 Mt CO2 Eq.
Population[2] (2013)	123	0.06%	4.47 Million
CO2 emissions / Pop.[1] (2012)	59		4.75 tCO2 per capita
GDP Size[2] (2013)	84	0.08%	Based on PPP
GDP Size[2] (2013)	85	0.06%	Based on exchange rates
UNDP human development index[3] (2012)	72		
GDP Structure[2], % (2013)	Agriculture: 7, Industry: 20, Services: 73		
Share of GDP[2], % (2013)	Imports: 76, Exports: 63		

The Municipality of Kab Elias plays an important role in leading the trend towards environmental protection. Being a town that mediates many towns around it, Kab Elias activities in the environmental movement are continuously tracked. The town is directly dependent on the economic movement that backed clean environment with availability of Archaeological and tourist landmarks and construction movement activists. The city was and is still encouraging the transition towards clean and renewable energy, and there are a lot of attempts in the spectrum area.
CES-MED project's perspective is to support selected municipalities in Lebanon on their effort towards energy sustainability and thus has opened the gate for the municipality of Kab Elias to join the CoM and allowed it to share the experience with more than 5,000 municipalities that already have joined the CoM.
The overall target being set by the municipality is the reduction of CO_2 emissions to 26% by 2020 compared to the baseline year 2013. The municipality will take all the necessary measures and utilize opportunities in collaboration with various local and national sectors to develop solutions to the carbon reduction and safeguard its community against the impacts of climate change.
The municipality cannot by itself reach this target without support from the international donors as the resources are limited and cannot handle the cost. Therefore, the municipality will work closely with CES-MED to identify sources of funding for those actions.

1.2 Current Status

1.2.1 Geographical Location and Sites

Kab Elias-Wadi El Delm, an administrative division of Beqaa Governorate, is located in Zahlé District in eastern Lebanon. It is 15 Km away from Zahlé and 45 Km away from Beirut, the capital of Lebanon covering an area of 41 Km² at an elevation 950 meters above sea level. It represents the largest third city in Bekaa after Zahlé and Baalbek with a population of 50,000 residents and 25,000 of Syrian refugees.
Like the rest of Lebanon's regions, Kab Elias-Wadi El Delm enjoys a typically Mediterranean climate characterized by hot and dry summers of an average temperature 31°C - 25°C, and mild to cool winters of average temperature 19°C - 11°C where most of the precipitation is concentrated.

Kab Elias- Wadi El Delm is the most prominent archaeological centre in Lebanon, dating back to 4000 years. It is the town of ancient history with ancient treasures, caves and ruins. Fakhr ad-Din II Castle in Kab Elias-Wadi El Delm is believed to have been one of the largest castles in the Beqaa Valley. It is also thought to have been built

by the Fakhr ad-Din II, who chose the location for its elevation and defensibility against potential assaults by the Ottoman military

Being one of the main towns of the Beqaa valley, Lebanon's most important agricultural region, the economy of Kab Elias-Wadi El Delm has long been built on agriculture. The town has the largest vegetable market with area of thirty four thousand square meters. Grapes are the area's chief product, with vineyards forming a prominent feature of the surrounding landscape. In addition to vineyards, the hillsides are covered with cherry, pomegranate, plum and mulberry orchards, while potatoes and leafy vegetables are cultivated on the Beqaa plateau.
Kab Elias-Wadi El Delm contains an educational centre complex for primary, intermediate and secondary schools, a central library, private institutes, a public garden, fire brigade, medical centres, mosques and churches in addition to commercial markets, shops and offices. All these sectors contribute to the economy growth. Kab Elias has also seen at a time a prosperous commercial activity due to its location midway between Beirut and Damascus.

FIGURE 1: PICTURE OF KAB ELIAS CITY

1.2.2 Employment

The main drivers that contribute to the economy growth in Kab Elias are agriculture, in which the city holds the largest vegetable market, in addition to tourism, construction and industry. Thus the labour force is fundamental in the domestic production. The employment status is linked to many factors that influence the number of people in the workplace, the economic base and employment opportunities available in the region, the education level and skill base of the people.

According to a report drafted by a World Bank team under the general title " *Lebanon: Economic and Social Impact Assessment of the Syrian Conflict",* it is stated:
"With the escalation of the Syrian conflict, spill overs onto Lebanon have rapidly moved beyond the humanitarian to the economic and social spheres where large, negative, and growing spill overs are occurring". Subsequently, Kab Elias is one of the most cities in Lebanon that had been affected by this crisis where number of Syrian's Refugees count 25,000 approximately.

In summary, this report finds that during the 2012-2014 period, the conflict may have

(1) Cut real GDP growth by 2.9 percentage points each year, entailing large losses in terms of wages, profits, taxes, or private consumption and investment.
(2) Pushed approximately 170,000 Lebanese into poverty (over and above the 1 million currently living below the poverty line) and doubled the unemployment rate to above 20 percent, most of them unskilled youth.
(3) Depressed government revenue collection by USD1.5 billion while simultaneously increasing government expenditure by USD1.1 billion due to the surge in demand for public services, bringing the total fiscal impact to USD2.6 billion.

1.2.3 Existing Infrastructure

Many obstacles and considerable challenges are facing Kab Elias as it spreads over long areas, the main challenges can be summarized as follows:

ELECTRICITY

The city of Kab Elias - Wadi El Delm suffers from shortage of electricity which brings the diesel generators to be a permanent entity to the city. The massive daily blackout period, 12 hours daily, makes the cost for electrification high. Hence, the city is working hard to overcome the issue by looking for solutions to reduce the energy bill and increase the renewable energy source.

STREET LIGHTING

Street lighting promotes security in the area and improves safety for drivers, riders and pedestrians in roads. Due to the blackout in electricity, the municipality has to connect the street lighting into the diesel generator, yet adding additional encumbrance.

SOLID WASTE MANAGEMENT

The responsibility for solid waste management is assigned to municipalities. Despite the attempts of Kab Elias-Wadi El Delm Municipality in managing the collection of its solid waste, the cost of the daily bill for collection and transportation is high. The municipality is looking for solutions to reduce the cost in order to treat its solid waste.

DRINKING WATER

The Syrian crisis has had its impact on the increase in the city's population to 50%, and thus leading to water scarcity in the region. The increase in demand for drinking water would need new water resources and better management for the water supply.

WASTE WATER TREATMENT

Domestic wastewater management is one of the greatest challenges for the municipality. It requires an adequate collection, treatment and disposal of the treated effluent and sludge, in addition to the maintenance of the network.

1.3 Complementarity with Municipal Plans and other related actions

Due to the growing concern over current environmental issues, the Municipality Council of Kab Elias engages national and international parties, concerned with environmental matters, in programs to help promote a more sustainable community for this and future generations. These parties are:

- CES-MED Cleaner Energy Saving Mediterranean Cities
- CoM Covenant of Mayors.
- USAID United States Agency for International Development
- UNDP United Nations Development Programme

The European Neighbourhood Partnership Instrument (ENPI) financially supports the CES-MED project, to help municipalities overcome challenges related to urban development, energy supply, and environmental management.

All those in line with the governmental strategy which ratified the UNFCCC in 1994 and Kyoto Protocol in 2006 with law No.359 and 738 respectively. Followed by NEEAP the Lebanon's National Energy Efficiency Action Plan, which has been approved by the Lebanese Council of Ministers.

1.4 Complementarity with national actions

Lebanon has committed itself to be a part of the global fight against climate change. It has ratified the United Nations Framework Convention on Climate Change (UNFCCC) by virtue of Law 359, with a primary objective of achieving the stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic activities from interfering with the climate system. One of the essential tools to fight against climate change, hence, is to improve the national knowledge on the matter and build our development and environmental policies on solid ground.

Through CES-MED project's support to selected municipalities in Lebanon on their effort towards energy sustainability and with the support from the Ministry of Interior and Municipalities as the focal point of the project, the Municipality of Kab Elias has taken the opportunity to play a key role in supporting the city in its target for sustainability.

The municipality of Kab Elias plays a vital role in the achievement of energy consumption and climate objectives, in protecting the environment, directing investments and implementing energy efficiency regulations. It has made a commitment to reduce the CO_2 emissions to at least 26% by 2020 compared to 2013. This pledge is to be achieved through the joint collaboration between the consortium GT &VH and the municipality through the CES-MED project.

1.5 Vision for the Future: "Sustainable Pilot City"

As the world moves toward a focus on a Sustainable Pilot City and a low- carbon approach to meet the growing energy requirements, Kab Elias-Wadi El Delm is taking action to create a conservative culture and ensure a sustainable economic future and clean environment.

Reaching these goals requires a set of strategies and actions by all stakeholders and all sectors to shape the policy and investment decisions needed for a brighter energy future.
Kab Elias is building the foundation that will help reduce the carbon footprint to 26 % with short and long-term initiatives that support its objectives:

- Leading in green energy and creating jobs
- Tackling greenhouse emissions in all sectors
- Promoting energy efficiency, and renewable resources
- Investing in public transport to support a strong infrastructure and liveable communities
- Reducing electric demand through conservation and smart grid technology

Kab Elias –Wadi El Delm is looking forward to building a future where it can be confident that the decisions taken today ensure its citizens grow up in an environment that is productive, and protected by all.

1.6 Organizational and Financial Aspects

1.6.1 Coordination with National and Local authorities

During the SEAP implementation, the municipality will work closely with other municipalities that have signed the CoM, with local and national authorities, community sectors and NGOs.

1.6.2 Adaptation of administrative structures

Kab Elias Sustainable Energy Action Plan analyses the city's energy use and introduces a headline target to reduce energy consumption and mitigate GHG emission by at least 26% by 2020 through greater efficiency in areas such as residential and commercial buildings, street lighting and transportation along with local renewable energy production.
Looking towards the future, this report identifies a set of actions that puts Kab Elias on track with a wide range of mitigation policies and strategies to become a pilot and sustainable smart city. Therefore, it is essential that it acts together with its partners to achieve a clean, and smart economy, resulting in sustainable living for our families, and the future generations to come.
The Municipality of Kab Elias provides great examples of how a successful partnership between the European Union and the local authorities of Lebanon functions. This municipality has been involved in a number of EU-funded projects that contribute to strengthening its capacity and to improve the quality of life of its citizens. Its determination to be sustainable, environmentally friendly municipalitiy with broad democratic participation of the citizens and with plenty of opportunities for work, education and access to health care is exemplary.

Section II: Methodology for BEI

2.1 The Methodology for Calculation of the Baseline Emission Inventory

Introduction:

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.

Method

The method used in BEI calculation will be considered as 'standard' emission factors in line with the Intergovernmental Panel on Climate Change (IPCC) principles and comply with United Nations Framework Convention on Climate Change (UNFCCC) reporting system.
CO_2 emissions from energy consumption within the territory of the local authority will be calculated either directly due to fuel combustion within the local authority or indirectly via fuel combustion associated with electricity and heat/cold usage within the area.
The emissions of CH_4 and N_2O will not be calculated.
CO_2 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

The base line year is 2013

Sectors

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

Procedures

The approach requires a set of procedures:

- Interview with data resources employees and evaluating the data available
- Collection and processing of quantitative data
- Establishment of indicators
- Gathering of qualitative information using document review and interviews /workshops with municipality.
- The selection of data sets will be based on criteria that is agreed on with municipality, who are then actively involved in contributing data.

Resources

- Municipalities.
- Ministry of Environment.
- Ministry of Public work and Transportation.
- Ministry of Energy and Water.
- Ministry of Interior and Municipalities.
- Electricité Du Liban (EDL).
- Data collection from the following departments in the Municipality & Governorate
    - Department of Traffic.
    - Department of services water, Electrical & Lighting.
    - Department of Backup Generator.
    - Department of facility and building. /Financial Division

LCEC: Lebanese Centre for Energy Conservation. The Lebanese Centre for Energy Conservation (LCEC) is a national organization affiliated to the Lebanese Ministry of Energy and Water. www.lcecp.org.lb

Methodology

- Identify the needed data for the baseline emission.
- Interview with data resources' representatives.
- Select the relevant data for the inventory.
- Assessment & validation of collected data.
- Checking level of accuracy & reality of collected data.
- Sorting the collected data.

2.2 Calculation of the power provided by BDG according to the Fuel Consumption

Kab Elias- Wadi El Delm suffers greatly from power outage which is characterized by daily cut-off counting around 12 hours in daily basis. In order to prevent power losses, BDG use becomes a need to provide power supply especially during the summer.
Since the database for BDG is insufficient and not well- documented, the private sector becomes the main provider for this service, but without getting any official control from the government.
In order to set a rule for calculating the emission part of BDG, the EDL data base will be used as reference, from which the estimated cut-off period will be calculated as KWh.
The fuel consumption will be counted according to the following:
The BDG fuel consumption depends on many factors:

- The capacity of Diesel Generators BDG in KVA
- Load ratio to capacity of BDG
- Fuel
- Years of operation
- The status of the engine -maintenance

The following link, explains the effect for the capacity of BDG on fuel consumption with load ratio:
www.dieselserviceandsupply.com for example: for 250kw Generator consumes the following:

TABLE 4: THE CAPACITY OF BDG ON FUEL CONSUMPTION WITH LOAD

BDG	1/4 load	1/2 load	3/4 load	Full load
250 KW	5.7(Gal/Hour)	9.5 (Gal/Hour)	13.6 (Gal/Hour)	18 (Gal/Hour)

In order to evaluate the actual GHG emission, some factors have to be defined and assumed to help calculating the GHG emission.
By consulting BDG providers and suppliers, the recommended maximum load share is 70% of the BDG capacity for more efficient use and long term of operation.
Assuming that the 75% load ratio, which is 13.6 Gal/hours for load of 187KW. (One Gal = 3.78541 litres).
So, each one KWh load consumption will consume 0.275 litres, which has been confirmed by the BDG provider.

1 KWh =» 0.275 litre of Diesel

The above figures will be used to convert power generated by the BDG from data available for the fuel consumptions

2.3 Power provided by BDG

In Kab Elias- Wadi El Delm, EDL is the only source which is in charge of providing the data necessary for power consumption. So, the power consumed by BDG is calculated from the combination of data provided by the BDG provider Fuel supplier and that of EDL data base.
Residential sector also counts in calculating the power consumption by BDG. This can be done by analysing the database of EDL and estimating the consumption power of residence at cut-off time. Then it is tuned to meet the actual consumption according to some inputs from the stakeholders and collected data from some studies conducted before.
The classification of residential building can be obtained from EDL Database through daily average power consumption. It is supported by a model adapted by Ruble and Karaki 2013.
For the tertiary sector, a similar methodology will be considered based on data obtained from the EDL

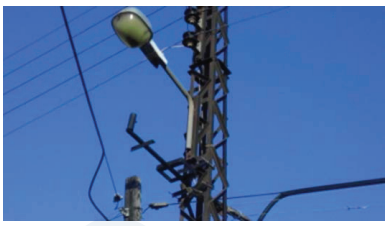
2.4 Heating and Cooling Power Consumption BEI methodology for the residential sector

The weather in Kab Elias- Wadi El Delm city is moderate in summer and cold in winter. There is no central cooling/ heating system in the city. Hence, the city's residents tend to heat one room in the flats or houses, while some other houses use central heating system. All commonly employ the fuel diesel oil.

The database for Diesel fuel consumptions for heating had been provided though the municipality.

2.5 Street Lighting Power Consumption BEI Methodology

Due to the shortage of power from EDL in daily base, EDL database will not reflect the actual power consumption in cut-off time, so there is a need to define the way to calculate the ideal power consumptions for the street lights by including the cut-off time power consumptions.
The future actions should indicate the actual issues and solutions with the assumption of the availability of EDL power for 24 hours as normal situation. Thus, in order to find out the actual consumption for the street lighting, the cut-off time, for Kab Elias city, along with the ideal street light operation hours according to sunrise and sunset will be defined.
The cut-off program in the city at a rate of 12 hours a day is measured as follows:
On the first day from 6:00AM to 10:00AM, and from 10AM till 2PM on the second day and so forth .The cut-off timing interval is 4 hours in day time from 6:00 AM till 6:00PM, and 6 hours from 6:00PM till 6:00AM. As a whole, there will be 12 hours daily cut-off.



Time of operation for street lights
Any action on the street light depends on operation of light photo cells which operate according to the existing light level, and according to sunrise and sunset. For this reason, the sunrise and sunset data, which can be taken from the following source, will help in defining the timing of operation:
http://www.timeanddate.com/sun/lebanon/zahle?month=2&year=2015

Although the timing is changed at a daily base, it is more convenient to have the average time for each month as a calculation base. To this end, the variations due to the type of photo cell used and light sensitivity will be considered minor in order to have a simple and as accurate as possible way for the calculation.
The following table summarizes the hours of operation all over the year.
Total operation hours per year is 4 382.53; we will consider it 4 400 as round figure.

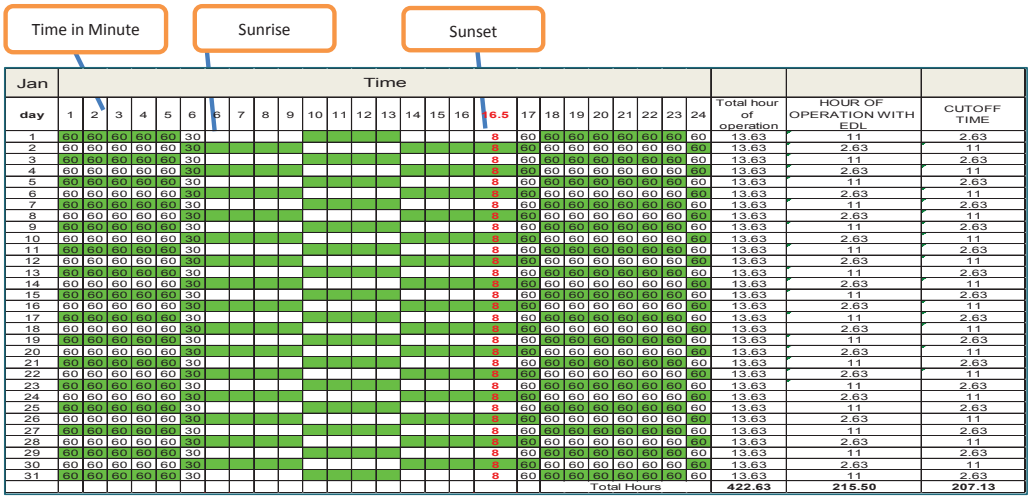
TABLE 5 SUMMARY OF THE OPERATION HOURS ALL OVER THE YEAR

MONTH	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
average daily time calculated from sunset to sunrise	13.63	13.5	12	11.20	10.27	9.8	10.14	11	12	13	13.73	14.2
number of days per each month	31	28	31	30	31	30	31	31	30	31	30	31
Total hours of operation per month	422.53	370	372	336	318	294	314	341	360	403	412	440

Time of operation for street lights with cut-off time from EDL

The following table explains the calculated cut-off time in one selected month. The cut-off time is 207 out of the 422 hours, which is about 49% for the month of January.
Similarly, the month of December is calculated at 50%, and, considering the rest of the months for the whole year, the cut-off time is calculated at 50%. Thus, we will consider in the upcoming calculations this factor. The total operation time is 4400 hours a year, and according to the above information, the EDL data will indicate only 50% of actual power consumptions.

TABLE 6: CUTOFF TIME IN ONE SELECTED MONTH



Jan	Time																										
day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	16.5	17	18	19	20	21	22	23	24	Total hour of operation	HOUR OF OPERATION WITH EDL	CUTOFF TIME
1	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
2	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
3	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
4	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
5	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
6	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
7	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
8	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
9	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
10	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
11	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
12	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
13	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
14	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
15	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
16	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
17	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
18	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
19	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
20	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
21	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
22	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
23	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
24	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
25	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
26	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
27	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
28	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
29	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
30	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	2.63	11
31	60	60	60	60	60	30											8	60	60	60	60	60	60	60	60	13.63	11	2.63
																			Total Hours							422.63	215.50	207.13

The Green colour indicates the availability of EDL, the white colour indicates the cut-off time.
So, the actual power consumption for the street light in Kab Elias will be as follows:

$$E_{ST} = (2 \times E_{EDL})$$

EST Actual power consumptions for street lights in MWh.
EEDL EDL database for power consumptions for street lights in MWh.

Emission from public street lighting power

$$ECO_2 = EST \times NEFE$$

ECO_2 CO_2-e emissions of Electrical Consumption in Year t CO_2-e
EST Actual power consumptions for street lighting In KWh.
NEFE National Emission Factor for electricity

2.6 Tertiary BEI methodology for electricity

The EDL database can help calculating the power consumption during the EDL operation and also can be analysed to calculate the power consumption on cut-off time from backup diesel generators.
The reason is that the tertiary sector will continue to consume power as EDL is available without reduction in consumption during the cut-off time.

2.6.1 Emissions from EDL power

The EDL provides the actual power consumption within a year. The calculation for GHG emission from power consumptions of the tertiary sector are realized in line with the equation below:

$$ECO_2 = ET \times NEFE.$$

ECO_2 CO_2-e emissions of Electrical Consumption in year tCO_2-e.
ET Actual power consumption for tertiary sector in KWh.
NEFE National Emission Factor for electricity [t/MWh] (0.65).

2.6.2 Emission from BDG

The power consumption from BDG will be the same as that from EDL, as the cut-off time is 12 hours daily. The assumptions presented in the above sections (Backup Diesel Generator BDG Fuel Consumption & BEI Methodology) can then be adopted, namely

1 KWh =» 0.275 litre of Diesel.

The above figures will be used to convert power consumption for the BDG for:

Fuel = power consumed from BDG in MWH x 0.275 x 1000

The calculation of GHG emissions for fuel consumption for BDG can be calculated with the following formula in accordance with IPCC guidelines:

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

Where :

EFC	CO_2-e emissions for fuel combustion in year tCO_2-e
Fuel	Amount of Fuel of type a (Diesel) in litre consumed in a year
EFf	Emission Factor of Fuel (Diesel) in tCO_2-e/TJ Diesel = 74.1 tCO_2-e/TJ t
NCV	Net Calorific Value of Diesel which is equal to 43.TJ/Gg
D	Density of Diesel equal to 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 guidelines).

2.6.3 Emissions from Transportation

In Kab Elias – Wadi El Delm city, the GHG emission is mostly attributed to the transportation sector. The consumption data will be taken from those provided by the municipality team. Traffic count data include the following:

- Distance in Km.
- Average consumption litre / Km
- Percentage of Passenger cars and taxis
- Percentage of Heavy and light-duty vehicles
- Percentage of Buses and other vehicles used for public transport services
- Percentage of Two-wheelers.

The default fuel consumption values which will be used are:

- 10Km/litre for gasoline vehicles
- 5Km/litre for Diesel vehicles

The calculation for GHG emission for fuel combustion for transportation can be calculated according to the following formula in accordance with IPCC guidelines:

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

Where :

EFC	CO_2-e emissions for fuel combustion in year tCO_2-e
Fuel	Amount of Fuel of type a (Gasoline /Diesel) in litre consumed in a year
EFf	Emission Factor of Fuel (Gasoline /Diesel) in tCO_2-e/TJ Gasoline 69.3 tCO_2-e/TJ t - Diesel 74.1 tCO_2-e/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 guidelines)

Section III: Base emissions inventory

3.1 BEI for Electrical Power Consumptions from EDL and BDG

In this section, we will assess the effects of backup generator and EDL on CO_2 emissions from the Electrical Sector in Lebanon.

Lebanon enjoys a large degree of electrification close to 100%, yet the electrical supply is unreliable and characterized by frequent and lengthy power cuts. Electricité Du Liban (EDL) is the sole official provider of electricity in Lebanon and is 100% owned by the government. The demand exceeds supply due to insufficient capacity.

The subsequent rationing of demand, translated into lengthy daily power cuts, has led to the gradual development of an off-grid parallel network.

This network has been estimated roughly 33% to 38% (in 2008) and about 60% by 2015 of electricity demand/consumption in Lebanon.

The power consumption of Kab Elias for the years 2012 and 2013 is analysed and studied according to the database provided by EDL, the annual fuel consumption for the BDG generators along with the estimation of fuel consumption/kwh and the fuel suppliers with the amount of fuel sold to the BDG providers. In other words, the overall information in this section has a multi approach to confirm the accuracy of the given figures.

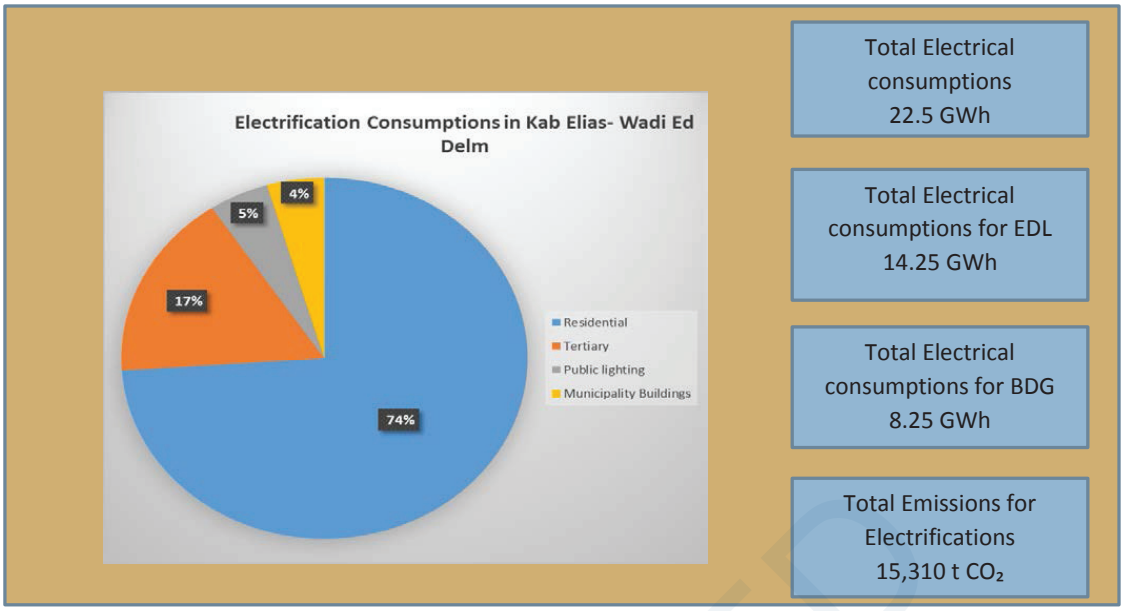
Table 7 shows the summary of electrical power consumption in 2013 for different sectors in Kab Elias. The total electrical consumption for electricity from the two sources EDL and BDG is about 22.5 GWh, excluding the industrial sector, which represents a small amount. The BDG represents 36.6% of the total consumptions. The total emission for electrification is about 15.3 $MtCO_2$ in 2013, where the BDG consumes about 2.3 Million Litres of Diesel Oil and counts for about 39.6% of total emission.

The Residential sector represents the 73.5% of total electrification emissions; the tertiary and municipality sectors represent about 17% and 4.6% respectively.

TABLE 7 : ELECTRIFICATION POWER CONSUMPTION (EDL & BDG) IN MUNICIPALITY OF KAB ELIAS FOR YEAR 2013

Type of Load	Electrical consumptions in KWH			BDG Diesel Fuel Consumptions in Litres	Emission in t CO_2 / year		Total Emission Per Sector
	TOTAL	EDL	BDG		EDL	BDG	t CO_2 / year
Residential	16,622,065	11,303,755	5,318,310	1,462,535	7,347	3,905	11,252
Tertiary	3,768,444	1,884,222	1,884,222	518,161	1,225	1,383	2,608
Public lighting	1,071,517	535,758	535,758	147,334	348	393	742
Municipality Buildings	1,023,528	511,764	511,764	140,735	333	376	708
Total in KWh	22,485,553	14,235,499	8,250,054	2,268,765	9,253	6,057	15,310
Total emissions in t CO_2 / year							15,310
The calculated figures for year 2013 the street light considered without cut-off through BDG							

CHART 3: ELECTRIFICATION CONSUMPTION IN KAB ELIAS-WADI EL DELM



3.2 BEI for Heating

The weather in Kab Elias – Wadi El Delm is cold in winter, so the residents depend on Diesel Fuel oil to heat their houses. Some of them use the remains of trees and sticks to fuel the stoves, and the majority heat one room. Others, who can afford paying the high cost of fuel, use central heating system. The estimated consumption for fuel oil per house is around 1000 to 1200 litres per year.
The total fuel consumption per year for heating is around 8,748,000 litre Diesel Fuel oil which represents 93% of total heating consumptions in the city.

Heating in the residential sector represents a key element in the future action for the city. The figures look low compared to the number of inhabitancies, but knowing the billing cost, which is around 4.37 million USD in a year, this represents huge amount of figures compared to the citizen capacities.
The action which insures the high rated of insulation for the building would be an essential part in reducing the cost of heating and creating a better and comfortable atmosphere to the houses and consequently, reducing the cost of fuel consumptions.

The methodology used for the calculation -of GHG emissions for heating is as follows:
The calculation for GHG emission for fuel consumption for BDG can be calculated with the following formula in accordance with IPCC guidelines:

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

EFC	CO_2e emissions for fuel combustion in year tCO_2-e
Fuel	Mount of Fuel of type a (Diesel) in litre consumed a year
EFf	Emission Factor of Fuel (Diesel) in tCO_2-e/TJ (Diesel = 74.1 tCO_2-e/TJ t)
NCV	Net Calorific Value of Diesel which is equal to 43.TJ/Gg
D	Density of Diesel equal to 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 guidelines).

TABLE 8 : FUEL CONSUMPTION & THE CO_2 EMISSION FOR HEATING

Fuel Consumptions for Heating		
Sector	Heating Diesel oil Fuel consumptions in litres / year	Total Emission tCO_2/year
Residential	8,748,000	23,745
Municipality	2,800	8
Tertiary	624,814	1,696
Total	9,375,614	25,448

3.3 BEI for Transportation

Transportation in Kab Elias- Wadi El Delm represents mainly traffic passing the city from the surrounded towns in addition to the daily traffic to the main vegetable market.
The Private transportation consumes around 3.65 million litres of gasoline and around 0.54 million diesel fuel for private transportation. Promoting the public transportation will help in reducing the fuel consumptions in the private sector.
The municipality trucks which collect the solid waste in daily base consume 80,000 litres of diesel oil. This could be a major part of the municipality consumptions.

- **CONVERSION FACTORS FOR THE MOST TYPICAL TRANSPORTATION FUELS (EMEP/EEA 2009; IPCC, 2006):**
  Gasoline 9.2 KWH/L
  Diesel 10.0 KWH/L
- **TOTAL CONSUMPTION**
  Total Gasoline Consumption is 3.713345 Million L
  Total Gas oil, diesel Consumption is 1.381615 Million L
- **STANDARD CO_2 EMISSION FACTORS (FROM IPCC, 2006)**
  Motor Gasoline STANDARD EMISSION FACTOR 0.249 t CO_2/MWh
  Gas oil, diesel STANDARD EMISSION FACTOR 0.267 t CO_2/MWh

The calculated GHG emission:

{Calculated consumption for Fuel in Litre x Fuel Conversion Factor (KWH/L)} X Conversion of Fuels from Mass to Energy units (IPCC, 2006) in Net Calorific value (MWh/t)} / 1000
Example:
Total Consumption for Private Transportation

- Gasoline 3,706,045 L x 9.2 KWH/L x 0.249 t CO_2/MWh / 1000 to convert from KWh to MWh = 8,489.8 t CO_2
- Gas oil diesel 1,301,615 L x 10 KWH/L x 0.267 t CO_2/MWh /1000 to convert from KWh to MWh = 3,475 t CO_2

TABLE 9 : FUEL CONSUMPTION & THE CO_2 EMISSION FOR TRANSPORTATION

Fuel consumptions for transportation					
	Gasoline Fuel in Litres	Emissions in tCO_2/year	Diesel Fuel in Litres	Emissions in tCO_2/year	Total Emissions tCO_2/year
Private Transportation Cars & Truck	3,706,045	8,489.8	1,301,615	3,475	11,965
Municipal Fleet	7,300	16.7	80,000	213.600	230
Public Transport		not applicable			
Total	**3,713,345**	**8,507**	**1,381,615**	**3,689**	
Total transportaions emissions in tCO_2/year for year 2013					**12,195**

FIGURE 2 : KAB ELIAS CITY

3.4 RESULTS AND SUMMARY

a) Residential Sector

Introduction

The residential sector in Kab Elias – Wadi El Delm counts for seventy five thousands inhabitants- fifty thousand are the city's residents and twenty five thousand refugees.
EDL supplies the database for the power consumption in Kab Elias – Wadi El Delm for year 2013, that cover the low voltage and medium voltage network.

Electrification Consumptions in Kab Elias – Wadi El Delm

The residential sector in Kab Elias – Wadi El Delm consumes around 16.62GWh in year 2013 for electrification, 11.3GWh of which are consumed through EDL and 5.3GWh by the BDG producing 11,252 tCO_2.
This sector represents 74% of total city consumptions in electrification which is considered the main target element in the strategic actions toward mitigation of the emissions.
The billing cost for BDG in residential sector counted for around 3.5 million USD in a year for around 32% of their total electrification consumptions; whereas, the EDL consumptions counted for 750 thousands USD in the same year which represent 68% of total power consumptions. This reveals a huge amount of losses for the households compared to what they are paying to normal power from EDL.
EDL has been implementing a rotating power outage regimen to balance the limited production capacity with that of the consumer demand in order to satisfy the national electricity demand. This has led to the development of a backup generator sector that relies on distributed diesel powered generators (BDG).

TABLE 10 : POWER CONSUMPTION & THE CO_2 EMISSIONS FOR RESIDENTIAL SECTOR

Residential sector		
Power Source	Power consumptions in KWh	Emission in tCO_2
EDL	11,303,755	7,347
BDG	5,318,310	3,905
Total	16,622,065	11,252

Kab Elias – Wadi El Delm households encounter many issues. The twelve hours a day cut-off time, the high costs citizens are paying, besides the emissions of generators that may significantly increase the inhalation exposure to harmful substances are a burden on the citizens.

House Hold Consumptions analysis

The residential sector in Kab Elias-Wadi El Delm is the major element in power consumptions. Before applying the actions to mitigate the power consumptions, there is a need to identify the source of consumptions in the houses.

The following table indicates the consumptions of power in houses related to the average daily consumption. It has been revealed that 73% of the residential sector consumes an average consumption of 4 to 10 KWh per day. By applying Ruble and Karaki 2013 modules for house consumptions, it is shown that lighting and refrigerators are the main appliances parts in addition to other electronic sets.

TABLE 11 : CONSUMPTION OF POWER IN HOUSES RELATED TO THE AVERAGE DAILY CONSUMPTION

Number of Houses	Daily power consumptions in KWh for 12 hours cut-off	Assumed Daily power consumptions in KWh for 24 hours without cut-off
38.9%	2	4
34.4%	5	10
16.6%	8	16
6.5%	11	22
2.4%	14	28
0.7%	18	36
0.4%	23	46

Utilizing high efficient rated appliances will be essential, especially for the refrigerators and lights to mitigate the power consumptions. On the other hand, the daily power consumptions, which look low for 38.9% of houses, give another feedback that such appliances will be expensive and not affordable to the citizens. This rises up the need for a national intensive program to promote the use of high efficient rated appliances.

Solar Water Heater

Lebanon enjoys a moderate climate with about three hundred sunny days and an average solar radiation of 5.15 kWh/m2 and 20 °C average temperature of distributed water. Such facts can be of great significance for using Solar Water Heater (SWH) systems.

SWH systems would be a solution because not only do they provide hot water for 70% throughout the year, but also help in reducing the power consumptions and the emission of CO_2 gas into the atmosphere.

Kab Elias – Wadi El Delm would need an intensive programme to encourage the use of Solar water Heater. The government has promoted the usage of solar water heaters with additional discount of 200$ on each unit. However, the local situation in the city hinders many residents to install the system, as many cannot afford paying for it, and this requires considering further steps towards increasing the installation of SWH.

Heating

The weather in Kab Elias – Wadi El Delm is cold in winter, so the residents depend on Diesel Fuel oil to heat their houses. Some of them use the remains of trees and sticks to fuel the stoves, and the majority heat one room. Others, who can afford paying the high cost of fuel, use central heating system. The estimated consumption for fuel oil per house is around 1000 to 1200 litres per year.

The total fuel consumption per year for heating is around 8,748,000 litre Diesel Fuel oil which represents 93% of total heating consumptions in the city.

Heating in the residential sector represents a key element in the future action for the city. The figures look low compared to the number of inhabitancies, but knowing the billing cost, which is around 4.37 million USD in a year, this represents a huge amount of figures compared to the citizen capacities.

The action which insures the high rated of insulation for the building would be an essential part in reducing the cost of heating and creating a better and comfortable atmosphere to the houses and consequently, reducing the cost of fuel consumptions.

SUMMARY FOR RESIDENTIAL SECTOR

Residential sector consumes 66% of the total electrification energy consumption and 93% of total heating consumptions in the city. It represents a key target in the city future plan to reduce energy consumption.

It also rises up the importance of:

- Energy conservation and energy efficiency in future plans.
- The importance of communication and awareness plan.
- Rating the new buildings
- Building heating insulations

3.4.1 Tertiary Sector

Introduction

The Tertiary sector in Kab Elias – Wadih El Delm consists of an educational centre complex for primary, intermediate and secondary schools, a central llibrary, a main vegetable market with an area of thirty four thousand square meters, a public garden, private institutes, fire brigade, medical centres, mosques and churches in addition to commercial markets, shops and offices.

Electrification Consumptions

The tertiary sector in Kab Elias – Wadi El Delm consume around 3.77 GWh in year 2013 for electrification, and produced 2,608 tCO_2. This sector represents 17 % of total city consumptions in electrification .The following table shows the energy consumption and the CO_2 emission of the tertiary sector corresponding to EDL & BDG.

TABLE 12 : POWER CONSUMPTION & THE CO_2 EMISSION FOR TERTIARY SECTOR

Tertiary sector		
Power Source	Power consumptions in KWh	Emissions in tCO_2
EDL	1,884,222	1,225
BDG	1,884,222	1,383
Total	3,768,444	2,608

Renewable Energy Source

The space area available in this sector makes it a remarkable feature. For example, the school complex covers an area of 40 thousand square meters and the main vegetable market covers an area of 34 thousands square meters. This makes the implementation of PV farm project an ideal location for using renewable energy source to reduce the city dependence on fossil fuels consumption and to increase the enhancement of green energy sources.

FIGURE 3 : MAIN VEGETABLE MARKET

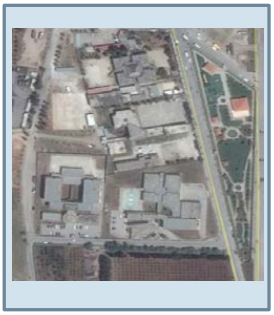


FIGURE 4 : SCHOOL COMPLEX

Lighting efficiency

Lighting consumption is an essential part in energy conservation and consumption in Tertiary sector. Shifting to more efficient lightning would reduce the consumption by 50%, so the school complex will be the ideal place to implement such project and work on projects.

Central and efficient heating system

The central heating and central generator sets for the school complex will result in good saving in fuel consumptions and maintenance cost.

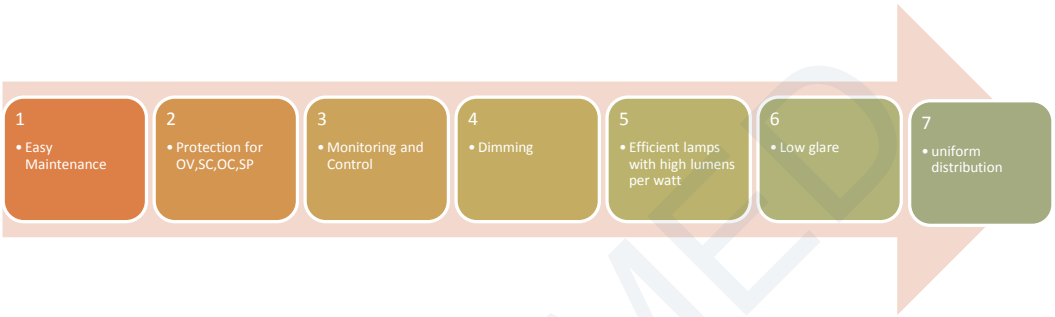
Currently, each school has one set of generators and an independent heating system. It will be much possible to join them together and have synchronised generator system for more efficient operation.

3.4.2 Municipality Buildings

The municipality consumed around 1,024 MWh in year 2013 although it counts for 4% of total electrification demand for the city. It's necessary for the municipality to give an example of its commitment to save energy and work on projects aimed at mitigating the emissions and integrating a renewable energy source in its buildings

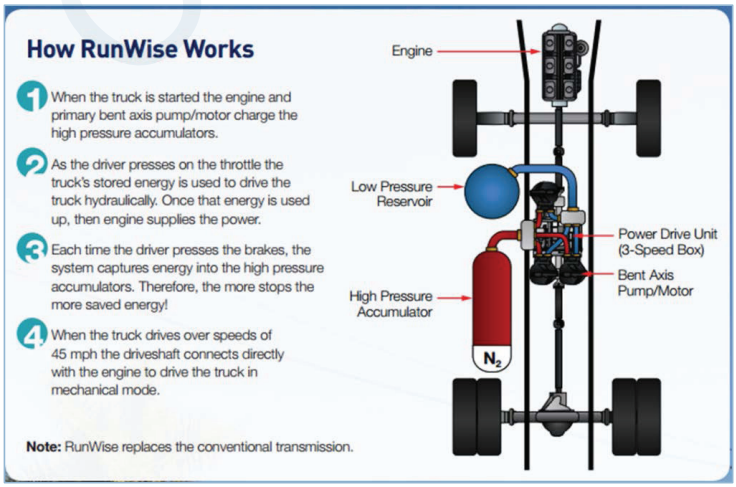
3.4.3 Public Street Lighting

The street lighting sector in Kab Elias – Wadi El Delm city suffers from low efficient lighting and high power consumptions, The main type of lamps used are HPS lamps rated 250, 150, 125 watt controlled through 34 substations. The power consumption for the street lighting is 1GWh /year.
In order to create an action to mitigate the power consumptions in street lighting, a proposal of replacing the lamps with more efficient ones will not be enough. Joint efforts and further studies are needed to achieve the main street lighting vision. However, the main essential parts in upgrading the street lighting should allow for better maintenance, protection, monitoring/ controlling, dimming of the street lighting, eliminating ghost effects, lowering glare and uniform distribution.



3.4.4 Transportation

Transportation in Kab Elias- Wadi El Delm represents mainly traffic passing the city from the surrounded towns in addition to the daily traffic to the main vegetable market.
The Private transportation consumes around 3.65 million litres of gasoline and around 0.54 million diesel fuel for private transportation. Promoting the public transportation will help in reducing the fuel consumptions in private sector.
The municipality trucks which collect the solid waste in daily base consume 80,000 litres of diesel oil. This could be a major part of the municipality consumptions.
By applying Hybrid Drive System with Advanced Technology for Fuel Reduction, it will replace the conventional transmission with a hydraulic transmission to drive the trucks off mechanical and hydraulic power, hence reducing the fuel consumption up to 50%. The brake energy recovery allows the truck to extend brake replacements.



Section IV: BAU Scenario

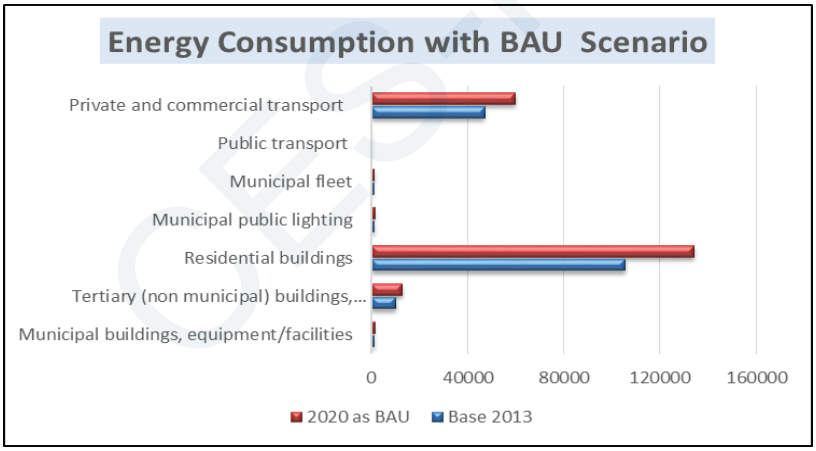
Kab Elias – Wadi El Del consumed 165.9 MWh/y as counted in year 2013 which corresponds to 210 MWh/year in 2020, according to JRC expectation for Lebanon if no action has been applied. Though the increase is considered, this doesn't reflect the current situation as the number of Syrian refugees is increasing which counts for 50 % of the original population in Kab Elias.

TABLE 13 : ENERGY CONSUMPTIONS IN KAB ELIAS WITH BAU 2020

	Energy Consumption in MWh/year	
BUILDINGS, EQUIPMENT/FACILITIES & TRANSPORTAION	**Base 2013**	**2020 as BAU**
Municipal buildings, equipment/facilities	1054	1338
Tertiary (non municipal) buildings, equipment/facilities	10128	12863
Residential buildings	105665	134195
Municipal public lighting	1072	1361
Municipal fleet	869	1104
Public transport	0	0
Private and commercial transport	47107	59826
Total	165895	210686

The chart below shows the current energy consumption according to year 2013 with BAU scenario for 2020 as no action been applied.

CHART 4 : ENERGY CONSUMPTIONS INKAB ELIAS WITH BAU 2020



The corresponded GHG emission for the energy consumptions is 52,954 tCO_2 (2013) and it is expected to reach 67,252 t CO_2 by 2020. Without applying any actions in energy conservation or increasing renewable energy sources, the emission per person will be 0.7 t CO_2/year.

TABLE 14 : GHG EMISSIONS FOR THE ENERGY CONSUMPTIONS WITH BAU

	GHG emissions in t CO_2/year	
BUILDINGS,EQUIPMENT/FACILITIES& TRANSPORTAION	**Base 2013**	**2020 as BAU**
Municipal buildings, equipment/facilities	716	909
Tertiary (non-municipal) buildings, equipment/facilities	4304	5466
Residential buildings	34997	44446
Municipal public lighting	742	942
Municipal fleet	230	292
Public transport	0	
Private and commercial transport	11965	15196
Total GHG emission in t CO_2/year	**52954**	**67252**

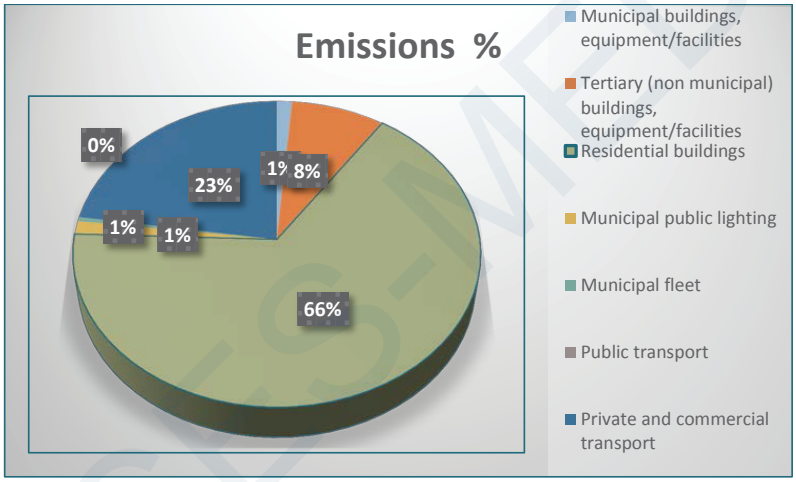


CHART 5 : PERCENTAGE OF GHG EMISSIONS FOR THE ENERGY CONSUMPTION OF EACH SECTOR IN THE CITY

TABLE 15 : SUSTAINABLE ENERGY ACTION PLAN SEAP TEMPLATE

Covenant of Mayors
Committed to local sustainable energy

Sustainable Energy Action Plan (SEAP) template

BASELINE EMISSION INVENTORY

1) Inventory year: 2013

For Covenant signatories who calculate their CO2 emissions per capita, please precise here the number of inhabitants during the inventory year: 75000

2) Emission factors

Please tick the corresponding box:

- ☑ Standard emission factors in line with the IPCC principles
- ☐ LCA (Life Cycle Assessment) factors

Emission reporting unit

Please tick the corresponding box:

- ☑ CO2 emissions
- ☐ CO2 equivalent emissions

3) Key results of the Baseline Emission Inventory

Green cells are compulsory fields

Grey fields are non editable

A. Final energy consumption

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

Category	FINAL ENERGY CONSUMPTION [MWh]															
			Fossil fuels								Renewable energies					
	Electricity	Heat/cold	Natural gas	Liquid gas	Heating Oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal	Total
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES:																
Municipal buildings, equipment/facilities	1023.528					30										1053.528
Tertiary (non municipal) buildings, equipment/facilities	3768.444					6360										10128.444
Residential buildings	16622.065					89043										105665.065
Municipal public lighting	1071.517															1071.517
Industries (excluding industries involved in the EU Emission trading scheme - ETS)																
Subtotal buildings, equipments/facilities and industries	22485.554					95433										117918.554
TRANSPORT:																
Municipal fleet						801	68									869
Public transport						0	0									0
Private and commercial transport						13015	34092									47107
Subtotal transport						13816	34160									47976
Total	22485.554					109249	34160									165895

Municipal purchases of certified green electricity (if any) **[MWh]:**	0
CO2 emission factor for certified green electricity purchases (for LCA approach)**:**	0

B. CO2 or CO2 equivalent emissions

Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

Category	CO2 emissions [t]/ CO2 equivalent emissions [t]															
			Fossil fuels								Renewable energies					
	Electricity	Heat/cold	Natural gas	Liquid gas	Heating Oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Biofuel	Plant oil	Other biomass	Solar thermal	Geothermal	Total
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES:																
Municipal buildings, equipment/facilities	708					8										716
Tertiary (non municipal) buildings, equipement/facilities	2608					1696										4304
Residential buildings	11252					23745										34997
Municipal public lighting	742															742
Industries (excluding industries involved in the EU Emission trading scheme - ETS)																
Subtotal buildings, equipments/facilities and industries	15310					25449										40759
TRANSPORT:																
Municipal fleet						213.6	16.7									230.3
Public transport						0	0									0
Private and commercial transport						3475	8489.8									11964.8
Subtotal transport						3688.6	8506.5									12195.1
OTHER:																
Waste management																
Waste water management																
Please specify here your other emissions																
Total	**15310**					**29137.6**	**8506.5**									**52954.1**

Corresponding CO2-emission factors in [t/MWh]	0.681					0.267	0.249									
CO2 emission factor for electricity not produced locally [t/MWh]	0.65															

Section V: Planned Actions and Measures

5.1 Municipal building

5.1.1 OVERVIEW

The municipality of Kab Elias-Wadi El Delm manages an area of around 41Km² where two rivers pass through it. It has approved the general master plan which regulates the usage of lands and identifies clearly the type of investment for each area.
The energy consumption for the municipality building and facilities consume 1054 MWh/y (2013), the municipality building itself consumes 9 MWh/y.
The municipality council and staff have moved into the new municipality building after our study has been conducted. The large space area with multi floors and facilities is subject to a higher impact on consumptions. The need to address it becomes vital due to the increase in the facility consumptions.

The table below includes other buildings which have been used by the school or other governmental facilities, which the municipality had no control on. For that, we will just consider the main building which consumes 9 MWh/ year.

TABLE 16 : ENERGY CONSUMPTION & GHG EMISSION FOR THE MUNICIPALITY AREA

Municipality Area	Energy Consumption in MWh/Year	GHG Emission in 2013 in t CO_2	GHG Emission 2020 as BAU in t CO_2
Municipality main Building	9	6.4	8.1
Municipality other buildings and Facilities	53	37.7	47.9

The municipality building represents a key element in the implementation of sustainable energy action plan.
The SEAP represents the pilot project for the municipality and the stakeholders, allowing them to expertise the changes in consumptions and giving positive feedback on the attitude of the employees and visitors. Not only does it aim at showing how successful and important sustainability is, but also increases the staff capacity with new implementations of actions.
To achieve a resilient and sustainable municipality, the following measures should be taken into account:

- Using high efficient light. The new municipality building had conventional lighting, and still hasn't identified high efficient light in its design study. This issue rises up the importance of using lamps replacement with high efficient ones when lamps reach an end-of-life.
- Utilising lightning control system. The new building had no lighting control for occupancy in offices or in corridors. If lightning control is implemented, this could save a lot of power when offices are empty. It could also help in reducing the power consumptions, mitigating the emissions and reducing the unseen cost.
- Raising staff awareness. This has its impact on their changing behaviour which will help in reducing consumptions. The staff should be aware not to keep the PCs and monitors on when they are out of office and turn off A/C or other electrical equipment or appliances.
- Identifying the set temperature for air-conditioning cooling and heating will help in reducing the power consumptions.
- Updating the procurements policy and procedures to include the sustainability conditions and rating for efficiency for the new purchase of equipment. This is essential in maintaining SEAP implementation plan.
- Installing Power Analyser in the building. It will help in identifying the power consumptions and support the municipality in its plan for monitoring consumptions and identifying the required steps in the plan to mitigate the consumptions and reduce the billing cost.
- The municipality also manages water pumping in the town and this consumes high impact of energy which counts for 94% of total power consumptions. A pilot project has been set to install the photovoltaic solar station for new water pumping station to supply seventy cubic meters per hour of drinking water. The project, which was financed by USAID, shows successful story as it reduces the dependence on

EDL and diesel generators. It produces around 156 MWh/y of renewable energy and helps in mitigating the GHG emission. Further projects are needed to be created in this line to reduce energy bill.

5.1.2 SHORT TERM ACTION PRIORITY ACTION - 1

The municipality has to involve local stakeholders and show them how certain implementations for sustainable energy action plan in their facilities are performed. In the process of saving energy, the following short term actions are proposed:

- Set up SEAP Unit inside the municipality. This unit should monitor the implementation of SEAP, the process of the actions and achievement progress.
- Setup a Website for the SEAP implementation, and create a page on Facebook and other social media. Link the website and Facebook page to the local city citizens, update them with the latest projects and get their feedback.
- Implement Energy Saving Instructions for employees to fulfil the reduction and unseen consumption as follows:
  - Switch off the light while leaving the office.
  - Fix the Air-condition thermostat on 22°C to24°C in winter/ summer.
  - Utilize as possible day lights through windows and reduce using artificial lights as possible.
  - Set the PC monitor on sleep mode for maximum 2 minutes of ideal condition.
  - Switch off PCs, UPSs and printers when leaving the work.
  - Minimize the usage of printing as possible.
- Set up simple Monitoring Mechanism in the municipality building to measure the extent of compliance with the rules related to mitigation of electrification consumptions. The mechanism should be able to show the instantaneous achievement in reduction of energy consumption in daily and annual bases as monitoring mechanism. The system will be connected to LCD presented in public areas of the building to show all employees the achievements that they could see which reflects their usage of electricity.
- Raising staff awareness and holding training campaigns are essential actions in the implementation of SEAP and that would be achieved through various and successive steps with the participation of NGOs representatives from the local community

The expected reduction in power consumption in the municipality depends on the effectiveness of the staff behaviour, the monitoring tools and the efficiency of the awareness campaigns held for the municipality staff. Such process will be well-monitored by the SEAP unit that sets incentives and gives appreciation to maintain successful results.
The SEAP unit is established and controlled by energy engineers from the local area who are in charge of leading the actions, supporting the implementation and assuring the compliance with proper actions and measures.
The SEAP unit costs consist of the additional work carried out by the staff of the municipality employees, supported by an expert who guides them in the implementation process. The expert has to be present in the municipality each month in order to prepare the progress report, monitor the achievements and guide the team in the process of work. In case the expert is out his office, communication can be done by phone call or email exchanges.

5.1.3 LONG TERM ACTION

In the short term phase, the municipality would have the SEAP unit setup completed along with the monitoring tools. The procurements department had also started processing the work in line with the municipality policy to mitigate the GHG emissions and reduce the energy bill.
The municipality employees, through the short term phase, will recognize the importance of the development of the approach for a low- carbon economy transition.
In the long term phase, the municipality will continue implementing actions set in the first phase and will support it with additional actions to achieve the final target- the reduction of power consumptions.

- Use of LED lamps. The municipality building contains lamps with energy saving one and CFL Fluorescent with lumen output equal to 60 to 70 lumen /watt. By replacing those lamps with LED lamps, this could increase the efficiency to 100-144 lumen per watt and reduce the power consumptions. 50% in power reduction for the lighting will be achieved.
- Install motion lighting sensors. This will support the mitigation of energy by turning off lights when they are not needed.
- Air-conditioning units consume high energy especially the non-saving model one. The new technologies of power saving A/C would save 30% less than the ordinary types; the replacement of the A/C rated A++ + would be a good solution to be implemented by the end of the life cycle of the existing units.

- The heat water pumps are part of the loads in winter, and converting the operation of the pump to be on VFD would reduce the energy consumptions and support the implementation of the energy saving in the municipality. It will count for 15- 30% in power consumption for the pump.

The actions can be summed up as follows:
Energy saving implementation can be achieved by converting lamps, A/C, and the installation of motion sensors.

1. Start replacing the Fluorescent and CFL lamps with LED lamps when needed to be replaced
2. Replace the Air Conditioning units with A+++ Inverter type when new A/C is needed to be replaced
3. Install lighting motion sensors in building
4. Replace the heating pumping driver with VFD driver for central heating system

5.1.4 MUNICIPALITY BUILDING WITH RENEWABLE ENERGY

On the top roof of the municipality building, PV Solar system can be installed. The implementation of this action, with costs compensated in six to seven years, can be financed through savings from the municipality billing for energy with support from other funding mechanisms.
The required installation will be around 36 PV modules each is 260 watt that will produce 13MWh/year.

FIGURE 5: TOP ROOF OF MUNICIPALITY BUILDING

TABLE 17 : EXPECTED PRODUCTION OF GREEN ENERGY & ANNUAL MITIGATION OF CO_2 FOR THE MUNICIPALITY BUILDING

Location	Expected production of green energy MWH/a	Mitigation in t CO_2/a	Estimated cost in €
Main municipal building	18	11.7	€ 25,000

TABLE 18 : FINANCIAL ANALYSIS & PROPOSED SOLUTION FOR MUNICIPALITY BUILDING

Local or Outsource Finance		Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%		0%	100%	4.50%	10
Fixed Financial amortization costs				Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)		€ 3,160	/year	€ 31,600	€ 25,000
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(10 years) in €	PPA Tariff
4,140	5.23%	18	10	1,159	€ 0.23/Kwh

Time schedule for implementation of the Short and long term action					
YEAR		2017	2018	2019	2020
Short Term Actions		X	X	X	X
Long Term Actions			X	X	X

5.1.5 Public Procurements of Products and Services

The Sustainable Procurement Policy embedded in the municipality process is intended to be an efficient public policy that saves natural and financial resources and promotes sustainable patterns of consumption and production. By identifying the reliable and efficient energy saving products through purchasing, setting an example and choosing more sustainable options, the municipality can positively reach effective environmental and social outcomes.
Such green procurement could also be promoted in local schools, the central library and other local municipality or governor offices.

5.1.6 Expected reduction in consumptions for Short and Long Term Actions

TABLE 19: EXPECTED REDUCTION IN CONSUMPTIONS FOR SHORT AND LONG TERM ACTIONS WITH RENEWABLE ENERGY SOURCE FOR THE MUNICIPALITY BUILDING AND PUPLIC PROCUREMENTS OF PRODUCTS AND SERVICES:

SECTORS & FIELDS OF ACTION	Action No.	KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing in €
			MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Municipal buildings, *equipment/facilities*			**11.43**	**7.76**	**25.94**	**17.03**	**0.025%**	**77,600**
Short Term Action	1	SEAP unit						5,600
	2	Setup a Website other social media						1,000
	3	Announcements on the local media like local TV channel						1,000
	4	Energy Saving Instructions			0.9	0.6	0.001%	5,000
	5	Monitoring Mechanism			0.9	0.6	0.001%	8,000
	6	Awareness and Training Campaign			0.9	0.6	0.001%	10,000
Long Term Action	7	Start replacing the FCL lamps with LED lamps.			1.7	1.1	0.002%	5,000
	8	Replace the Water pumping driver with VFD driver for Central heating system			0.3	0.2	0.000%	3,000
	9	Replace the Air Condition with A+++ Inverter type.			0.7	0.5	0.001%	7,500
	10	Install lighting motion sensors in building.			0.2	0.1	0.000%	1,500
	11	Renewable Energy			18	11.7	0.017%	25,000
	12	Public procurement			2.34	1.63	0.002%	5,000

5.1.7 Financial Analysis and Proposed Solution

Though the results are not that important and not commercially advisable, the municipality should demonstrate and show the stakeholders and citizens the actual implementation of sustainable project, and build up the capacity for future projects in the city.

In Table 18 the financial analysis already has shown good NPV results for the renewable energy part of the municipal building, compared with the table 20 the technical actions from 4, 5 7, 8, 9 &10 show negative NPV results. These actions need support from donors to allow them to be implemented.

TABLE 20: FINANCIAL ANALYSIS AND PROPOSED SOLUTION FOR TECHNICAL ACTIONS FROM 4, 5 7, 8, 9 &10

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%	0%	100%	4.50%	10
Fixed Financial amortization costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)	€ 6,649	/year	€ 66,486	€ 52,600
Annual revenues in € / IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(20 years) in €	PPA Tariff
1,826 / -18.5%	7.94	NA	-52,037	€ 0.230/Kwh

Time schedule for implementation of the Short and long term action					
YEAR	2016	2017	2018	2019	2020
Short Term Actions	X	X	X	X	X
Long Term Actions			X	X	X
Renewable Energy source for the municipality building			X	X	X
Public Procurement			X	X	X

5.2 Water Supply and Waste Water Treatment

5.2.1 OVERVIEW

The water supply and waste water are linked together, as the second one is the result of the first one.

For that the actions in saving water supply will positively affect the reduction in waste water.

5.2.2 WATER SUPPLY

Kab Elias consumes electricity for around 962MWh/year and half of its cost goes to the Diesel Fuel Generator due to the shortage in EDL capacity which adds more costs on the municipality. The water supply itself is managed by another government agent which is usually not willing to pay for the electricity billing. Due to this and to avoid shortage in water supply, the municipality is handling the payment to reduce the issue on the citizen.

TABLE 21: ENERGY CONSUMPTION & GHG EMISSIONS FOR WATER PUMPING

Municipality Area	Energy Consumption in MWh/Year	GHG Emission in 2013 in t CO_2	GHG Emission 2020 as BAU in t CO_2
Water Pumping	962	684	868

The municipality has already converted the water pumping station to operate on PV solar system funded by USAID. Due to the project success, there is an intention to convert the other water pumping station to the same module in order to save the high cost in electrification and reduce the dependence on fusel fuels.

5.2.3 Waste Water

The human demography has increased by more than fifty percent in the city due to the high number of displaced Syrian refugees who had affected water consumption and made waste water a more serious issue with lack of implementation of waste water treatment plant. Some projects which have been executed with standalone treatment plant to serve limited houses are not enough. The city still needs a totalized plan to treat the waste water and this action becomes now a must with the high demand on water which has its effect on the amount of untreated waste water.

The solution should be sustainable, with low impact on the city and should take into consideration the increase in the city demography and the refugees demand.

With the presence of the high number of refugees and lack of national and international support, solving such an issue is crucial. Henceforth, there must be planned actions in order to overcome the main issue.

5.2.4 SHORT TERM ACTION - PRIORITY ACTION - 2

It is essential to start solving the problem from the source which means from the water demand, the possibility to rationalize that demand and regulate water consumption.
The short term action suggests various measures to be considered:

- Conduct awareness campaign to enhance the water conservation regulate the water consumption with an expected reduction to 5%.
- Distribute water saving tools for the faucet (Tap). This will help to rescue the water consumption up to 4.75% if it is adapted.
- Encourage citizens to collect rain water in the winter season to reduce the high season demand in summer. The expected result will be 2.7 % reduction according to the availability of water tanks in the houses.
- Conduct routine maintenance and check the water leak in main feeder piping. This could rescue the loss of water by 8.75 %.
- Update the municipality policy to include in every new construction a standalone water treatment plant, this could rescue the loss of water by 4.2 %.
- Install water meters on the main water supply and main branches to monitor water consumptions, this could rescue the loss of water by 8.75 %.
- Include in new constructions the reuse of treated water to feed the flush water supply in separate piping. This could rescue the loss of water by 4.2 %.

5.2.5 LONG TERM ACTION

The long term action plan to address the issue includes the following areas:

- Prepare strategic plan for waste water treatment
- Install water treatment plant (finance to be defined)
- Install PV solar station on one of the water pumping stations to feed 30% of demand. A pilot project has been set to install the photovoltaic solar station for new water pumping station, to supply seventy cubic meters per hour of drinking water.

The project, which was financed by USAID, shows successful story as it reduces the dependence on EDL and diesel generators. It produces around 156 MWh/y of renewable energy and helps in mitigating the GHG emission. Further projects are needed to be created in this line to reduce energy bill.

The following proposed action is to set a plan to mitigate the emission by utilising renewable energy source for 30% of the needed energy for the pumping stations. The estimated cost fails in € 150,000 which could be managed through local or international donors. The following table shows the expected renewable energy production where it will be listed in drinking water sector later in this report

5.2.4 EXPECTED REDUCTION IN ENERGY CONSUMPTION

TABLE 22: EXPECTED REDUCTION IN ENERGY CONSUMPTION FOR WATER SUPPLY & WASTE WATER TREATMENT

SECTORS & FIELDS OF ACTION	Action No.	KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing in €
			MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Water supply and waste water treatment			**1222**	**869**	**570**	**404**	**0.601%**	301,000
Short Term Action	13	Conduct awareness campaign			61	43	0.06%	20,000
	14	Distribute water saving tools for the faucet (Tap).			58	41	0.06%	10,000
	15	Encourage citizens to collect rain water in the winter season			33	23	0.03%	1,000
	16	Conduct routine maintenance and check the water leak in main feeder piping and fix the leaks			107	76	0.11%	50,000
	17	Update the municipality policy to include a standalone water treatment plant. in every new			52	37	0.06%	10,000

		construction						
	18	Install water meters on the main water supply and main branches to monitor water consumptions.			107	76	0.11%	50,000
	19	Include in new construction the reuse of treated water to feed the flush water supply in separate piping			52	37	0.06%	10,000
Long Term Action	20	Prepare strategic plan for waste water treatment			to be defined			
	21	Install water treatment plant			to be defined			
	22	Install PV solar station on one of the water pumping stations			100	71	0.106%	150,000

5.2.5 FINANCIAL ANALYSIS AND PROPOSED SOLUTION

TABLE 23: FINANCIAL ANALYSIS & PROPORSED SOLUTION FOR PRIORITY ACTION -2

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%	0%	100%	4.50%	10
Fixed Financial amortization costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)	€ 38,046	/year	€ 380,464	€ 301,000
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(4years) in €	PPA Tariff
131,100	14.2%	570	4	89,861	€ 0.230/Kwh

Time schedule for implementation of the Short and long term action					
YEAR	2016	2017	2018	2019	2020
Short Term Actions	X	X	X	X	X
Long Term Actions			X	X	X

5.3 Solid Waste Management

5.3.1 OVERVIEW

Kab Elias – Wadi El Delm had a population of 75 thousand people in 2013 that produce 19,162 tons of Municipal Solid Waste (MSW) per year. While the composition of wastes is in majority organic (exceeding 50 % varying between local citizen area and refugee areas, as well as between summer and winter),it is considered that the MSW generation per capita varies from around 0.3 Kg/p/d in refugee areas to around 0.9 to 1.1 Kg/p/d in local citizen areas.

The municipal solid waste in Kab Elias is collected and transported by municipality trucks. It is then subjected to manual sorting in the landfill. The unsorted wastes are disposed in a waste landfill which is not considered sanitary.

With the absence of solid waste strategy, sorting from source is not followed. Even if there are many attempts from NGOs and municipality to promote such a process, they are limited especially within areas like schools that are not well supported with comprehensive programs due to shortage in capacity and finance.

The foreseen increase in waste generation is estimated at an average of 1.65% across the country. The annual fuel consumption for collection and transportation of the solid waste is around 80,000 litres of diesel oil that produces 213 t CO_2/year.
The municipality trucks that collect daily the solid waste consume 80,000 litres of diesel oil, which represents the majority in municipal consumptions. The municipality has taken a step forward and used GIS system in municipality trucks in order to achieve efficient control and management for the solid waste collection and avoid unseen losses due to the long routes covered.

In order to overcome the expected increase in waste which is considered to be 1.65 per year, and the high cost in transportation which counts for € 70,000 /year, the municipality had to take the following actions.

5.3.2 SHORT TERM ACTION - PRIORITY ACTION – 3

The short term action proposes a smart waste collection method. It focuses on the changing behaviour in solid waste management and moving on to the smart way in sorting the solid waste at the source.
The sorting of solid waste at the source is important since it helps in reducing the daily trips for the solid waste trucks, the fuel consumption and the maintenance cost for the collection. .
Solid waste consists of organic materials which cannot be kept for a long time in houses while paper, cardboard, glass, metal, and plastics can be stored for days.
Hence, the amount of waste collected and sorted varies from city to other. It may be low in Beirut but high in Kab Elias. Since there are no studies that show the exact amount, the municipality could look for these figures and can tune the plan for sorting at source according to the local situation and plan achievement.
One of the expected results could be reducing the number of trips from daily to three or four trips in a week. Two or three trips would be for collecting organic wastes and one for other solid wastes. If well implemented, with awareness programmes, the reduction in fuel consumptions would reach 18.5 % and success of the action is insured.
It is good to select the simplest way in sorting the solid waste. It could be done by dividing the waste to two types: one organic and other nonorganic in order to simplify the process and avoid miss leading the citizens, as well as to insure successful steps in sorting the solid wastes.
The plan should be supported by NGO's and experts with well-designed awareness programme. It would be good to divide the city into different sectors and assign volunteers to help in distributing the instructions among people on how they can sort the garbage. Getting support from local women's organizations to train them for this programme would be helpful.
The following hints provide some proposed steps, but still need to be reviewed at time of implementation to insure the success of the plan:

- Preparation of marketing material for sorting
- Dividing the city into different sectors and selecting volunteers for each sector willing to support the municipality plan in sorting the solid wastes
- Conducting seminars to volunteer groups training them on methods of sorting solid wastes. The volunteers, supported with instruction leaflets, will then work out the steps in educating the citizens on the proper way for sorting
- Distributing different coloured dustbins with clear sign on each one, which indicate the type of garbage (organic or nonorganic).
- Publishing the sorting method through local TV channels
- Holding sessions-one session per group- at schools to educate teachers and students on how to sort solid wastes and manage them properly
- Working with women organizations to support the programme
- Assigning coloured garbage bags for different types of waste (black for organic, any other colour different from black for non-organic)
- The estimated cost is € 30,000 for purchasing fifty dustbins or garbage tanks.

The short term action would be accomplished by:

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

5.3.3 LONG TERM ACTION

The long term action will concentrate on providing modern collection garbage trucks, which could save fuel and reduce the cost of operation, as the new technologies will help in reducing fuel consumptions for the trucks. By

applying Hybrid Drive System with Advanced Technology for Fuel Reduction, it replaces the conventional transmission with a hydraulic transmission to drive the truck off mechanical and hydraulic power, hence reducing the fuel consumption up to 50%. The brake energy recovery also allows the truck to extend brake replacements. If this technology is implemented in Kab Elias, it will help in mitigation the emission and reduce the operation cost for solid waste management.

The expected reduction in fuel cost in yearly base can be part on supporting financially the action, but this will not be enough as external finance is needed to support the purchase of new truck to replace the old ones and the saving of fuel in operation.

The long term action can be summarized as follows:

- Purchasing new 4 fuel saving trucks with recommended spare parts and maintenance for five years which count for € 740,000
- Evaluating the rehabilitation of the existing landfill and converting it to sanitary landfill which complies with ecosystem standard and protects the underground water cost to be defined
- Conducting feasibility study to build new solid waste treatment plant to serve the local city
- Executing the result from the above study; the new landfill and solid waste treatment plant

The following table shows the calculation for GHG emission reduction by 2020

TABLE 24: KEY ACTIONS FOR SOLID WASTE MANAGEMENT

SECTORS & FIELDS OF ACTION	Action No.	KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing in €
			MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Solid waste Management			**1103**	**291**	**528**	**141**	**0.210%**	838,000
Short Term Action	23	Ensuring capacity development and enhancing public awareness						10,000
	24	Preparation of marketing materials for the sorting process						5,000
	25	Dividing the city to different sectors and selecting volunteers for each sector						3,000
	26	Conducting seminars to volunteer groups						5,000
	27	Distributing different coloured dustbins with clear sign on each one,						30,000
	28	Developing and implementing plans for sorting solid waste from source			203	54	0.08%	5,000
	29	Developing waste strategy plan						20,000
	30	Implementing waste power generation from solid waste						to be defined
Long Term Action	31	Purchasing new 4 fuel saving trucks with recommended spare parts			325	87	0.129%	740,000
	32	Rehabilitation of the existing landfill						10,000
	33	Conducting feasibility study to build new solid waste treatment plant						10,000
	34	Executing the result from the above study; the new landfill and solid waste treatment plant						To be defined

5.3.4 Financial Analyse and Proposed Solution

TABLE 25: FINANCIAL ANALYSIS & PROPORSED SOLUTION FOR PRIORITY ACTION -3

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%	0%	100%	4.50%	10
Fixed Financial amortization costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)	€ 105,923	/year	€ 1,059,232	€ 838,000
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(12years) in €	PPA Tariff
121,440	5.28%	528	0	48,128	€ 0.230/Kwh

Time schedule for implementation of the Short term action	2016	2017	2018	2019	2020
Short Term action	X	X	X	X	X
Long Term action			X	X	X

5.4 Urban Development

The municipality vision is to present Kab Elias-Wadi El Delm as Sustainable Pilot City in the region, and this cannot be achieved without preparing the strategic development plan for the city.
The city is under pressure which has never been as intense: fluctuations in population, migration, poverty, economic growth and global recession, lack of resources, environmental degradation and climate change. All these are happening in changing the legal environment brought on by ongoing processes of lack of government support, centralization and the external effects of the crisis in neighbouring countries.
The city population grew to 50% the last three years, without sustainable access to safe drinking water and basic sanitation. For that the local city authority needs the strategic development plan in order to understand and develop all aspects of the city, and be able to integrate technical, environmental, political, social and economic interests in the city.
The strategic development plan will allow to bring additional dimensions to technical planning to help in prioritising the efficiently allocate resources. It will also allow involving a wider range of partners, especially from the communities and the private sector to invest in the city to enhance the local economy. Moreover, it will identify the strengths and weaknesses while defining the main strategies for local development.
The important part in the strategic plan will be built on understanding and developing all aspects of the city, integrating technical, environmental, political, social and economic interests in the same territory.
The strategic planning, created through participation and partnership with citizens and stakeholders, helps the municipality to select appropriate goals that steer towards that collective vision for the future.
The action for developing strategic plan for the city has been kept as a priority request from the municipality mayor. For that it will be considered one of the main actions in the plan.

5.5 PUBLIC STREET LIGHTING

5.5.1 OVERVIEW

Kab Elias city is longing for establishing a smart city platform to enhance the smart monitoring and central management. The public street lighting becomes a key sector in mitigation for GHG emission essentially with the stretching of the city infrastructure and the increase in energy demand and maintenance cost.

5.5.1.1 LIGHT SOURCE

In Kab Elias – Wadi El Delm the High Pressure Sodium (HPS) lamps have been the conventional means of illuminating roadways and various public spaces for decades. The total number of street lights reached one thousand one hundred twenty luminaries with most of the lamps rated for 400 watt. Before year 2103, the municipality replaced the 400 watt street lamps with 250 watt for main roads and 150 watt for branch streets

from main road. Other branch roads use 125 watt lamps. This step has shown to the municipality council fifty percent reduction in consumptions as represented in the following table:

TABLE 26: TABLE EXPLAINS THE REDUCTION IN THE CONSUMPTION DUE TO LAMP REPLACEMENT

Public Street lighting	Phase 1	Phase 2		
Street Light wattage	400 watt	250 watt	150 watt	125 watt
Number of street lights	1120	559	377	184
Total consumption in year	2,254 MWh/Year	1,072 MWh/Year		
GHG emission in t CO_2	1605 t CO_2 / Year	763 t CO_2 / Year		
CO_2 saving in t CO_2	842 t CO_2/ year			

As now, new LED Street lights technology has been developed to the point of being economically feasible investments for long-term cost savings. Potential cost savings in energy consumption could be as high as 40% or more. LED street lights are becoming a more common means of interior and exterior lighting around the world. Moreover, LED street lights are capable of producing a better quality white light with less energy consumption than their HPS counterparts. The quality gained from LED lighting improves the perception of more powerful light, while reducing the power of the light that is actually emitted.

The improved light quality can be seen from different implementations all over Lebanon and has showed that overall positive opinions of the facility improved significantly after LED lights were installed. Respondents generally felt that the facility was cleaner, had better access and mobility, and was generally a safer place to park than it was prior to installation of LED lights.

LEDs are rapidly gaining recognition and acceptance as an alternative means of street lighting primarily for their low power consumption, low maintenance and excellent light quality.

Most demonstrations pilot programs using LED street lights record a 40% to 60% reduction in energy consumption. The efficacy of LEDs is approaching that of HPS lamps; some products reaching 100 lumens per watt. Therefore, a comparable lighting output can be achieved through LED lamps, but with approximately half the power consumption. The estimated life for these products can range from 12-15 years compared with HPS lamps which is 3 to 5 years.

The environmental benefits of LED are not limited to a reduced greenhouse gas emission as a result of lower energy consumption. LED lights are also recyclable and do not contain any heavy metals such as mercury or lead and no toxic gasses that can be found in HPS lamps, this reduces maintenance through less frequent bulb replacement. LED fixtures also do not use tungsten filaments and are, therefore, more rugged than their HPS counterparts.

Replacing the HPS lamps with LED lights would produce reduction in power consumption for around 507 MWh/year which counts for around 53% energy saving. The following table explains the reduction and mitigation in GHG emission when this step is completed

TABLE 27: TABLE EXPLAINS THE REDUCTION IN THE CONSUMPTION & GHG EMISSIONS DUE TO LED LAMP REPLACEMENT

Public street Lighting	Current situation with HPS lamps			Replacement with LED lamps		
Lamp type in watt	250 watt	150 watt	125 watt	150 watt	70 watt	70 watt
Annual Power consumption	1,072 MWh/Year			565 MWh/ year		
GHG emission	763 t CO_2 / Year			402 t CO_2/year		

5.5.1.2 ASTRONOMIC TIMER

The other part which could also be considered is the switch timing for the street lights that relays on photocell. This can be replaced with **Astronomic timer** which is more accurate and precise timer compared with photocell.

This step will reduce the consumption power by 15% as explained in following chart which shows the sunrise and sunset timing where the photocell acts little before/after timing and counts for loss of around 365 hours of operation per year.

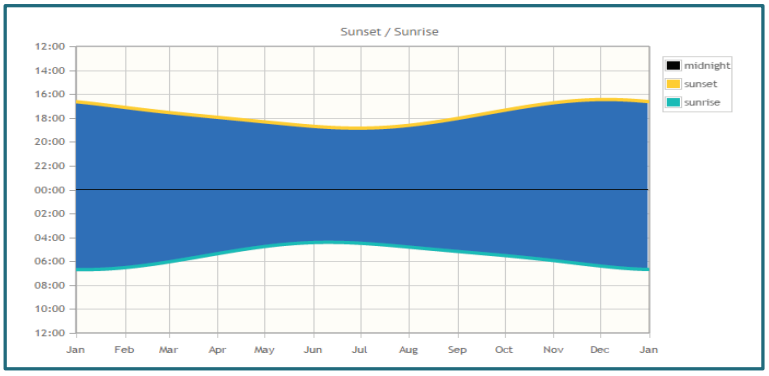


Chart 6 : EXPLAIN THE TIMING FOR SUNSET AND SUNRISE

Astronomic timer use would also help in precise timing for switching and programming the actual operation after 20 min of sun set and almost 30 min before sun rise which is an acceptable trimming as light will be still there.

TABLE 28: TABLE EXPLAINS THE FEATURE OF USING ASTRONOMINAL TIMER ON ENERGY CONSUMPTIONS

Public Street Lighting	Current situation with HPS lamps with Photo Cell control for operation			Current situation with HPS lamps with Astronomic Timer control for operation		
Lamp type in watt	250 watt	150 watt	125 watt	150 watt	150 watt	125 watt
Annual Power consumption	1,072 MWh/Year			911 MWh/ year		
Power GHG emission	763 t CO_2 / Year			648 t CO_2/year		

In Kab Elias –Wadi El Delm there are thirty four feeder pillars which control the 1120 street lights through photocells. By replacing thirty four photocells by Astronomic timer would support the mitigation in power consumptions.

5.5.1.3 DIMMING AND CONTROL

The dimming and street lighting control can be employed for HPS lamps with the introduction of new technologies. This step will not be encouraging; as nowadays the LED, as efficient lamp, is available with dimming features. To demonstrate the effects in power reduction, the action will be divided into **two scenarios:**

The first scenario is to set a standalone control gear for the street light which has internal timer. It can dim the lights for 6 hours daily to 50% at midnight as shown in the chart below.

Although it could produce saving in power for around 25% reduction in power consumptions, the internal timer in the control gear of luminary will be affected by the power instruction, which is the main feature of Lebanon's network till the time this report was written.

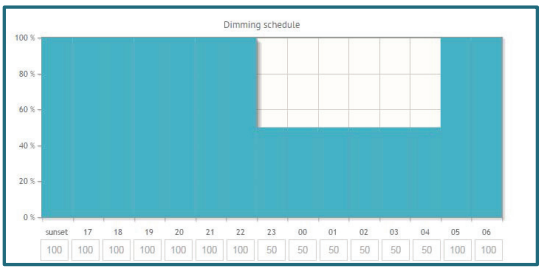


FIGURE 6: DIMMING SCHEDULE SCENARIO ONE

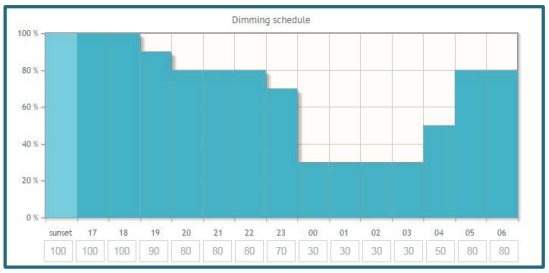


FIGURE 7: DIMMING SCHEDULE SCENARIO TWO

The **second scenario** is to have a central control and monitoring system for the street lighting. This step will overcome the previous issue in scenario one and will be functioning and operating after the power is back to normal. Also this scenario will set the platform for smart city and increase the range of operation from 10 -12 years to 15 to 20 years.

This solution is best suited as it can reprogram the dimming in different scenarios with different areas, the case that fits Kab Elias's situation.

TABLE 29 : THE DIMMING EFECT ON ENERGY CONSUMPTIONS FOR STREET LIGHTING

Public street lighting	Current situation with LED lamps with Astronomic Timer control for operation **without** dimming and remote control			Current situation with LED lamps with Astronomic Timer control for operation and dimming and remote control		
Lamp type in watt	150 watt	70 watt	70 watt	150 watt	70 watt	70 watt
Annual Power consumption	510 MWh/Year			312 MWh/ year		
Power GHG emission	362 t CO_2 / Year			222 t CO_2/year		

TABLE 30 : RESULTS COMPARED WITH BAU

Current situation (2013)	: 1,072 MWh/y	GHG Emission: 763 t CO_2/y
Business As Usual by year 2020	: 1,361 MWh/y	GHG Emission: 968 t CO_2/y
HPS lamps With Astronomic Timer	: 1156 MWh/y	GHG Emission: 822 t CO_2/y
With Led street lighting	: 752 MWh/y	GHG Emission: 535 t CO_2/y
With Led With Astronomic Timer	: 647MWh/y	GHG Emission: 460 t CO_2/y
Dimming and control	: 396 MWh/y	GHG Emission: 282 t CO_2/y

5.5.1.4 THE MAIN CHALLENGES

A set of challenges can be highlighted from the poor maintenance and the network quality to the lack of monitoring process. The following points summarise those challenges and propose the needed actions for them.

- Administrative challenges
  - Infrastructure of the city does not have any master plan for the street lighting. There is also no street lighting standard and policy available.
  - There is no unit responsible for street lighting in the municipality which monitors the work and reports the issues with the maintenance team.
- Technical challenges
  - The identification number on the lighting column is not available. This causes serious issues in the credibility of the maintenance costing and the efficiency of maintenance or technical support.

- The feeder pillars count for 34 units many of which have faulty metering that affect the monitoring process needed for future evaluation.
- The main feeder doesn't have power analyser to detect the leakage in power. This may happen due to the weak tightening of wiring, vandalism or line theft.
- The protection against Earth Leakage and surge protection is not available which affects much the service.

5.5.2 SHORT TERM ACTION- PRIORITY ACTION – 4

In the short term action, the master plan will be produced along with strategies and policies. The basic measures for consumptions and monitoring process will be established in order to monitor the achievements made with the implementation of these actions:

1. Establish street lighting unit to support the implementation of the SEAP for street lighting sector.
2. Prepare the master street lighting drawing where each pole should have identification number with full data like power and type, and to assign number for each pole in the site as to the master drawing.
3. Identify each feeder pillar by number, install new KWh meters and calculate the total load connected on each feeder. With Data collection for the load consumptions: Each month the data should be taken for each feeder and be verified with the actual connected load.
4. Prepare the maintenance check form which includes the maintenance process, identification number for the street lighting, and type of issues and action made for fixing it along with detail spare parts used in maintenance with time consumed and costing.
5. By using the master plan drawing, the public lighting unit will define the main roads and sub main roads and branches and assign each area with the recommended power for street lights.
6. Conduct a technical training for the maintenance staff to ensure compliancy with the technical and efficiency of work.
7. Monitoring process: Add a page for the municipality web site to include the citizen's feedback on or complaint about any defective street lights as a tool for monitoring the maintenance staff.

There will be real reduction in consumption for this action as line theft will be prevented and the maintenance efficacy will be improved which is estimated between 10 to 15 % reduction in consumptions, but as mentioned it will be justified when real measures are taken.

5.5.3 LONG TERM ACTION-

In the long term action, a pilot project is to be implemented in order to set the platform for a smart city. Despite the city's specific area, the general plan will be fulfilled when fund total is available.

1. Install new Smart Feeder pillars with full protection and measurement tools required equipment which contain:
   - Outdoor enclosure with security lock
   - Astronomical timer
   - Power analyser/metering
   - Control components
   - Protection devices short circuits, over current, Earth faults, Surge protection
   - Wireless communication with main station
2. Install new LED lighting according to the master plan with dimmable drivers. The LED light should be selected according to the international standard to comply with the safety regulation for the street lighting and meet the location and site needs. Also the street lighting should have enough space for controller which will be added in the future inside the street light near to the street light driver.
3. Install remote monitoring and control for the system which consist of:
   - Electronic ballast controller designed for carrying out the remote management of a luminary in street lighting installations inside the street lighting with impeded power line controller.
   - Control component inside the feeder pillar to communicate with street lighting and the main station in the municipality.
   - Main station in the municipality with remote software and monitoring and control tools
   - Proper training on the system.

   The preferable step in the installation is to complete one phase of the work with around 2020 street lighting or (20%) along with their feeder pillars and main control in the municipality building. The total project is estimated to be completed in around twelve years.

5.5.4 EXPECTED REDUCTION IN CONSUMPTION

It is expected that the short term action with part of the long term action will be completed before 2020. The long term action will continue after that till year 2030 when a complete converting of the street lighting to smart system is accomplished. Unless the financing mechanism was solved, implementation period could be minimized accordingly.

TABLE 31 : SHORT & LONG TERM ACTIONS FOR PUBLIC STREET LIGHTING

SECTORS & FIELDS OF ACTION	Action No.	KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing in €
			MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Municipal public lighting			**1361**	**968**	**965**	**688**	**1.023%**	**1,209 ,750**
Short Term Action	35	Public lighting unit						7,000
	36	master street lighting drawing assign number for each pole						5,000
	37	Identify each feeder pillar by number and install new KWh meters						5,000
	38	maintenance check form			136	97	0.14%	1,000
	39	master plan drawing for the Public lighting unit						1,000
	40	technical training						3,000
	41	Monitoring process						2,000
Long Term Action	42	New Smart Feeder pillars this could be done before or after replacing the lamps with LED			60	43	0.064%	120,000
	43	Replace HPS by Intelligent LED Lights			554	395	0.587%	710,500
	44	Remote monitoring and control			215	153	0.228%	355,250

5.5.5 Financial Analyse and Proposed Solution

TABLE 32 : THE FINANCIAL MECHANISM FOR PUBLIC STREET LIGHTING

Local or Outsource Finance		Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%		0%	100%	4.50%	10
Fixed Financial amortization costs				Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)		€ 152,912	/year	€ 1,529,124	€ 1,209,750
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(9 years) in €	PPA Tariff
221,950	5.7%	965	9	84,184	€ 0.230/Kwh

Time schedule for implementation of the Short and long term action					
YEAR	2016	2017	2018	2019	2020
Short Term Actions	X	X	X	X	X
Long Term Actions			X	X	X

5.6 LOCAL RENEWABLE ENERGY PRODUCTION

5.6.1 OVERVIEW

The municipality of Kab Elias - Wadi El Delm depends on fundamental factors to ensure the success of generating electricity on solar energy. The presence of three hundred clear solar days and the many places that

can be encompassed by projects help to generate renewable energy plant. For example, there is a central market for vegetables, which extends over a wide area of 33,000 m² and educational complex, which has an area of 2,000 m², in addition to other places. However, technical and administrative obstacles are encountered.
Technical obstacles: the city suffers from permanent power cut-off, 12 hours a day and at different periods of time. However, the success of the investment in sustainable energy projects must ensure the availability of electricity from the main provider of electricity which is in our case EDL.
The power generation of renewable energy in Kab Elias is a technical advantage. It will not only help in generating power, but also in saving transmission line power loss due to the long distance from the main generating plant to the city which counts for around 20% of generated power.

Administrative obstacles: there is no law that takes into account the role of municipalities in terms of renewable energy generation that can be linked to the relevant power generation with EDL projects.
The municipality, in coordination with all government departments and public institutions, plays a significant role in overcoming the obstacles and assuring the success of the subsequent steps through promoting the use of renewable energy in all aspects of the city.

The municipality now has a huge opportunity to optimize some of the projects in the city, such as municipal buildings, and the water pumping stations, from which it provides the local needs of consumption that can be linked with the backup diesel generators to provide power and save biofuels.

5.6.2 THE MAIN VEGETABLE MARKET

The municipality would like to build a canopy of solar panels on top of the vegetable market building. The system would transform solar energy into electrical energy to contribute to the generation of electricity .This project would be able to provide 20% on the city demand for electricity, generate a minimum of 3 GWh per year and mitigate the emission by – 2,074 t CO_2/year.
The main obstacle facing the municipality is not being allowed to produce and sell electricity, as EDL is the sole agent that produces and sells electrical power in Lebanon. Also the internal policy for EDL does not allow purchasing electricity from a third party. In order to overcome these obstacles, the municipality can come up with an agreement with EDL to execute this action and then handover the project to EDL, in return EDL will ensure providing the city with 24/24 hour of electricity.
The project's budget falls within 6 million Euro which needs funds. Since funds are not available, the municipality has to look for international donors.

FIGURE 6:
THE MAIN VEGETABLE MARKET

TABLE 33 : THE FINANCIAL SUMMARY FOR THE VEGETABLE MARKET

Local or Outsource Finance		Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%		0%	100%	4.50%	10
Fixed Financial amortization costs				Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)		€ 505,600	/year	€ 5,056,000	€ 4,000,000
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(15 years) in €	PPA Tariff
477,020	4.69%	2,074	15	84,184	€ 0.230/Kwh

Time schedule for implementation of the Short and long term action					
YEAR	2016	2017	2018	2019	2020
Short Term Actions	X	X	X	X	X
Long Term Actions			X	X	X

5.7 BUILDINGS

5.7.1 OVERVIEW

The buildings in the residential and tertiary sectors are responsible for 74 % of total city energy consumption and represent the largest energy consumer and CO_2 emitter in urban areas; therefore, it is crucial to devise efficient policies to reduce energy consumption and CO_2 emissions in this sector.
The electrification and heating are the main reasons for causing those emissions and can be summarized as follows:

- The electrification represents the 26% of total GHG emissions of the city (21 % in residential sector and 5% in tertiary sector).
- Heating in the buildings represents 48 % of total city GHG emissions (44.8% in residential sector and 3.2% in tertiary sector).

The municipality as a prime local authority can enact policies, develop and update legislations for proper implementation of the SEAP.
Good performance of the building envelope makes it a key factor in affecting the energy consumptions for the heating in buildings in addition to the walls insulation and building orientation.
Allowing the policies and measures to promote energy efficiency and renewable energies in buildings is an important step in the mitigation plan. Changing behaviour, efficiency of the technical installations, ability to benefit from natural lighting, efficiency of electrical appliances and lighting are so important in the fight against emissions.
The expected scenario for the increase in GHG emission in 2020 is 27% compared with the base year 2013. Although this figure looks low compared with the current situation and the high increase in refugee due to Syrian crisis, it makes the challenges in the implementation of the plan a real fight against the stream. For that it is so important to stuck to the plan and carefully monitor the results.

TABLE 34 : BAU FOR TERTIARY & RESIDENTIAL BUILDINGS

Business As Usual Without Action Plan				
	Year 2013		Year 2020 As BAU	
	Consumption in MWH	GHG Emission in t CO_2	Consumption in MWH	GHG Emission in t CO_2
Tertiary buildings	10,128	4,304	12,863	5,466
Residential buildings	105,665	34,997	134,195	44,446
Total	115,793	39,301	147,058	49,912

The short term will concentrate on changing behaviours and raising awareness campaign supported with clear understanding for the beneficiary in reduction costs and saving money; whereas, the long term will concentrate on creating policies and rules and look for initiatives. However, through implementation, the process can be adjusted according to the achievements and results.

5.7.2 RESIDENTIAL SECTOR

The residential sector represents 66% of total city emission. The need for strong engagement of citizens on values, leading to an effective and long term behavioural change, is key element in mitigation energy plan for the city.
The short term action focuses on conducting awareness campaigns that emphasize on promoting the usage of energy saving technologies and addressing the changing behaviour for citizen.

5.7.3 SHORT TERM ACTION - PRIORITY ACTION - 5

The short term actions for the Residential sector will be as follows:

1. **WORKSHOPS WITH LOCAL MOSQUES/CHURCHES** and religious men. In the workshop, the municipality plan will be explained on how to implement the SEAP. Link the plan with the holy message, which every religion calls for, in saving the earth conservation and development.
   The municipality could target the different actions which can be followed to save the Earth like regulating the power consumptions and water conservation. It can request the support from them to change behaviour of the citizen through their weekly sermon, which is among the moral and religious responsibility in the preservation of the environment and natural resources.
2. **WORKSHOPS WITH LOCAL NGO'S** to explain the municipality plan in implementing the SEAP.
   In the workshop, the municipality could target the changing behaviour and connect it with saving earth and planting trees knowing the fact that each replacement of electrical water heater with solar water heater is equal to planting twenty trees yearly. The municipality could also request support from NGO's in implementing the plan through their NGO's members and their regular activities in the city ;i.e. taking part in the solar day.

Replacing one electrical water heater = 20 trees/year

3. **THE OPEN SOLAR DAY**
   Open solar day aims at creating awareness on solar energy as free and clean energy source to the citizen. It focuses on recognizing the benefits of using solar power to create a more sustainable future by relying less on traditional forms of energy.
   The Open Day will open the door for citizens to rely more on sun in life and remove the constraints for using the solar energy. The Open Day can be preceded by a series of workshops held for local concerned NGO's and finance institutions, supported by LCEC.
   The event could be held in a public garden with demo kits for solar heaters and PV. A marketing material can be published and distributed throughout the day, which shows the national initiative (BDL is offering $200 per replacement). This day is open to public especially school students who can share in the demonstration of solar system for visitors. Free kids educational games will be set to allow the new generation know about the use of solar heaters. In the event, there will be with draw on five or more free solar water heaters which can be financed by the event sponsors.
4. **PUBLIC AWARENESS CAMPAIGN ON HOW CITIZEN CAN SAVE MONEY IN HOUSES AND WITH REWARD.** . This targets the citizens to change their behaviour and link it to save money in houses through regulating the power consumptions. It will lead to a long term behavioural change. This can be supported though the local TV channel of Kab Elias city with guideline instruction that shows the steps to proper and successful achievement in changing behavioural and addressing energy conservation. The municipality will include contests on the first ten houses that have achieved the highest percentage energy reductions and provide reward for achievement.
5. **INCREASE THE INITIATIVES FOR SOLAR WATER HEATER FOR LOW INCOME HOMES**
   The municipality could play a good role in increasing the replacement of electrical water heater with solar heaters. This is accomplished through updating their internal laws to offer $200 deduction from the local taxes for each replacement of electrical water by solar water heaters. Following this programme has its advantages:
   The incentives will be increased from only $200 which the BDL offers to $400 which the municipality could propose. The replacement programme will enhance the smooth implementation of solar water heaters in the city. The programme can be enhanced with the support of local banks which can offer short loans offer. The municipality counsel can search for finance through local or international donors and payment can be deducted from the local taxes for the citizen with defined legal part with the internal laws .The estimated cost for this action will be in range of € 200,000. The programme could cover around 1000 houses with most low income one.

5.7.4 LONG TERM ACTION

The long term can be established in two phases. Phase one will try to implement the building codes in new buildings and the second phase will search for finance to support the replacement of electrical water heater with solar water heater by increasing the initiatives.

1. **BUILDING CODE**

The Building Code for Lebanon is supposed to be set in the coming year, in which a building energy efficiency code will be set for new buildings and major retrofits in Lebanon.

This code is supposed to define the minimum acceptable energy performance for buildings by addressing equipment energy efficiency and enveloping thermal requirements accordingly with Lebanese climatic conditions.
The buildings will typically be constructed to be used for many decades. Improvement of buildings' efficiency at the planning stage is relatively simple, while improvements after their initial construction are much more difficult. The decisions made during a building's project phase will hence determine much of the consumption, if not all, of a building's lifetime.
By applying new expected building code, mitigation of the GHG emissions and supporting the conservation in energy consumption in the new building will be achieved.
It is considered a step forward if the municipality could set new legislation laws for modern buildings to include the energy efficient requirement in new building. This requires:

- Build double walls for external walls in new building with thermal insulation
- Support new building with thermal study and efficient approach.

2. INCLUDE SOLAR WATER HEATING SYSTEM IN NEW BUILDING

The new building should include the solar water heater as part of building standard, this could insure the usage of solar water heater in new building.

5.7.5 EXPECTED REDUCTION IN CONSUMPTION

TABLE 35 : EXPECTED RESULTS FOR THE SHORT & LONG TERM ACTIONS FOR RESIDENTIAL SECTOR

SECTORS & FIELDS OF ACTION	Action No.	KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing in €
			MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Residential buildings			**134195**	**44446**	**15531**	**7563**	**11.247%**	**296,000**
Short Term Action	46	Workshop with mosques / churches			1690	1144	1.70%	3,000
	47	Workshop with local NGO'S					0.00%	3,000
	48	Open Solar Day			2110	1429	2.13%	30,000
	49	Yearly Contests through local TV channel			2533	1715	2.55%	30,000
	50	Increase the initiatives for solar water heater			1100	745	1.11%	200,000
Long Term Action	51	New Building Code			7200	1923	2.860%	15,000
	52	Solar water Heater			898	607	0.903%	15,000

5.7.6 FINANCIAL ANALYSIS AND PROPOSED SOLUTION

TABLE 36 : FINANCIAL ANALYSIS AND PROPOSED SOLUTION FOR RESIDENTIAL SECTOR

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%	0%	100%	4.50%	10
Fixed Financial amortization costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)	€ 37,414	/year	€ 374,144	€ 296,000
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(2 years) in €	PPA Tariff
3,572,130	854%	15,531	2	3,044,162	€ 0.230/Kwh

Although the NPV and IRR are very promising but the actual saving is not part of municipal income.

5.7.7 Tertiary Sector

The tertiary sector is responsible for 8% of total city emission and 17% for electrification emissions, and represents a key element in mitigation process.

5.7.8 The short term action in tertiary SECTOR - PRIORITY ACTION - 5

Public awareness campaign will be held for tertiary sectors addressing energy conservation, behavioural changes, and energy efficiency. The campaign will concentrate on tools and policies to tune the consumptions patterns, and to allow for strong engagement of tertiary sector on values, leading to an effective and long-term behavioural changes. The awareness campaign will be started with workshop with the owners and administrative staff of the tertiary sector followed by instruction leaflets posted in locations and yearly meeting to compare the results and get support from experts for any obstacles.

TABLE 37 : EXPECTED RESULT IN THE SHORT TERM ACTION IN TERTIARY SECTOR

Expected result in the short term action in tertiary sector								
Tertiary sector	Year 2020 As BAU	Years of actions						
Consumption in MWH		2016	2017	2018	2019	2020	Total saving	Saving in GWH
Changing behavioural	4,786	5%	5%	5%	5%	5%	25%	1,197
Lightings	2,393	5%	5%	5%	5%	5%	25%	600
Electrical appliances	2,393	1%	1%	1%	1%	1%	5%	120
Total as BAU	4,786	MWh in 2020			Saving in MWh			1,917

5.7.9 LONG TERM ACTION

In the long term:

1. Implementing building codes in new buildings. This could reduce the expected consumption in energy and support the future plan, details for it can be taken as that of the residential sector.

The expected result explained here with:

TABLE 38 : EXPECTED RESULT IN THE LONG TERM ACTION IN TERTIARY SECTOR

Long Term Action Plan for tertiary sector new			
	Year 2020 As BAU	Years of actions	
	Emission in t CO_2	Expected saving	Reduction in emission in t CO_2
Tertiary building	5,466		
New building as increase in heating emission	1,162	30%	348
Total expected reduction in emission is 348 t CO_2 which represent 0.5 % reduction in GHG emission as 2020 BAU scenario compared with total city emission the estimated cost for this action € 30,000			

5.7.10 EXPECTED REDUCTION IN CONSUMPTION

TABLE 39 : EXPECTED RESULT IN THE SHORT & LONG TERM ACTIONS IN TERTIARY SECTOR

SECTORS & FIELDS OF ACTION	Action No.	KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing in €
			MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Tertiary buildings, *equipment/facilities*			**12863**	**5466**	**2420**	**1674**	**2.489%**	**45,000**
Short Term Action	53	Public awareness campaign			1917	1326	1.97%	30,000
Long Term Action	54	Implementing building codes in new buildings			503	348	0.518%	15,000

5.7.11 FINANCIAL ANALYSIS AND PROPOSED SOLUTION

TABLE 40 : FINANCIAL ANALYSIS & PROPOSED SOLUTION FOR TERTIARY SECTOR

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%	0%	100%	4.50%	10
Fixed Financial amortization costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)	€ 5,688 /year		€ 56,880	€ 45,000
Annual revenues in € / IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(2 years) in €	PPA Tariff
556,600 / 878%	2,420	0	475,752	€ 0.230/Kwh

Time schedule for implementation of the Short and long term action in Tertiary sector	2016	2017	2018	2019	2020
Short Term action	X	X	X	X	X
Long Term action			X	X	X

5.8 TRANSPORTATION

5.8.1 OVERVIEW

The transportation sector is responsible for 23% of the city total emission as it produces 12,195 t CO_2/ year (2013).The municipality fleets produce 1.9% (230 t CO_2) of transportation emission and the remain 98% are caused by private transportation.
Refer to the details in the municipality sector, where the solid waste collection consumes most of the fuel consumptions.

5.8.2 SHORT TERM ACTION

1. **Promoting Eco driving**

   Conduct an awareness campaign for the municipality staff and public. The campaign concentrates on eco-drive and explains the recommended drive technique as modern, smart and efficient way to save fuel and reach destination. Eco-driving is a “driving method of reducing the fuel consumed in driving” by refraining from sudden starts, sharp acceleration, and sudden braking; avoiding vehicle overload; driving at economic speed; ensuring tires are pumped to the correct pressure; and other ways. It is an essential activity that forms the basis of environmental initiatives. Eco-driving is effective on the three fronts of the “environment,” “management,” and “safety” in cutting NOX and PM emissions, reducing fuel cost, and promoting safety management and preventing accidents. (http://www.totokyo.or.jp/en/ecology/) The action will concentrate on

Inviting the specific local NGO's & Volunteers to attend training by qualified driving instructors allowing them to share the experience with others.

2. **Assign speed signs** in main roads and sub roads

   Zones speed limit improve air quality, in an overall analysis of pollutants, 30 km/h zones reduce CO_2 emissions by 15%, NOX emissions by 40% and CO emissions by 45%. Only hydrocarbons will increase, by 4%. (http://www.copenhagenize.com/2015/01/is-copenhagen-finally-up-to-speed-on.html), reduce noise pollution, by reducing the speed by 10 km/h, a noise reduction of 2-3 dB is achieved. That is far cheaper than noise reducing asphalt. Improve fuel efficiency, since they improve flow, motorists will save on fuel and reduce C02 emissions. Also, the noise of five cars at 50 km/h is the same as ten cars at 30 km/h. The noise of one large truck equals as much noise as 15 cars. Improve local business, the traffic calming effect that 30 km/h zones have on neighbourhoods is remarkable. Pedestrians and cyclists increase and, since pedestrians and cyclists spend more money in shops, local business benefits. Improve congestion, with slower speeds, the amount of stop-starts is reduced – if not eliminated – which improves flow and helps reduce congestion. Reduce injury and death, a study carried out in London concluded that there was a 42% reduction in injuries after the implementation of 30 km/h zones. Younger children were the group with the most significant reduction in KSI's (Killed & Seriously Injured). A 27% reduction was measured in Barcelona, which led to the city rolling out massive 30 km/h zones across the urban landscape. *http://www.copenhagenize.com/2015/01/is-copenhagen-finally-up-to-speed-on.html*

3. **Marathon Day**

   Conduct a marathon day to encourage walking. It is open for the public and students are invited to participate, an act for changing behaviour and encourage walking.

4. **Bike to Park Day**

   Conduct a Bike to Park Day .This will allow changing behaviour for the citizens and encourage them to ride bicycles.

5.8.3 Long TERM ACTION

The long term action will look for establishing public transport in the city to enhance the use of public transportation efficiently, and reduce traffic congestion with affordable cost for the citizen.
The city has twelve private buses each with 20 passengers that travel long distance to reach Zahlé city. If the municipality stops the service for the private transportation and uses the public transport from the city to its border, this will reduce the uncontrolled trips and the dependence on the private cars and will mainstream the concept of public transport.
It will also have a major impact in reducing congestion within the city and will reduce emissions in significant level. This step can be supported with promotion programs for students and citizen to enhance the public transport.
The long term action will consist of:

1. **Promote the Public transportation**

   Purchasing new 3 buses to the city to support internal movement in the city and reduce the dependence on the private cars.

2. **Creating special initiative payment programme** for local citizens with affordable cost per year or per month to enhance the smooth moving in public transport
3. **Allocating the bus station** with fixed timing to support the programme and ensure the credibility of the service.
4. **Conducting awareness campaign** linked to the launching of the service.

5.8.4 EXPECTED REDUCTION IN CONSUMPTION

Table 41 : EXPECTED RESULTS FOR THE SHORT & LONG TERM ACTIONS FOR TRANSPORTATION SECTOR

SECTORS & FIELDS OF ACTION	Action No.	KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing in €
			MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
TRANSPORT:			**59836**	**15196**	**18549**	**4711**	**7.005%**	**395,000**
Short Term Action	55	Promotion of eco driving			598	152	0.23%	10,000
	56	Assign speed signs limit			2992	760	1.13%	20,000
	57	Marathon Day			299	76	0.11%	10,000
	58	Bike to Park Day			299	76	0.11%	10,000
Long Term Action	59	Promote the Public transportation			5984	1520	2.260%	180,000
	60	Creating special initiative payment programme			1197	304	0.452%	5,000
	61	Allocating the bus station			5984	1520	2.260%	150,000
	62	Conducting awareness campaign linked to the launching of the service			1196.72	303.92	0.452%	10,000

5.8.5 FINANCIAL ANALYSIS AND PROPOSED SOLUTION

Table 42 : FINANCIAL ANALYSIS & PROPOSED SOLUTION FOR TRANSPORTATION SECTOR

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%	0%	100%	4.50%	10
Fixed Financial amortization costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)	€ 49,928	/year	€ 499,280	€ 395,000
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(2 years) in €	PPA Tariff
1,135,198	127%	18,549	2	587,034	€ 0.0621/Kwh

Time schedule for implementation of the Short and long term action in Tertiary sector

	2016	2017	2018	2019	2020
Short Term action	X	X	X	X	X
Long Term action			X	X	X

5.9 SUMMARY FOR THE SUSTAINABLE ACTION PLAN

SECTORS & FIELDS OF ACTION	Action No.	KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing in €
			MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Municipal buildings, *equipment/facilities*			**11.43**	**7.76**	**25.94**	**17.03**	**0.025%**	**77,600.00**
Short Term Action	1	SEAP unit						6,600
	2	Setup a Website other social media						5,000
	3	Announce on the local media like local TV channel						1,000
	4	Energy Saving Instruction			0.9	0.6	0.001%	1,000
	5	Monitoring Mechanism			0.9	0.6	0.001%	8,000
	6	Awareness and Training Campaign			0.9	0.6	0.001%	10,000
Long Term Action	7	Start replacing the FCL lamps with LED lamps.			1.7	1.1	0.002%	5,000
	8	Replace the Water pumping driver with VFD driver for Central heating system			0.3	0.2	0.000%	3,000
	9	Replace the Air Condition with A+++ Inverter type.			0.7	0.5	0.001%	7,500
	10	Install lighting motion sensors in building.			0.2	0.1	0.000%	1,500
	11	Renewable Energy			18	11.7	0.017%	25,000
	12	Public procurement			2.34	1.63	0.002%	5,000
Water supply and waste water treatment			**1222**	**869**	**570**	**404**	**0.601%**	**301,000.00**
Short Term Action	13	Conduct awareness campaign			61	43	0.06%	20,000
	14	Distribute water saving tools for the faucet (Tap).			58	41	0.06%	10,000
	15	Encourage citizens to collect rain water in the winter season			33	23	0.03%	1,000
	16	Conduct routine maintenance and check the water leak in main feeder piping and fix the leaks			107	76	0.11%	50,000
	17	Update the municipality policy to include a standalone water treatment plant. in every new construction			52	37	0.06%	10,000

	18	Install water meters on the main water supply and main branches to monitor water consumptions.			107	76	0.11%	50,000
	19	Include in new construction the reuse of treated water to feed the flush water supply in separate piping			52	37	0.06%	10,000
Long Term Action	20	Prepare strategic plan for waste water treatment			to be defined			
	21	Install water treatment plant			to be defined			
	22	Install PV solar station on one of the water pumping stations			100	71	0.106%	150,000
Solid waste Management			**1103**	**291**	**528**	**141**	**0.210%**	**838,000**
Short Term Action	23	Ensuring capacity development and enhancing public awareness						10,000
	24	Preparation of marketing materials for the sorting process						5,000
	25	Dividing the city to different sectors and selecting volunteers for each sector						3,000
	26	Conducting seminars to volunteer groups						5,000
	27	Distributing different coloured dustbins with clear sign on each one,						30,000
	28	Developing and implementing plans for sorting solid waste from source			203	54	0.08%	5,000
	29	Developing waste strategy plan						20,000
	30	Implementing waste power generation from solid waste						to be defined
Long Term Action	31	Purchasing new 4 fuel saving trucks with recommended spare parts			325	87	0.129%	740,000
	32	Rehabilitation of the existing landfill						10,000
	33	Conducting feasibility study to build new solid waste treatment plant						10,000
	34	Executing the result from the above study; the new landfill and solid waste treatment plant						to be defined
Urban Development								400,000
Municipal public lighting			**1361**	**968**	**965**	**688**	**1.023%**	1,209,750
Short Term Action	35	Public lighting unit						7,000
	36	master street lighting drawing assign number for each pole						5,000

	37	Identify each feeder pillar by number and install new KWh meters						5,000
	38	maintenance check form			136	97	0.14%	1,000
	39	master plan drawing for the Public lighting unit						1,000
	40	technical training						3,000
	41	Monitoring process						2,000
Long Term Action	42	New Smart Feeder pillars this could be done before or after replacing the lamps with LED			60	43	0.064%	120,000
	43	Replace HPS by Intelligent LED Lights			554	395	0.587%	710,500
	44	Remote monitoring and control			215	153	0.228%	355,250
RENEWABLE ENERGY						**2074**	**3.084%**	**4,000,000**
Long Term Action	45	MAIN VEGETABLE MARKET				2074	3.084%	4,000,000
BUILDING:								
Residential buildings			**134195**	**44446**	**15531**	**7563**	**11.247%**	**296,000**
Short Term Action	46	Workshop with mosques / churches			1690	1144	1.70%	3,000
	47	Workshop with local NGO'S					0.00%	3,000
	48	Open Solar Day			2110	1429	2.13%	30,000
	49	Yearly Contests through local TV channel			2533	1715	2.55%	30,000
	50	Increase the initiatives for solar water heater			1100	745	1.11%	200,000
Long Term Action	51	New Building Code			7200	1923	2.860%	15,000
	52	Solar water Heater			898	607	0.903%	15,000
Tertiary buildings, *equipment/facilities*			**12863**	**5466**	**2420**	**1674**	**2.489%**	45,000
Short Term Action	53	Public awareness campaign			1917	1326	1.97%	30,000
Long Term Action	54	Implementing building codes in new buildings			503	348	0.518%	15,000
TRANSPORT:			**59836**	**15196**	**18549**	**4711**	**7.005%**	**395,000**
Short	55	Promotion of eco driving			598	152	0.23%	10,000

Term Action	56	Assign speed signs limit			2992	760	1.13%	20,000
	57	Marathon Day			299	76	0.11%	10,000
	58	Bike to Park Day			299	76	0.11%	10,000
Long Term Action	59	Promote the Public transportation			5984	1520	2.260%	180,000
	60	Creating special initiative payment programme			1197	304	0.452%	5,000
	61	Allocating the bus station			5984	1520	2.260%	150,000
	62	Conducting awareness campaign linked to the launching of the service			1196.72	303.92	0.452%	10,000
Total			**210,591**	**67,244**	**38,588.94**	**17,272..03**	**26%**	**7,562 ,350**

5.10 KEY PERFORMANCE AND INDICATORS FOR THE SEAP ACTIONS

Action No.	Actions	Key Performance Indicators	Measurement Units
Municipal buildings, equipment/facilities			
1	SEAP unit	• Develop SEAP unit in the Municipality. • Appointing SEAP manager in the municipality. • The number of buildings and facilities covered by this work.	• Formal announcement by the municipality council for developing the SEAP. • Number of year for the contract with the SAEP manager. • The percentage of municipality facilities supervised by the SEAP manager.
2	Setup a Website other social media	• Develop a Website or page on the original municipality web site for the SEAP of the municipality	• Lunching the Web Site or a page on the existing web site.
3	Announce on the local media like local TV channel on the SEAP	• Publish the announcement on local TV channel	• Number of Feedback from citizen
4	Energy Saving Instructions	• Publish the energy saving instructions in the municipality building.	• Energy consumptions measures in KWh and saving in %
5	Monitoring Mechanism	• Install the monitoring mechanism	• KWh saving in %
6	Awareness and Training Campaign	• Conduct training for the municipality staff	• Number of campaigns • Number of attendances
7	Start replacing the FCL lamps with LED lamps.	• Number of lamps replaced with LED lamps	• Number of lamps replaced with LED • Amount of watt reduced
8	Replace the Water pumping driver with VFD driver for Central heating system	• Implementation of VFD driver	• Successfully operated
9	Replace the Air Condition with A+++ Inverter type	• Replacing the A/C	• Number of A/C replaced
10	Install lighting motion sensors in building.	• Area covered with motion sensors	• m²
11	Renewable Energy	• Installation of the PV system on the VSM • System installed capacity	• KWp • KWh/a

12	Green Public procurement	• Update public procurement polices • Training for the municipality procurement staff • The number of Devices brought with green procurement procedures	• Public procurement polices • Number of municipality staff trained • Device number
	Water supply and waste water treatment		
13	Conduct awareness campaign	• Conduct awareness campaign for water conservation and regulate water consumptions with tools and facts for citizen	• Number of attendances
14	Distribute water saving tools for the faucet (Tap).	• Statistical count for the types of faucets in homes • Purchase the most famous Faucet (tap) type used in houses. • Distribute the water saving faucets to the houses	• Count the number of houses who have water saving faucet
15	Encourage citizens to collect rain water in the winter season	• Print leaflet and distribute on the city shows the importance of using rain water with instruction how to collect it.	• Number of houses who received the leaflet for rain water collection
16	Conduct routine maintenance and check the water leak in main feeder piping and fix the leaks	• Prepare water distribution drawing for the water network. • Define the main feeders and sub feeders • Maintain main feeders leak • Maintain sub feeders leak • Compare water consumptions	• Number of leaks fixed in the main feeders • Number of leaks fixed in the sub feeders. • Number of feedbacks and complains from citizens after fixing leaks.
17	Update the municipality policy to include a standalone water treatment plant. in every new construction	• Update the police through municipality council.	• Number of new constructions which include new polices for standalone water treatment plant.
18	Install water meters on the main water supply and main branches to monitor water consumptions.	• Install & Fix water meters on main feeders and sub feeders. • Count the number of users on each sub feeders and compare average consumptions per user. • Maintain feeders • Compare water consumptions	• Water consumptions on main feeders • Water consumptions on sub feeders • Average water consumption per user • Water consumptions on main feeders after maintenance • Average water consumption per user after maintenance • Number of the installed Meters.
19	Include in new construction the reuse of treated water to feed the flush water supply in separate piping	• Update the policy through the municipality council.	• Number of new constructions which include new polices for standalone water treatment plant.

20	Prepare strategic plan for waste water treatment	• Assign consultants for preparation of waste water strategy	• Deliver the output of the strategic plan for water treatment
21	Install water treatment plant (finance to be defined)	• According to the strategic plan for waste water, location and capacity of the treatment plant to be defined • Assign consultant to design the treatment plant and prepare the budget line for the project • Resource the finance and execute the work.	• Design completed • Finance resourced • Execute the job
22	Install PV solar station on one of the water pumping stations	• Get finance for PV installation	• Execute the job
	Solid waste Management		
23	Ensuring capacity development and enhancing public awareness	• Conduct workshop for municipality staff and NGO's for solid waste management	• Number of staff attended the workshop
24	Preparation of marketing materials for the sorting process	• Design the leaflet and the marketing materials for solid waste sorting	• Print the marketing materials
25	Dividing the city into different sectors and selecting volunteers for each sector willing to support the municipality plan in sorting the solid wastes	• Sectors defined • Volunteers selected	• Number of sectors & volunteers • Feedbacks & Complains
26	Conducting seminars to volunteer groups training them on methods of sorting solid wastes. The volunteers, supported with instructional leaflets, will then work out the steps in educating the citizens on the proper way for sorting	• Conduct a training seminars by the help of specialists • Design objective & instructional leaflets	• Number of attendances • Print the leaflets
27	Distributing different coloured dustbins with clear sign on each one, which indicate the type of garbage (organic or nonorganic).	• Purchase & Distribute the coloured dustbins • Define-to the citizens - the Organic & nonorganic garbage.	• Number of signed & coloured dustbins

28	Developing and implementing plans for sorting solid waste at source	• Apply Plans	• Feedbacks from the volunteers & solid waste workers
29	Developing waste strategy plan with waste management plan in order to overcome the high cost in collection and transportation, and look for a solution to the landfill either by converting it to sanitary landfill or utilising another one near the city	• Assign consultants for preparation & developing such strategy.	• Deliver the output of the strategic plan
30	Implementing waste power generation from solid waste to feed energy to the future solid waste plant	• Electric generation from solid wastes	• Capacity of generated power
31	Purchasing new 4 fuel saving trucks with recommended spare parts	• Get funding & purchase trucks & spare parts	• Fuel consumption reduction in L/m
32	Evaluating the rehabilitation of the existing landfill and converting it to sanitary landfill which complies with ecosystem standard and protects the underground water.(cost to be defined)	• Assign consultants for evaluation & development	• Work completed
33	Conducting feasibility study to build new solid waste treatment plant to serve the local city	• Conduct the feasibility study	• Work completed
34	Executing the result from the above study; the new landfill and solid waste treatment plant	• Get funding for executing the result • Determine the location of the new landfill & the solid waste treatment plant	• Capacity of the landfill • Capacity of the solid waste treatment plant
Urban Development			
Municipal public lighting			
35	Public lighting unit	• Launch the unit	• The qualification of the unit

36	master street lighting drawing assign number for each pole	• Preparation of the drawing	• Number of poles being assigned with number
37	Identify each feeder pillar by number and install new KWh meters	• Preparation of the drawing	• Number of poles being assigned with number • Number of feeder pillar with KWH meter
38	maintenance check form	• check form prepared and launched	• Number of check forms being executed after launching the process
39	master plan drawing for the Public lighting unit	• Preparation of the drawing	• Define the main roads and sub main roads and branches. • Assign each area with the recommended power for street lights.
40	technical training	• Conduct technical training	• Number of attendance
41	Monitoring process	• Create the monitoring process	• Number of complaints received to the municipality for detective lights • The power consumption in KWH.
42	New Smart Feeder pillars this could be done before or after replacing the lamps with LED	• Install smart feeder pillars	• Number of smart feeder pillars
43	Replace HPS by Intelligent LED Lights	• Installation of intelligent LED lights	• Number of lights replaced
44	Remote monitoring and control	• Create the monitoring and the control process	• Number of completed remote monitoring & control
RENEWABLE ENERGY Green power generation			
45	MAIN VEGETABLE MARKET	• Finance ,design and tendering	• Launch
Residential buildings			
46	Workshop with mosques / churches	• Conduct workshop	• Number of mosques / churches & attendance
47	Workshop with local NGO'S	• Conduct workshop	• Number of staff attended
48	Open Solar Day	• Conduct open day	• Number of staff attended

49	Yearly Contests through local TV channel	• Conduct yearly contests	• Number of participants
50	Increase the initiatives for solar water heater	• Get the finance for initiatives	• Number of the initiates offered
51	New Building Code	• Apply the new code	• Number of new houses with new code
52	Solar water Heater	• Install SWH	• Number of houses with SWH
	Tertiary buildings, *equipment/facilities*		
53	Public awareness campaign will be held for tertiary sectors addressing energy conservation, behavioural changes	• Conduct awareness campaign	• Number of staff attended
54	Implementing building codes in new buildings	• Apply the new code	• Number of new tertiary buildings with new code
	TRANSPORT		
55	Promotion of eco driving	• Conduct training in eco driving	• Number of trained staff
56	Assign speed signs limit	• Fix speed signs limit	• Number of signs
57	Marathon Day	• Conduct Marathon Day	• Number of participants
58	Bike to Park Day	• Conduct Bike to Park Day	• Number of participants
59	Promote the Public transportation	• Promotion for Public transportation	• Comparison between Public & Private transportation
60	Creating special initiative payment programme	• Create initiative programme	• Number of participants
61	Allocating the bus station	• Number of bus stations	• Number of bus stations
62	Conducting awareness campaign linked to the launching of the service	• Conduct awareness campaign	• Number of participants

ANNEXES

ANNEX I – PROJECT FICHES

KAB Elias Priority Action of SEAP (1)			
1- General presentation			
Building municipality capacity for implementation of SEAP and demonstrate pilot project with renewable energy			
Summary of the Action:			

The municipality had to show the stakeholder certain implementations for sustainable energy action plan in their facilities. The following are the proposed actions for short term phase and as energy saving processes.

- Set up SEAP Unit inside the municipality. This unit should work out the implementation of SEAP and the process of the actions with monitoring practice and achievement progress. The SEAP unit could be consisted of municipality Staff supported with expert in SEAP implementation which could hold a meeting in the municipality each three months to evaluate the work and support the municipality in the progress of SEAP implementation in the city.
- Setup a Website for the SEAP implementation, and create a page on Facebook and other social media. Link the website and Facebook page to the local city citizens, update them with the latest projects and get their feedback.
- Use the local media like local TV channel to give information on the project with regular updates.
- Implement Energy Saving Instructions for employees to full fill the reduction and unseen consumption as follows:
  - ✓ Switch off the light while leaving the office.
  - ✓ Fix the Air-condition thermostat on 22°C to24°C in winter/ summer.
  - ✓ Utilize as possible day lights through windows and reduce using artificial lights as possible.
  - ✓ Set the PC monitor on sleep mode for maximum 2 minutes of ideal condition.
  - ✓ Switch off PC, UPS and printer when leaving the work.
  - ✓ Minimize the usage of printing as possible.
- Set up simple Monitoring Mechanism in the municipality building to measure the extent of compliance with the rules related to mitigation of electrification consumptions. The mechanism should be able to show the instantaneous achievement in reduction of energy consumption in daily base and in annual base as monitoring mechanism. The system will be connected to LCD presented in public area of the building to show all employees the achievements that they could see which reflect their usage of electricity.
- Conduct Awareness and Training Campaigns for the municipality staff. This should include the representatives of NGOs of the local community in order to increase the municipality capacity in the implementation of sustainable energy action plan.
- Renewable Energy in the Municipality building.

The envisaged energy saving from these actions can be summaries as follows:

Energy saving considered around 23.6 % of municipal building consumption which count for 2.7 MWh/a, Considering that instruction for energy saving will be enforced in the municipality. And the monitoring mechanism will support the implementation along with training for staff. The proposed renewable energy is considered 36 PV each with 260 watt, the calculated power in average will be 9.36KWp which count for 18 MWh/a considering losses.

Contact person in the local authority	Project owner	State of Action	Location
The municipality Mayor	Kab Elias Municipality	NEW	Kab Elias City

General Objectives of the project

The municipality building represents a key element in the implementation of sustainable energy action plan. SEAP represents the pilot project for the municipality and the stakeholders, allowing them to expertise the changes in consumptions and giving positive feedback on the attitude of the employees and visitors. Not only does it aim at showing how successful and important sustainability is, but also increases the staff capacity with new implementations of actions.

Principal partners and stakeholders	Ultimate beneficiaries of the project	
The Municipality of Kab Elias, The Municipal Council., NGOs	The Municipality of Kab Elias, The Stakeholders of Kab Elias 75,000 inhabitants	
Link to municipal development plan	**Area(s) of Intervention**	**Estimated investment cost**
The SEAP unit is a need to cover the shortage in technical support for the implementation of SEAP	The Municipality of Kab Elias	€55,600

2- Technical description

Main Technology to implement and equipment to use	Previous or linked studies
The action will be divided to two main phases one includes the usage of advanced power analysers in municipality building for monitoring the consumption powers, and it should be able to show the instantaneous achievement in reduction of energy consumption in daily base and in annual base as monitoring mechanism. The system will be connected to LCD presented in public area of the building to show all employees the achievements that they could see which reflects their usage of electricity The second phase will consist of integrating solar energy modules in the roof of the building which should demonstrate the usage of renewable energy in municipality building. The important step will be in not using the backup batteries where the green energy produced will be utilised by to the grid either through EDL or through backup diesel generators. The technology to be used called fuel saving technology, the use of this technology in Lebanon will be an important evolution.	There are no previous studies but there are many projects had been successful implementation in Lebanon municipalities.

Project lifetime : exploitation or use duration	Implementation timeframe and Start date if set	Engineering studies	Other previous studies (if any)
Five Years	Jan 2017	Required	Not applicable

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

The SEAP unit should support the implementation plan, the support from experts is necessary in this initial phase of work, in order to set the plan in place and start the proper implementation and monitoring, the municipality should consider the starting as essential part in plan.

SECTORS & fields of action		KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing
	Action No.		MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Municipal buildings, equipment/facilities			**11.43**	**7.76**	**20.7**	**13.5**	**0.019%**	**€ 55,600**
	1	SEAP unit						€ 5,600
	2	Setup a Website other social media						€ 5,000
	3	local media like local TV channel						€ 1,000
	4	Energy Saving Instruction			0.9	0.6	0.001%	€ 1,000
	5	Monitoring Mechanism			0.9	0.6	0.001%	€ 8,000
	6	Awareness and Training Campaign			0.9	0.6	0.001%	€ 10,000
	11	RENEWABLE ENERGY			18	11.7	0.016%	€ 25,000

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

Not applicable

3- Organisation and procedures

Formal approval	The municipality council is required to approve the plan and the implementation	**Staff allocated to prepare, implement and monitor the action (number, position and duration of engagement)**	SEAP UNIT is part of this action which will set the unit for proper implementation and monitoring
Legal responsible body (is) for:	Municipality Lawyer	**Municipal of city staff training needs**	Will be part of the actions
Technical assistance needs		**Role of Partners**	

An expert will be appointed to collaborate and support the municipality in its plan; moreover, support from different local communities, NGOs and government will be highly required.	The **Municipality of Kab Elias** to launch the events and implement the actions. The **Municipal Council**: to issue a set of laws to regulate the power consumptions. **NGOs** to support the municipality work in participation in the events and the general goals of the action **LCEC** : Project Evaluation & Technical Support **MOI** : Legal Support & Coordination between Municipalities

4- Cost estimates

All cost	Initial and start-up expenses	Approximate operational Costs (including maintenance	Approximate annual income for energy producing projects
€ 55,600	€ 25,000	NA	€ 4,761

Draft calculation of the NPV.

The calculation assumption based on actions not related to the SEAP unit as this unit should cover all actions in the SEAP in addition to the Awareness Raising Also the results are not that important and not commercially advisable, the municipality should demonstrate and show the stakeholders and citizens the actual implementation of sustainable project, and build up the capacity for future projects in the city.
The financial analysis already shown good NPV results for the renewable energy part of the municipal building, compared with the technical actions from 4, 5 7, 8, 9 &10 shows negative NPV results. These actions needs support from donors to allow them to be implemented.
. For that the estimated invest will be considered only for the renewable energy.

Local or Outsource Finance		Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%		0%	100%	4.50%	10
Fixed Financial amortization costs				Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)		€ 3,160	/year	€ 31,600	€ 25,000
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(10 years) in €	PPA Tariff
4,140	5.23%	18	10	1,159	€ 0.23/Kwh

Time schedule for implementation of the Short and long term action					
YEAR		2017	2018	2019	2020
Short Term Actions		X	X	X	X
Long Term Actions			X	X	X

5- Available and foreseen sources of funding

Local authority's own resources	National Funds and Programmes	International Financial Institutions	EU Funds & Programmes and other external funds
To be defined by the municipality	NA	EU, UNDP, AFD, USAID, MPEW	To be defined
Public-Private Partnerships amount/share (available or to raise)	**Lined up private investments**	**Loans and potential borrower**	**Expected annual cost savings to the City budget**
NA	NA	100%	€ 4,761

Other

6- Projected Energy Estimates in 2020			
Energy savings MWh/a	**Renewable energy production MWh/a**	**CO_2 reduction t CO_2/a**	**Target Year**
2.7	18	13.5	NOV. 2020
Percentage of net reduction on the territory	**Reduction as related to BAU scenario**	**Per capita calculated reduction**	
0.019%	20.7 MWh/a	0.00028 t CO_2/a	

7- Summary of related Awareness Raising (AR)actions	
AR related to the action	**AR related to community**
• Awareness and Training workshops on changing behaviour for the Municipality staff. • Taking the measures related to the activities of preserving the environment to impact their change in behaviour. • Implementing Energy Saving Instruction and tools for employees.	• Linking the actions to the associations and NGOs and their social networks. • Promoting the installation of similar equipment in other public and private buildings through a renewable energy equipment forum aimed at relevant stakeholders. • Promoting the project in the media through publicity, social media networks and implementing a municipal website

8- Assumptions and risks
The Assumptions: Municipal council set the SEAP unit to monitor the actions and will be supported with experts to insure the implementation, the risks are the low product and sheep installation for solar system, improper monitoring and follow up for instruction by municipality staff.
9- Key success factors
The proper planning, learning from others, involves the municipality staff in implementation and Monitoring process.
10- Next steps
Long term action related to the municipal
11- Annexes
Refer to the CAPP

KAB Elias Priority Action of SEAP (2)

1- General presentation

Title : Water supply and waste water treatment

Summary of the Action:

The city suffers from shortage in water supply especially at end of summer and before winter season, this causes a lot of pressure on the municipality from citizens, the human demography has increased by more than fifty percent in the city due to the high number of displaced Syrian refugees. This shortage is affecting water consumption. On the other hand, the waste water is another serious issue with lack of implementation of waste water treatment plant.

The following are the short term actions which target regulating the water consumption and solving the shortage in water consumption and rescuing the loss of water due to leaks in the main feeders. In addition to that, the water supply and waste water are linked together, as the second one is the result of the first one. For that the actions in saving water supply will positively affect the reduction in waste water.

The short term action suggests various measures to be considered:

- Conduct awareness campaign to enhance the water conservation regulate the water consumption with an expected reduction to 5%.
- Distribute water saving tools for the faucet (Tap). This will help to rescue the water consumption up to 4.75% if it is adapted.
- Encourage citizens to collect rain water in the winter season to reduce the high season demand in summer. The expected result will be 2.7 % reduction according to the availability of water tanks in the houses.
- Conduct routine maintenance and check the water leak in main feeder piping. This could rescue the loss of water by 8.75 %.
- Update the municipality policy to include in every new construction a standalone water treatment plant, this could rescue the loss of water by 4.2 %.
- Install water meters on the main water supply and main branches to monitor water consumptions, this could rescue the loss of water by 8.75 %.
- Include in new constructions the reuse of treated water to feed the flush water supply in separate piping. This could rescue the loss of water by 4.2 %.

The water supply is one of the main needs for the city, for which the the municipality is responsible for. Even if the municipality has no direct control on the supply water to the city; it should look for financial resources to provide water to cover the city's demand. Also the municipal council pays for supplying the fuel for diesel generator to insure the continuity of water supply.

The regulation in water demand would reduce the power consumptions according to the following table:

	Key Action measures	Percentage of expected reduction in consumptions	Reduction in consumptions(MWh)
13	Conduct awareness campaign	5%	61
14	Distribute water saving tools	4.75%	58
15	collect rain water in the winter season	2.7%	33
16	Conduct routine maintenance	8.75%	107
17	Update the municipality policy	4.2%	52
18	Install water meters on the main water supply and main branches	8.75%	107
19	reuse of treated water to feed the flush water	4.2%	52

Contact person in the local authority	Project owner	State of Action	Location
The Municipality Mayor	Kab Elias Municipality	NEW	Kab Elias City

General Objectives of the project

The main objective of the proposed action is to regulate the water consumptions in the city through rising awareness and reducing the effect of water leaks, which also will effect on the reducing of the waste water amount produced by the city. The estimated water leak in the city is not defined where through this action it will be defined and will be reduced to the minimum possible level.

The other importance in these actions is to setting of the base for water consumption in the city and monitor the demand in regular way.

Principal partners and stakeholders	Ultimate beneficiaries of the project	
Municipality of Kab Elias ,Municipal Council, NGO's	Municipality of Kab Elias , Stakeholders of Kab Elias 75,000 inhabitants	
Link to municipal development plan	**Area(s) of Intervention**	**Estimated investment cost**
The water demand and waste water are essential parts in the municipality development plan.	Municipality of Kab Elias	€ 151,000

2- Technical description

Main Technology to implement and equipment to use	Previous or linked studies
The installation of water meters will be remotely connected with the municipality monitoring room. Such technologies will be part of the special water contractor. The main advantages are: the ability of the municipality to monitor and record the water demand in the city as first step and the better planning for future maintenance	NA

Project lifetime : exploitation or use duration	Implementation timeframe and Start date if set	Engineering studies	Other previous studies (if any)
Five Years	Jan 2017	Not applicable	Not applicable

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

SECTORS & fields of action		KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing
	Action No.		MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Water supply and waste water treatment			1222	869	470	333	0.495%	€ 151,000.00
Short Term Action	13	Conduct awareness campaign			61	43	0.06%	€ 20,000
	14	Distribute water saving tools			58	41	0.06%	€ 10,000
	15	Encourage citizens to collect rain water in the winter season			33	23	0.03%	€ 1,000
	16	Conduct routine maintenance and check the water leak in main feeder piping and fix the leaks			107	76	0.11%	€ 50,000
	17	Update the municipality policy to include in every new construction a standalone water treatment plant.			52	37	0.06%	€ 10,000
	18	Install water meters on the main water supply and main branches to monitor water consumptions.			107	76	0.11%	€ 50,000
	19	Include in new construction the reuse of treated water to feed the flush water supply in separate piping			52	37	0.06%	€ 10,000

Availability of environmental impact assessment or mitigating measures to protect environment if any
Not applicable

3- Organisation and procedures

Formal approval	The municipality council required to approve the plan and the implementation	**Staff allocated to prepare, implement and monitor the action (number, position and duration of engagement)**	SEAP UNIT is part of this action which will set the unit for proper implementation and monitoring
Legal responsible body (is) for:	Municipality Lawyer	**Municipal of city staff training needs**	Will be part of the this actions

Technical assistance needs	Role of Partners
The expert should handle the technical needs	The **Municipality of Kab Elias** to appoint expert for the SEAP. The **Municipal Council**: to issue a set of laws to regulate the power consumptions. **NGOs** to support the municipality work in participation in the events and the general goals of the action **LCEC** : Project Evaluation & Technical Support **MOI** : Legal Support & Coordination between Municipalities

4- Cost estimates

All cost	Initial and start-up expenses	Approximate operational Costs (including maintenance	Approximate annual income for energy producing projects
€ 151,000	€ 20,000	NA	€ 108,100

Draft calculation of the NPV and return of Investment (IRR).

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%	0%	100%	4.50%	10
Fixed Financial amortization costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)	€ 19,086.4	/year	€ 190,864	€ 151,000
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(3 years) in €	PPA Tariff
108,100	8.7%	470	2	11,571	€ 0.230/Kwh

Time schedule for implementation of the Short and long term action					
YEAR	2016	2017	2018	2019	2020
Short Term Actions	X	X	X	X	X

5- Available and foreseen sources of funding

Local authority's own resources	National Funds and Programmes	International Financial Institutions	EU Funds & Programmes and other external funds

To be defined by the municipality	NA	EU, UNDP, AFD, USAID, MPEW	To be defined
Public-Private Partnerships amount/share (available or to raise)	**Lined up private investments**	**Loans and potential borrower**	**Expected annual cost savings to the City budget**
NA	NA	100%	€ 108,100
Other			
6- Projected Energy Estimates in 2020			
Energy savings MWh/a	**Renewable energy production MWh/a**	**CO_2 reduction t CO_2/a**	**Target Year**
470	0	333	NOV. 2020
Percentage of net reduction on the territory	**Reduction as related to BAU scenario**	**Per capita calculated reduction**	
0.495%	470 MWh/a	0.00444 t CO_2/a	
7- Summary of related Awareness Raising (AR)actions			
AR related to the action		**AR related to community**	
• Distribute water saving tools for the faucet (Tap). • Encourage citizens to collect rain water in the winter season to reduce the high season demand in summer. • Conduct routine maintenance and check the water leak in main feeder piping.		• Reuse of recycled water, if properly managed, may alleviate pollution of water resources and sensitive receiving bodies. • Reusing the treated wastewater in watering the plants would provide a new water source, reduce water scarcity and save on costs.	
8- Assumptions and risks			
The Assumptions: The cooperation between the Governmental Est and the municipality in installation of water meters, the main risk is rejection of such cooperation in management level and contradiction of responsibility.			
9- Key success factors			
The need for water and increase in demand would be the main keys to insure the success of the action.			
10- Next steps			
Long term action related to the municipal.			
11- Annexes			
Refer to the CAPP			

KAB Elias Priority Action of SEAP (3)			
1- General presentation			
Title : Solid Waste Management			
Summary of the Action:			

The action will concentrate on reducing the consumption of fuel related to the solid waste collection as it represents the majority in the municipality consumption. The focus will be on changing behaviour in solid waste management and moving on to the smart way in sorting the solid waste at source.
The following proposed steps are proposed but they still need to be reviewed at time of implementation to insure the success of the plan:

- Preparation of marketing material
- Dividing the city into different sectors and selecting volunteers for each sector willing to support the municipality plan in sorting the solid wastes
- Conducting seminars to volunteer groups training them on methods of sorting solid wastes. The volunteers, supported with instruction leaflets, will then work out the steps in educating the citizens on the proper way for sorting
- Distributing different coloured dustbins with clear sign on each one, which indicate the type of garbage (organic or nonorganic).
- Publishing the sorting method through local TV channel
- Holding sessions - one per group- at schools to educate teachers and students on how to sort solid wastes and manage them properly
- Working with women organizations to support the programme
- Assigning coloured garbage bags for different types of waste (black for organic, any other colour different from black for non-organic).

The short term action would be accomplished by:

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

The short term action proposes a smart waste collection method. It focuses on the changing behaviour in solid waste management and moving on to the smart way in sorting the solid waste at the source.
The sorting of solid waste at the source is important since it helps in reducing the daily trips for the solid waste trucks, the fuel consumption and the maintenance cost for the collection.
Solid waste consists of organic materials which cannot be kept for a long time in houses while paper, cardboard, glass, metal, and plastics can be stored for days.
Hence, the amount of waste collected and sorted varies from city to other. It may be low in Beirut but high in Kab Elias. Since there are no studies that show the exact amount, the municipality could look for these figures and can tune the plan for sorting at source according to the local situation and plan achievement.
One of the expected results could be reducing the number of trips from daily to three or four trips in a week. Two or three trips would be for collecting organic wastes and one for other solid wastes. If well implemented, with awareness programmes, the reduction in fuel consumptions would reach 18.5 % and success of the action is insured.

Contact person in the local authority	Project owner	State of Action	Location
The Municipality Mayor	Kab Elias Municipality	NEW	Kab Elias City

General Objectives of the project

The main objectives in this action is to increase the municipality capacity in solid waste management and implement the sorting at source, in addition to reduce the collection trips and distance of travel hence reduce the fuel consumptions and mitigate the emission as results of waste collection.

This also will encourage the recycle process for the solid waste which will support the protection of natural sources and minimizing the environmental impact due to the solid waste.

Principal partners and stakeholders	Ultimate beneficiaries of the project	
Municipality of Kab Elias ,Municipal Council, NGO's	Municipality of Kab Elias , Stakeholder of Kab Elias 75,000 inhabitants	
Link to municipal development plan	**Area(s) of Intervention**	**Estimated investment cost**

The solid waste management is essential part in municipality development plan.	Municipality of Kab Elias	€ 78,000

2- Technical description

Main Technology to implement and equipment to use	Previous or linked studies
In the next phase there will be fuel saving technologies used for solid waste collection	There is no previous study

Project lifetime : exploitation or use duration	Implementation timeframe and Start date if set	Engineering studies	Other previous studies (if any)
Five Years	Jan 2017	required	Not applicable

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

SECTORS & fields of action		KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing
	Action No.		MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Solid waste Management			**1103**	**291**	**203**	**54**	**0.08%**	**€ 78,000**
Short Term Action	23	Ensuring capacity development and enhancing public awareness						**€ 10,000**
	24	Preparation of marketing material for sorting						**€ 5,000**
	25	Dividing the city to different sectors						**€ 3,000**
	26	Conducting seminars to volunteer groups training them on methods of sorting solid wastes.						**€ 5,000**
	27	Distributing different coloured dustbins						**€ 30,000**
	28	Developing and implementing plans for sorting solid waste from source			203	54	0.08%	**€ 5,000**
	29	Developing waste strategy plan						**€ 20,000**
	30	Implementing waste power generation from solid waste to feed energy to the future solid waste plant						**to be defined**

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

Not applicable

3- Organisation and procedures

Formal approval	The municipality council required to approve the plan and the implementation	**Staff allocated to prepare, implement and monitor the action (number, position and duration of engagement)**	SEAP UNIT is part of this action which will set the unit for proper implementation and monitoring
Legal responsible body (is) for:	Municipality Lawyer	**Municipal of city staff training needs**	Will be part of the this action

Technical assistance needs	Role of Partners
The implementation of action will require technical support to set the mechanism for work	The **Municipality of Kab Elias** to launch the events and implement the actions. **NGOs** to support the municipality work in participation in the events and the general goals of the action

4- Cost estimates

All cost	Initial and start-up expenses	Approximate operational Costs (including maintenance	Approximate annual income for energy producing projects
€ 78,000	€ 78,000	NA	€ 24,435

Draft calculation of the NPV and return of Investment (IRR).

Time schedule for implementation of the Short and long term action					
YEAR	2016	2017	2018	2019	2020
Short Term Actions	X	X	X	X	X

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%	0%	100%	4.50%	10
Fixed Financial amortization costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)	€ 9,859 /year		€ 98,592	€ 78,000
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(3 years) in €	PPA Tariff
46,690	19.84%	203.0	3	29,757	€ 0.23/Kwh

5- Available and foreseen sources of funding

Local authority's own resources	National Funds and Programmes	International Financial Institutions	EU Funds & Programmes and other external funds
To be defined by the municipality	NA	To be defined	To be defined
Public-Private Partnerships amount/share (available or to raise)	**Lined up private investments**	**Loans and potential borrower**	**Expected annual cost savings to the City budget**
NA	NA	100%	€ 46,690

Other

6- Projected Energy Estimates in 2020

Energy savings MWh/a	Renewable energy production MWh/a	CO_2 reduction t CO_2/a	Target Year
203	0	54	NOV. 2020
Percentage of net reduction on the territory	**Reduction as related to BAU scenario**	**Per capita calculated reduction**	

0.08%	203MWh/a	0.00072 t CO_2/a	

7- Summary of related Awareness Raising (AR)actions

AR related to the action	AR related to community
• Installation by the municipality of recycling bins in all municipal buildings and facilities promoting recycling of plastic bottles, batteries, paper.	• Awareness campaigns and seminars to explain the negative effects on solid waste accumulation and how to reuse waste and recycle it: Educational kits distributed in houses with practical tips to reduce solid waste at its source. • Conducting seminars to volunteer groups, associations or women organizations on methods for sorting solid waste, to turn them into ambassadors in educating the citizens on the proper way for sorting. • Conducting conferences in schools to educate teachers and students on sorting solid waste. • Launching awareness operation: cleaning day and sorting in neighbourhood. Issue a «Clean» certificate for deserving ones. • Using the municipality's website, producing posters and benefitting from the radio station programs to promote this project. • Producing posters on pick-up trucks for high visibility

8- Assumptions and risks

- The Assumptions: the Finance is available and the citizen be aware about the actions before start implementation.
- The Risks: the poor monitoring of implementation of action and lose interest from citizen

9- Key success factors

- The municipality is sorting the Solid waste at land fill and this step would reduce the fuel cost and the number of trips in addition to reduce the maintenance cost for the trucks.

10- Next steps

- Long term action related to the municipal

11- Annexes

- Refer to the CAPP

Kab Elias Priority Action of SEAP (4)			
1- General presentation			
Title : Public Street Lighting			
Summary of the Action:			

Kab Elias city is looking at establishing a smart city platform to enhance the smart monitoring and central management. The public street lighting becomes a key sector in mitigation for GHG emission essentially with the stretching of the city infrastructure and increase in energy demand and maintenance cost.

In short term action, the master plan will be produced along with strategies and policies. The basic measures for consumptions and monitoring process will be established in order to monitor the achievements made with the implementation of these actions:

1. Establish street lighting unit to support the implementation of the SEAP for street lighting sector.
2. Prepare the master street lighting drawings where each pole should have identification number with full data like power and type, and to assign number for each pole in the site within the master drawing.
3. Identify each feeder pillar by number and install new KWh meters and calculate the total load connected on each feeder. With Data collection for the load consumptions: Each month the data should be taken for each feeder and to be verified with actual connected load.
4. Prepare the maintenance check form which includes the maintenance process, identification number for the street lighting, and type of problems or defects and action made for fixing it along with detailed spare parts list used in maintenance with time consumed and costing.
5. By using the master plan drawing, the public lighting unit will define the main roads, sub main roads and branches and assign each area with the recommended power for street lights.
6. Conduct a technical training for the maintenance staff to insure compliancy with the technical and efficiency of work.
7. Monitoring process: Addition of a page for the municipality web site to include the citizen feedback on or complain for any defective street lights as tool for monitoring the maintenance staff.

There will be real reduction in consumption for this action as line theft will be prevented and the maintenance efficacy will be improved this is estimated between 10 to 15 % reduction in consumptions, but as mentioned it will be verified when real measures are taken.

In the long term action, a pilot project is to be implemented in order to set the platform for a smart city, through the city's specific area, where the general plan could be fulfilled when fund total is available.

1. Install new Smart Feeder pillars with full protection, measurement tools and required equipment which contain:
   - Outdoor enclosure with security lock
   - Astronomical timer
   - Power analyser/metering
   - Control components
   - Protection devices short circuits, over current , Earth faults & Surge protection
   - Wireless communication with main station
2. Install new LED lighting according to the master plan with dimmable drivers. The LED light should be selected according to international standard to comply with safety regulation for the street lighting and meet the location and site needs. Also the street lighting should have enough space for controller which will be added in the future inside the street light near to the street light driver.
3. Install remote monitoring and control for the system which consist of:
   - Electronic ballast controller designed for carrying out the remote management of a luminary in street lighting installations inside the street lighting with impeded power line controller.
   - Control component inside the feeder pillar to communicate with street lighting and the main station in the municipality.
   - Main station in the municipality with remote software, monitoring and control tools
   - Proper training on the system.

The preferable step in the installation will be to complete one phase of work with around 230 street lighting or (20%) along with their feeder pillars and main control in the municipality building. The total project is estimated for around twelve year's duration.

Contact person in the local authority	Project owner	State of Action	Location
The municipality Mayor	Kab Elias Municipality	NEW	Kab Elias City
General Objectives of the project			

The main objective is to regulate the energy consumed by the public street lighting and reduce the GHG emission from public lighting.

Principal partners and stakeholders	Ultimate beneficiaries of the project	
Municipality of Kab Elias ,Municipal Council, NGO's	Municipality of Kab Elias , Stakeholder of Kab Elias 75,000 inhabitants	
Link to municipal development plan	**Area(s) of Intervention**	**Estimated investment cost**
The public street lighting is essential part in municipality development plan.	Municipality of Kab Elias	€ 854,500

2- Technical description

Main Technology to implement and equipment to use	Previous or linked studies
The new technologies of LED street lighting will be used along with Astronomical timer & Power analyser/metering	There is no previous study

Project lifetime : exploitation or use duration	Implementation timeframe and Start date if set	Engineering studies	Other previous studies (if any)
Five Years	Jan 2017	required	Not applicable

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

SECTORS & fields of action		KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing
	Action No.		MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
Municipal public lighting			**1361**	**968**	**750**	**535**	**0.791%**	**€ 854,500**
Short Term Action	35	Public lighting unit						**€ 7,000**
	36	master street lighting drawing assign number for each pole						**€ 5,000**
	37	Identify each feeder pillar by number and install new KWh meters						**€ 5,000**
	38	maintenance check form			136	97	0.14%	**€ 1,000**
	39	master plan drawing the Public lighting unit will define the usage						**€ 1,000**
	40	technical training						**€ 3,000**
	41	Monitoring process						**€ 2,000**
Long Term Action	42	New Smart Feeder pillars this could be done before or after replacing the lamps with LED			60	43	0.064%	€ 120,000
	43	Replace HPS by Intelligent LED Lights			554	395	0.587%	€ 710,500

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

Not applicable			
3- Organisation and procedures			
Formal approval	The municipality council is required to approve the plan and the implementation	**Staff allocated to prepare, implement and monitor the action (number, position and duration of engagement)**	SEAP UNIT is part of this action which will set the unit for proper implementation and monitoring
Legal responsible body (is) for:	Municipality Lawyer	**Municipal of city staff training needs**	Will be part of the this actions
Technical assistance needs		**Role of Partners**	
The implementation of action will require technical support to set the mechanism of work		The **Municipality of Kab Elias** to launch the events and implement the actions. **NGOs** to support the municipality work in participation in the events and the general goals of the action	

4- Cost estimates

All cost	Initial and start-up expenses	Approximate operational Costs (including maintenance	Approximate annual income for energy producing projects
€ **854,500**	€ 318,000 this represents the short term action and 25% of long term action implementation	NA	€ 172,500

Draft calculation of the NPV and return of Investment (IRR).

Local or Outsource Finance		Private (or own) funds	Bank Loan	Interest rate	Amortization period in years
0%		0%	100%	4.50%	10
Fixed Financial amortization costs				Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualized)		€ 108,009	/year	€ 1,080,088	€ 854,500
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(8 years) in €	PPA Tariff
172,500	5.791%	750	8	57,702	€ 0.230/Kwh

Time schedule for implementation of the Short and long term action					
YEAR	2016	2017	2018	2019	2020
Short Term Actions	X	X	X	X	X
Long Term Actions			X	X	X

5- Available and foreseen sources of funding

Local authority's own resources	National Funds and Programmes	International Financial Institutions	EU Funds & Programmes and other external funds
To be defined by the municipality	NA	To be defined	To be defined

Public-Private Partnerships amount/share (available or to raise)	Lined up private investments	Loans and potential borrower	Expected annual cost savings to the City budget
NA	NA	20%	€ 172,500
Other			

6- Projected Energy Estimates in 2020			
Energy savings MWh/a	**Renewable energy production MWh/a**	**CO_2 reduction t CO_2/a**	**Target Year**
750	0	535	NOV. 2020
Percentage of net reduction on the territory	**Reduction as related to BAU scenario**	**Per capita calculated reduction**	
0.791%	750 MWh/a	0.007133 t CO_2/a	

7- Summary of related Awareness Raising (AR)actions

AR related to the action	AR related to community
• Creating an info centre to inform citizens about new technologies	• Create awareness with posters. • Meetings with the community members. • AR campaign on being an eco-citizen • Training to the students (primary and secondary schools) on using the energy correctly.

8- Assumptions and risks

- The Assumptions: the Finance is available and the citizen be aware about the actions before start implementation.
- The Risks: poor implementation, low product quality and maintenance

9- Key success factors

- The reduction on cost for energy consumption would bring more finance to the city.

10- Next steps

- Long term action related to the municipal

11- Annexes

- Refer to the CAPP

KAB Elias Priority Action of SEAP (5)			
1- General presentation			
Title : Residential and Tertiary Sectors			
Summary of the Action:			
The building sector for residential and Tertiary represent 74% of city emission, where the residential sector represents 66% of total city emission and tertiary sector represents 8% of city emissions. Both of them are somehow linked together, so any action in residential or tertiary will bring benefit to both sectors. For residential, the need for strong engagement of citizens on values, leading to an effective and long term behavioural change, is a key element in mitigation energy plan for the city. The short term action focuses on conducting awareness campaigns that emphasize on promoting the usage of energy saving technologies and addressing the changing behaviour to citizen. 1. WORKSHOPS WITH LOCAL MOSQUES/CHURCHES and religious men. In the workshop, the municipality plan will be explained on how to implement the SEAP. Link the plan with the holy message, which every religion calls for, in saving the earth conservation and development. The municipality could target the different actions which can be followed to save the Earth like regulating the power consumptions and water conservation. It can request the support from them to change behaviour of the citizen through their weekly sermon, which is among the moral and religious responsibility in the preservation of the environment and natural resources. 2. WORKSHOPS WITH LOCAL NGO'S to explain the municipality plan in implementing the SEAP. In the workshop, the municipality could target the changing behaviour and connect it with saving earth and planting trees knowing the fact that each replacement of electrical water heater with solar water heater is equivalent to planting twenty trees yearly. The municipality could also request support from NGO's in implementing the plan through their NGO's members and their regular activities in the city ;i.e. taking part in the solar day 3. THE OPEN SOLAR DAY, Open solar day aims at creating awareness on solar energy as free and clean energy source to the citizen. It focuses on recognizing the benefits of using solar power to create a more sustainable future by relying less on traditional forms of energy. The Open Day will open the door for citizens to rely more on sun in life and remove the constraints on using the solar energy. The Open Day can be preceded by a series of workshops held for local concerned NGO's and finance institutions, supported by LCEC. The event could be held in a public garden with demo kits for solar heaters and PV. A marketing material can be published and distributed throughout the day, which shows the national initiative (BDL is offering $200 per replacement). This day is open to public especially school students who can participate in the demonstration of solar system for visitors. Free kids educational games will be set to allow the new generation know about the use of solar heaters. In the event, there will be withdraw on five or more free solar water heaters which can be financed by the event sponsors 4. PUBLIC AWARENESS CAMPAIGN ON HOW CITIZENS CAN SAVE MONEY IN HOUSES AND WITH REWARD. This targets the citizens to change their behaviour and link it to save money in houses through regulating the power consumptions. It will lead to a long term behavioural change. This can be supported though the local TV channel of Kab Elias city with guideline instructions that show the steps to proper and successful achievement in changing behaviour and addressing energy conservation. The municipality will include contests on the first ten houses that have achieved the highest percentage energy reductions and provide reward for achievement. 5. INCREASE THE INITIATIVES FOR SOLAR WATER HEATER IN LOW INCOME HOMES The municipality could play a good role in increasing the replacement of electrical water heater with solar heaters. This is accomplished through updating their internal laws to offer $200 deduction from the local taxes for each replacement of electrical water by solar water heaters. Following this programme has its advantages: The incentives will be increased from only $200 which the BDL offers to $400 which the municipality could propose. The replacement programme will enhance the smooth implementation of solar water heaters in the city. The programme can be enhanced with the support of local banks which can offer short loans offer. The municipality council can search for finance through local or international donors and payment can be deducted from the local taxes for the citizen with defined legal part with the internal laws .The estimated cost for this action will be in range of € 200,000. The programme could cover around 1000 houses with most low income one. 6. The tertiary sector is responsible for 8% of total city emission and 17% for electrification emissions, and represents a key element in mitigation process. Public awareness campaign will be held for tertiary sectors addressing energy conservation, behavioural changes, and energy efficiency. The campaign will concentrate on tools and policies to tune the consumptions patterns, and to allow for strong engagement of tertiary sector on values, leading to an effective and long-term behavioural changes. The awareness campaign will be started with workshop with the owners and administrative staff of the tertiary sector followed by instruction leaflets posted in locations and yearly meeting to compare the results and get support from experts for any obstacles.			
Contact person in the local authority	**Project owner**	**State of Action**	**Location**
The Municipality Mayor	Kab Elias Municipality	NEW	Kab Elias City
General Objectives of the project			

The main objective in raising awareness, addressing energy conservation, behavioural changes, and energy efficiency. Promote the solar day, as open day for citizen to enhance the usage of renewable resources and share the experience with family and children, and young people. Concentre on residential sector and tertiary as they represent the majority of city emission in order to support the mitigation plan for GHG emission.

Principal partners and stakeholders	Ultimate beneficiaries of the project	
Municipality of Kab Elias ,Municipal Council, NGO's	Municipality of Kab Elias , Stakeholder of Kab Elias 75,000 inhabitants	
Link to municipal development plan	**Area(s) of Intervention**	**Estimated investment cost**
The action supports the converting the city to green one	Municipality of Kab Elias	€ 296,000

2- Technical description

Main Technology to implement and equipment to use		Previous or linked studies	
NA		There is no previous study	
Project lifetime : exploitation or use duration	**Implementation timeframe and Start date if set**	**Engineering studies**	**Other previous studies (if any)**
Five Years	Jan 2017	required	Not applicable

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

SECTORS & fields of action		KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing
	Action No.		MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
BUILDING:			**147058**	**46363**	**9350**	**6359**	**9.46%**	**€ 296,000**
Residential buildings			**134195**	**44446**	**7433**	**5033**	**7.485%**	**€ 266,000**
Short Term Action	46	Workshop with mosques / churches			1690	1144	1.70%	**€ 3,000**
	47	Workshop with local NGO'S					0.00%	**€ 3,000**
	48	Open Solar Day			2110	1429	2.13%	**€ 30,000**
	49	Yearly Contests through local TV channel			2533	1715	2.55%	**€ 30,000**
	50	Increase the initiatives for solar water heater			1100	745	1.11%	**€ 200,000**
Tertiary buildings, *equipment/facilities*			**12863**	**5466**	**1917**	**1326**	**1.972%**	**€ 30,000**
Short Term Action	53	Public awareness campaign			1917	1326	1.97%	**€ 30,000**

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

Not applicable

3- Organisation and procedures

Formal approval	The municipality council required to approve the plan and the implementation	**Staff allocated to prepare, implement and monitor the action (number, position and duration of engagement)**	SEAP UNIT is part of this action which will set the unit for proper implementation and monitoring
Legal responsible body (is) for:	Municipality Lawyer	**Municipal of city staff training needs**	Will be part of the this actions

Technical assistance needs	Role of Partners
The implementation of action will require technical support to set the mechanism for work	• The Municipality of Kab Elias to launch the events and implement the actions. • NGOs to support the municipality work in participation in the events and the general goals of the action

4- Cost estimates

All cost	Initial and start-up expenses	Approximate operational Costs (including maintenance	Approximate annual income for energy producing projects
€ 296,000	€ 36,000 to start with actions 46 to 48	NA	NA

Draft calculation of the NPV and return of Investment (IRR).

The annual revenue for this action is negative as it for Residence

Time schedule for implementation of the Short term action in Residential buildings Residential buildings	2016	2017	2018	2019	2020
Workshop with mosques / churches	X	X			
Workshop with local NGO'S	X	X			
Open Solar Day		X	X	X	X
Yearly Contests through local TV channel		X	X	X	X
Increase the initiatives for solar water heater			X	X	X

Tertiary Sector	2016	2017	2018	2019	2020
Public awareness campaign will be held for tertiary sectors addressing energy conservation, behavioural changes		X	X		

5- Available and foreseen sources of funding

Local authority's own resources	National Funds and Programmes	International Financial Institutions	EU Funds & Programmes and other external funds
To be defined by the municipality	NA	To be defined	To be defined
Public-Private Partnerships amount/share (available or to raise)	**Lined up private investments**	**Loans and potential borrower**	**Expected annual cost savings to the City budget**
NA	NA	100%	This action related to citizens saving

Other

6- Projected Energy Estimates in 2020

Energy savings MWh/a	Renewable energy production MWh/a	CO_2 reduction t CO_2/a	Target Year
9,350		6,359	NOV. 2020
Percentage of net reduction on the territory	**Reduction as related to BAU scenario**	**Per capita calculated reduction**	
9.45 %	9,350 MWh/a	0.0847866 t CO_2/a	

7- Summary of related Awareness Raising (AR)actions	
AR related to the action	**AR related to community**
Creating an info centre to inform citizens about new technologies	• Awareness campaigns towards religious dignitaries to get them on board as spokespeople for the cause: • Launch an advertising campaign on the theme:" Replacing your electrical water heater with solar water heater is equivalent to planting twenty trees yearly". • AR action on the benefits of using solar power: • AR actions for the tertiary sector: Leaflets, catalogues, posters. • Provide consumers with Fact sheets practical tips on long-term energy saving in homes and on and advantages for green buildings. • Information lectures for municipality employees and posters in all municipal buildings and facilities • Launch a competition between buildings / departments and select the first ten buildings that have achieved the highest percentage of energy reductions and provide reward for achievement • Information on the incentives offered by the municipality to the replacement by solar energy via local radio and TV conferences
8- Assumptions and risks	
• The Assumptions: the Finance is available and the citizen be aware about the actions before start implementation. • The Risks: poor implementation, low product quality and maintenance	
9- Key success factors	
• The reduction on the cost of energy for citizen	
10- Next steps	
• Long term action related to the municipal	
11- Annexes	
• Refer to the CAPP	

ANNEX II – CITIZENS AWARENESS PROMOTION PLAN

(CAPP)

Kab Elias

A Pilot Green City

Preparing and including the "Awareness Raising Actions" component in the SEAP

In addition to the requirement linked to the public consultation of the SEAP, a Citizen Awareness Promotion Plan (CAPP) has to be elaborated by the municipality as part of the Sustainable Energy Action Plan document (SEAP).

Identification of CAPP actions through participatory training workshops

The CES-MED project has conducted a tailored communication and CAPP training workshop for the local authority and it communication team in coordination with (and attended by) the Focal Point and the SEAP Consultants. Prior to conducting the workshop, which was led by CES-MED key communication expert (KE), a three parts "Communication Kit" was handed on to the local authority and SEAP Consultant, who were asked to get acquainted with its content prior to conducting the training.

The "Communication Info Kit" (annex1) includes:

Part 1: the "CAPP Guidelines" document: a tailored comprehensive manual prepared by CES-MED for the use of cities/municipalities on how to identify, plan and conduct awareness raising actions (Arabic, English and French versions)

(http://www.ces-med.eu/images/CAPP/Annex_7_CAPP_v.4.0_02122014_EN.pdf).

Part 2 includes;

PPT Presentation of the CAPP Guidelines

Presentation of " How to prepare and implement a communication and an awareness campaign" showing techniques, materials and models

Pools of benchmark examples and references to best practices from across the world towards citizen engagement and behaviour change, with adaptation to the CES-MED cities context

Part 3: consists of 4 Tables to assess CAPP conditions and identify actions.

Table 1 is used to conduct a rapid investigation to identify awareness situation, levels and needs linked to behavioural change in the city; and to initiate discussions with the workshop participants towards the identification of target audiences and the SEAP CAPP actions.

Table2: presents the content of a plan to implement a CAPP action related to a Pilot Project.

Table 3 presents the proposed actions related to the general sustainable energy challenges and to the city.

Table 4: presents the proposed CAPP actions linked to each SEAP priority projects.

During the workshop, the "Communication Kit" material was explained. The following discussions, assessment and analysis addressed awareness raising conditions and challenges, communication concepts and CAPP methodologies, tools, techniques before examining and multiple benchmark applications.

A practical exercise was than conducted to specify the SEAP's CAPP actions, whereby the local authority general awareness raising needs and SEAP'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 SEAP Consultants, prior to including them in the SEAP (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 SEAP document and other similar awareness raising actions.

Preparation of COMMUNITY AWARENESS PROMOTIONAL PLAN (CAPP)

Template 1- Situation analysis of Kab Elias

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 is the target audience of the CAPP?

2) What are the priority issues to be addressed by the CAPP (that also could be identified by the PAED as priority actions)?

3) What is the level of awareness for the energy key problems? What are the main issues of concern to raise awareness about?

4) What are the previous awareness-raising actionsthat CAPP needed to be built on?

5) What is the situation, related to the public consultation, mainly based on?

Filling out the template helped in pointing out how raising awareness can be utilized as a tool to improve energy policy and facilitate the implementation of its actions. It has also allowed initiating discussions in the Communication Workshop and helped identifying appropriate campaigns and actions.

Specific objectives:

Provide the necessary information about the current conditions and the situation regarding awareness of energy saving and renewable energy,

Help to identify the most appropriate a) awareness raising campaigns that would accompany the SEAP vision/strategy and b) the awareness raising actions that would accompany the priority actions determined in the SEAP.

Steps to follow:

(i) The SEAP team of the municipality has filled the templates based on their understanding and perception 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 templates were discussed in the "CES-MED Communication Workshops", which were led by CES-MED Communication Expert and attended by the SEAP consultant and the SEAP municipal team. In parallel, the vision/strategy of the city and the proposed pilot actions in the SEAP were reviewed as part of the workshop exercise.

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

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		
Other	X		

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		

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	

Previous awareness actions conducted by the city/municipality or by other actors	
Has the city or local authority done previous actions	Yes
If yes, who conducted the actions (the city/municipality, NGO, national authority…)	Through the Municipality, and in participation with the USAID, the Municipality completed the solar energy project to provide water to town. This project was successful and beneficial, and all the segments of the community interacted with it. A pilot project for waste water purification station in participation with UNDP.
If yes, describe the action	Brochures – photos – seminars – awareness campaigns (that involve various tools).
If yes, what was the budget and how did you fund it	$200.000 for the well project and the water extraction using the solar energy. $40.000 for the waste water purification station.
If yes, outcome, impact and feedback	Solar Energy and Waste Purification Station: Preserving the environment, limiting the emissions of gas with greenhouse effects, and using water in plants irrigation. Economic Benefit: Saving fuel and having a low maintenance and operation cost, the provision of water in a constant and sustainable manner, while reducing the cost of its extraction. Public Health: Reducing the air pollution level and preserving people's health. Social Justice: Distributing water equally and avoiding the conflicts, as well as limiting the problems that arise between the people around the water issue.

Public consultation	
Does the city practice public consultation?	Yes
Has the city done public consultations for SEAP?	Yes, with the different civic society associations. These associations participated in the seminars that SEAP invited them to.
Is it part of the legislative process?	No, these sessions represent the importance of the responsibility and the participation between the various components of the local authority and the local community.
Foreseen consultation(s)	Explaining the suggested plan around the implementation of the project's mechanism tool and the registration of notes, and taking them into consideration, as well as launching the workshop with the participation of all the local community members.
Does the city liaise with national institutions, stakeholders?	Yes, constantly and continuously.

Situation analysis

From this study, it appears that all target groups are aware and informed about energy challenges; they have all identified the priority issues related to energy and acknowledged the importance of addressing them through sustainable energy actions.

The template reveals the important leverages on which we can use and base our communication upon are: high price of oil, (non) availability of energy and transport, cleanliness of the environment and waste management; These issues are directly related to a shortage of electricity (ongoing for many years), a major waste management crisis, topped by an unprecedented wave of refugees which are impacting directly household expenses and daily necessities; The ambiguity lays in the fact that the citizens of Kab Elias are in general aware about some energy issues and challenges but do not feel convinced about the existing ways to solve them such as renewable energies.

Nevertheless, the municipality of Kab Elias has conducted awareness raising actions and campaigns that are related to sustainable energy to the civil society as well as to its professionals in the energy sector. It was able to assess their positive impact through implementation and by attaining the objectives of environment and people's health preservation, fuel savings and water distribution. However, we don't have the necessary feedback on the level of awareness in the population towards these actions.

The means of communication, and the tools used in the awareness campaigns were various including brochures, photos and seminars. These actions have been funded for through the participation of USAID (for the solar energy project to provide water to town) and UNDP (for the pilot project for waste water purification station).

Finally, regarding public consultations, even if they are not part of the legislation of the city, they represent the importance of the responsibility of the local authority towards its community. In that respect, public consultations have been well conducted by the municipality, with several associations, regarding the SEAP. More are foreseen in regards to the implementation of the project's mechanism tool and the launch of the workshop involving the participation of all community members.

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**
Raising Energy Efficiency and rationalizing its usage.	Reduce energy consumption. Provide energy in schools. Work on feeding the public lighting network in town. Using the ceiling of the vegetables market to produce energy and use it in town.	**Topic:** **Shifting the public lighting network in town to a network that relies on sustainable energy** **Activities:** Awareness actions to explain the rationalization concept for energy: in schools, mosques, municipal buildings, shops… Awareness actions on energy efficiency technology (recuperating rain water, using solar energy…)
Supporting the balance between the use of alternative energy and the reduction of the emissions.	Support the houses in providing the transition to the alternative energy. Urge the institutions to use the alternative energy and assisting them in empowering it.	**Topic**: **Encouraging all the members of the local community on shifting to alternative energy through the adoption of systems and the provision of services that would help them.** **Activities:** Holding workshops on energy rationalization and distributing fliers to clarify the concept. Define practical advantages for RE users (public or private sector) (such as free installation, eco labels etc.).
General Awareness and Capacity Building.	Comprehensive Media Plan that focuses on the awareness and motivation in the application of the procedures required to adopt the alternative energy for: Households Private Institutions	**Topic**: **Raise and increase the sense of responsibility on the energy issues and the reduction of the emissions that affect the environment** **Activities:** Appointing a dedicated team and establish a communication unit. Raising awareness among the citizens with a

	Schools	media campaign on the importance of the procedures related to saving the environment and energy and promoting the project and the strategic vision of the city. Holding workshops to enhance youth capacities, distributing booklets and cooperating with schools.

Template 3.2

CAPP activities as related to SEAP Priority Actions of Kab Elias

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 SEAP.

SEAP Priority Actions	**Related CAPP Activities:**
Municipal Buildings	**Target Audience:** - Civil society, private and public stakeholders - Municipality staff - Schools, mosques and all other governmental facilities and - Professionals in energy sector - Government agencies and associations **Key Message:** Increasing the renewable source will benefit the city at both environmental and economic levels by savings in the Municipality annual budget. **Objectives:** - Increase the staff capacity with new implementations of actions - Achieve a resilient and sustainable municipality by using Renewable Energy and making it a source of energy for the municipality. Reduce power consumption as well as the municipal energy bill - Promote the project and the strategic vision of the city at local, national and international level in the clean energy sector. **Communication Tools:** Holding Awareness and Training workshops for the Municipality staff and raising staff awareness on the positive effects of taking the individual measures related to the activities of preserving the environment to impact their change in behaviour. Linking the actions to the associations and NGOs and their social

	networks, in order to increase the municipality capacity in the implementation of sustainable energy action plan. Implementing Energy Saving Instruction and tools for employees to switch off PC, monitors, A/C or other electrical equipment or appliances when they are out of office; Fix the Air-condition thermostat on 22°C to24°C in winter/ summer; Utilize as possible day lights through windows and reduce artificial lights as possible; Minimize the usage of printing as possible etc. (information posters, stickers, fact sheets with the savings expected in %….) Promoting the installation of similar equipment in other public and private buildings through a renewable energy equipment forum aimed at relevant stakeholders. Promoting the project in the media through publicity, social media networks and implementing a municipal website.
Water supply and waste water treatment	**Target Audience:** - Civil society and especially the farmers - Agricultural Development, Environment and Land Use Planning, and Public Health administrations **Key Message:** -Reuse of recycled water, if properly managed, may alleviate pollution of water resources and sensitive receiving bodies. - Reusing the treated wastewater in watering the plants would provide a new water source, will reduce water scarcity and save on costs. **Objectives:** -Save underground water from waste water pollution and leakage of the waste water without treatment. - Increase sustainability. - Respond to the high demand on water which has its effect on the amount of untreated waste water. **Communication Tools:** Raising awareness on finite resources with a series of short videos to highlight the impacts of wastewater on the ecosystem and on the community, and the benefits of a better management for various audiences: production of promotional material (leaflets, brochures, posters, catalogues) and if possible, billboard advertisements. Contribute to press releases, media advisories, press conferences and training. Raising public awareness with regard to the safety and cleanliness of

	the treated wastewater: Info days for the citizens, dissemination of messages through radio, newspapers and television, especially using local media. Promotional distribution of water saving tools for the faucet (Tap) to save on water consumption. Production and distribution of fact sheets to citizens to encourage them to collect rain water in water tanks during rainy season and alleviate the high season demand in summer; the fact sheets will display expected result for their household bills.
Solid waste management	**Target Audience:** - Civil society, private and public operators, all stakeholders **Key Message:** - Waste should not be wasted: Reduce the amount of solid waste and save your environment. **Objectives :** - Implement the principles of the comprehensive and sustainable waste management (in order to improve the quality of life and reduce the cost of waste management). - Practice responsible and integrated waste management within the city. - Reduce the number of trips for the waste collection trucks - Increase sustainability **Communication Tools** Awareness campaigns and seminars to explain the negative effects on solid waste accumulation and how to reuse waste and recycle it: Educational kits distributed in houses with practical tips to reduce solid waste at its source. Conducting seminars to volunteer groups, associations or women organizations on methods for sorting solid waste, to turn them into ambassadors in educating the citizens on the proper way for sorting. Conducting conferences in schools to educate teachers and students on sorting solid waste. Launching awareness operation: cleaning day and sorting in neighbourhood. Issue a «Clean» certificate for deserving ones. Installation by the municipality of recycling bins in all municipal buildings and facilities promoting recycling of plastic bottles, batteries, paper. Using the municipality's website, producing posters and benefitting

	from the radio station programs to promote this project. Producing posters on pick-up trucks for high visibility.
Public street lighting	**Target Audience:** - Civil society - Private and public operators - Professionals in energy sector **Key Message:** Reduce energy consumption in town through smart management and consume it more responsibly **Objectives:** - Reduce the city's energy - Limit the impact of the emission of the greenhouse gas. - Promote the use of similar equipment in the households, and other or private buildings. **Communication Tools:** Create awareness with 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. 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 energies technologies (electricity from natural resources) through messages conveyed by television, the radio and the written press. Training to the students (primary and secondary schools) on using the energy correctly. Creating an info centre to inform citizens about new technologies.
Buildings in the residential and tertiary sectors	**Target Audience:** - Civil society, NGOs, private and public operators Professionals in tertiary sector - Architects and construction professionals Mosques and churches (people in charge)

	Key Message: For a cleaner, safer and quieter city The sun is energy and it is free: use it! **Objectives:** - Reduce city energy consumption and CO_2 emissions in the residential and tertiary sectors - Round-the-clock electricity Increase sustainability - Switch to an effective and long-term behavioural change **Communication Tools** Awareness campaigns towards religious dignitaries to get them on board as spokespeople for the cause: workshops and involvement in actions on the ground. Launch an advertising campaign on the theme:" Replacing your electrical water heater with solar water heater is equal to planting twenty trees yearly". AR action on the benefits of using solar power: The open solar day. Targeting regular citizens with info booths on solar energy, kids with educational games, school students to discover and take part in the demonstration of solar system, financial institutions and NGOs, architects, roofers, A/C and electrical appliances suppliers… AR actions for the tertiary sector: Leaflets, catalogues, posters. Create an info centre to inform citizens about new technologies. Provide consumers with Fact sheets practical tips on long-term energy saving in homes and on and advantages for green buildings. Information lectures for municipality employees and posters in all municipal buildings and facilities Launch a competition between buildings / departments and select the first ten buildings that have achieved the highest percentage of energy reductions and provide reward for achievement Information on the incentives offered by the municipality to the replacement by solar energy via local radio and TV conferences.
Private transportation and municipality fleets	**Target Audience:** Civil society, specifically young people private and public operators Professionals in energy sector

	Key Message: For a cleaner, safer and quieter city If you care (about the environment), share (your car) **Objectives :** - Reduce the fuel consumptions and carbon footprint - Increase sustainability - Increase roads capacity - Encourage car sharing **Communication Tools** Build AR campaigns to transport decision makers and other community groups, in particular the disabled and the elderly (shared taxi called "service"). Promote a car pooling scheme run on the Internet and co-financed by the municipality, at the disposal of all employees and city dwellers. Use all media forms and produce imaginative posters, local TV and radio press articles about the issue. Define practical advantages for car sharers (public or private sector) when setting up employees' mobility plans (such as free and dedicated parking places, financial contribution from the company for petrol, free bicycles, access to the repair shop, etc.). Conduct an awareness campaign on eco-driving that explains how the recommended drive technique is a modern, smart and efficient way to save fuel. Invite the specific local NGO's & Volunteers to attend training by qualified driving instructors allowing them to share the experience with others. Design clear signage for speed on main and sub roads. Communicate through local associations, local radios and social media to grab people's opinions and promote a Bike to Park Day. Communicate through social media to promote and rally people to a marathon day and encourage walking.

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, 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 Kab Elias specifically, the population seems to be very concerned by energy issues correlating with their daily life and affecting it; they are clearly educated to the energy issues and climate change but seem to be suspicious about the efficacy of new technologies as a mean to solve those problems and the literacy around them. Therefore, they have little engagement and involvement in the development of the renewable energies process towards a sustainable path.

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

On one hand, 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. We need to find out what would be the best way to anticipate the barriers that affect its choices and preferences for better environmental behaviours. The actions will be seen as a credible message if promoted through the proper insight such as cost of the citizen's double energy bills, a concrete concept as where the climate change might sound like a virtual one. The one question they might need an answer to is: "what's in it for me?"

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.

It is essential for each and every family to become mindful of the many ways they could help, through awareness and message-spreading, and a continuous nurturing process of the younger population. In general, children are an excellent target to focus on as they will not only shift in their attitudes but they will also see to it that the elders and their relatives apply it too. It is necessary to shape their perception with educational approaches so that they will become the cornerstone of energy-saving and respect for the environment.

Kab Elias municipality is a very active force, setting various challenges and aiming at meeting them. However, it needs to assess the perception of options it offers to her citizens as viable and sustainable alternatives that will benefit them; use the adequate medium to deliver its message and lead the people in their choices towards a change in behaviour, enabling individuals to make informed decisions.

Therefore, it is important to use a leverage which we can use and base our communication upon such as:

Educating the audiences and offering helpful energy efficiency tips to reduce cost and usage through entertainment, talk shows, special guests and happening; Engage with associations at the local and grassroots level to understand the population needs and opinions.

Adopting a comprehensive communication strategy adjusted to all stakeholders (Professional, head teachers, youth movements, religious leaders, associations...). Building a sustainable awareness plan adapted to the project in order to implement the concept of eco responsibility development and realize awareness raising measures and campaigns to distribute information and increase public acceptance, in particular with regards to large-scale renewable energy projects.

Enforcing laws to ensure the energy efficiency consequences of all their renovation projects, construction and planning to provide alternatives to classical highly polluting models.

Boosting lower energy consumption at the municipality level will encourage citizens to master their consumption, know about renewable and efficient energy, and encourage their production and use.

Building a proper Web site 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.

Last but not least, implement and empower a communication cell within the municipality, plan to set up its structure, strengthen its capabilities and its human resources. It can 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; Establish a strong and dynamic communication methodology to facilitate the planning and implementation of SEAPs as well as stick to the vision slogan in every communication to highlight the goal aimed at: A pilot green city.

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 and establish communication between the municipality and the civil society and keep it constantly aware of projects and involve it. Communicate and promote at the municipalities level about actions and measures toward energy saving and energy efficiency that improves the quality of life in the city. After all, the main behavioural barrier is a lack of awareness by consumers, retailers, industrials and other professional.

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