This project is funded
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CES-MED

CLEANER ENERGY SAVING MEDITERRANEAN CITIES

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

Lebanon
Municipality of Beirut
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, and with the active participation of the National Authorities in Lebanon and the municipality of Beirut. 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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GEORGES B. TABET

Sustainable Energy Action Plan (SEAP)

Municipality of Beirut

- 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 Centre for Energy Conservation

LCPS Lebanese Centre 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 Beirut 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 the Sustainable Energy Action Plans. The preparation was undertaken to support the local authority through several training sessions and technical assistance in formulating and applying sustainable policies in the city.

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

The report was drafted by the Consortium partners Georges B. Tabet and Vincent Meyrand from Via Habilis Ingénierie and Oussama Kassamani, the SEAP Consultant. They were supported by the Municipality of Beirut and under the guidance of Dr. Naguib Amin, the Team Leader for CES-MED project, Dr. Alexandra Papadopoulou, the CES MED Energy Expert and Ms Myriam Makdissi, CES-MED Communication Expert, The team support from Human Dynamic in Sofia; and CES-MED Team in Beirut.

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

Judge Omer Hamza, Director General for Local and Administrative councils of MOIM;
Eng. Majeed Hashem, Ministry of Interior and Municipalities;
Judge Ziad Chebeib, Governor of Beirut Municipality;
Mr. Belal Hamad, Former President of the Municipal Council Mayor of Beirut Municipality;
Mr. Nadim Abourizk, Former Vice President of the Municipal Council of Beirut;
Mr. Rachid Achkar, Former Member of the Municipal Council of Beirut
Mr. Isam Kaskas, Beirut Governor's Advisor
Eng. Huda Salloum; Director General of Traffic Department of MoIM
Mr. Jean Dabaghi; Mr. Georges Hanna; Traffic Department of MoIM
Ms. Yummna Nael; Head of Department of Properties at Beirut Municipality
And from Beirut Municipality staff: Mr. Mohammad Doghan, Mr. Saad Al Dine Al Halabi, Mr. Fouad Akiki;
Dr. Kamal Haik, Director General of Electricité du Liban, EDL;
Eng. Bernard Pertot Data and Information Technologies Manager Electricité du Liban, EDL.

Our deep appreciation also goes to all parties who are not mentioned in this report for their devotion and dedication in work.

We are looking forward to a city that undertakes sustainability and works towards a healthy future, with clean power, clean air and clean water for its people to live and work in.

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 transform their regions into a low carbon economy and create more sustainable communities.

The Municipality of Beirut, with a population of 500,000 citizens, is one of the Lebanese regions committed to the Covenant of Mayors on energy sustainability. It is supported by the CES-MED project that provides the place and space for low carbon leaders and networks from business, finance and the public sector to work together to deliver a low-carbon future. The commitment will be challenging and will require initiatives on a major scale.

The Mayor of Beirut Municipality will provide the leadership and commit resources for the actions to happen as the city council has agreed to be a signatory to the Covenant of Mayors. Beirut has set out its ambition to transform its energy system and infrastructure into a form that is increasingly managed and controlled locally, which will contribute to a resilient and sustainable energy economy in the city.

To achieve this, the Municipality of Beirut will need to collaborate and cooperate with other municipalities that are members of the CoM. It will need organisations and companies to play their part and also need its local citizens and businesses looking at how they use energy in all sectors.

Working in partnership with local authorities and stakeholders is essential to implement the SEAP and achieve its main objectives. It is important for the all parties to work jointly and in a coordinated way to identify, develop and exploit opportunities effectively to bring investments, jobs, environmental and social benefits to the city.

The total target for the SEAP implementation is to mitigate carbon emission with a total reduction of 1,157,673.4 t CO_2 by 2020, which represents more than 37% of the city's total emissions. For the implementation of the SEAP, the total budget is EUR 564,480,800.

Based on the CoM guidelines, the year 2013 was considered as the baseline year since the data collected then is considered complete and reliable.

The Municipality of Beirut has included in the Baseline Emission Inventory all the following sectors:

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

The main objectives of this report are:

- 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 CO2 emission reduction;
- Making sustainable energy policy part of all key activities of the local authority.

The method used in the BEI calculation is 'standard' emission factors in line with the Intergovernmental Panel on Climate Change Guidelines 2006 (IPCC, 2006) and to comply with the United Nations Framework Convention on Climate Change (UNFCCC) reporting system. The base line year is 2013.

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. Chart 1 below shows the energy consumption in the city, which indicates the following:

- The transport sector is the major sector in energy consumption; the cost of Beirut's congestion to the country's economy is substantial. It sets about 8% of Lebanon's GDP making this sector a main source for CO_2 emission. The current situation reveals that congestion is still growing and is getting worse due to the absence of an integrated vision for the city, thus making this sector a main issue in the city.
  The adopted actions in this sector will save 3,277,791 MWh/a and mitigate the emission by 824,970 t CO_2;
- The tertiary sector counts for 73% of electrification emissions. Without precise regulation and managed interaction from main parties, reducing the emission and reaching achievement may be limited and not well controlled. In addition, there is much work to be done on national base. For example, regulating the Diesel generator would need certain rules, which the municipality may implement, but still there must be a need for authorities to control and monitor.
  The adopted actions in this sector will save 407,400 MWh/a and mitigate the emission by 268,884 t CO_2;
- The Residential sector consumes 26% of the total energy consumption in the city and represents a key target in the city future plan to reduce energy consumption.
  The adopted actions in this sector will save 80,455 MWh/a and mitigate the emission by 52,911 t CO_2;
- In 2013, CO_2 emission accounted for a total of 2.46 million t CO_2 for an area of 20 Km² with an approximate 500,000 inhabitants. This amount of emission comes from two main consumption sources:
  - 1.33 million t CO_2 for electrification;
  - 1.13 million t CO_2 for transportation.

All those figures, mentioned above, raise the importance of implementing essential rules for planning the energy actions in line with converting Beirut into smart and sustainable city in the future.
In addition, to identifying the nature of the CO_2 emitter entities in the city's territory offers a significant potential to help select the actions to begin with.

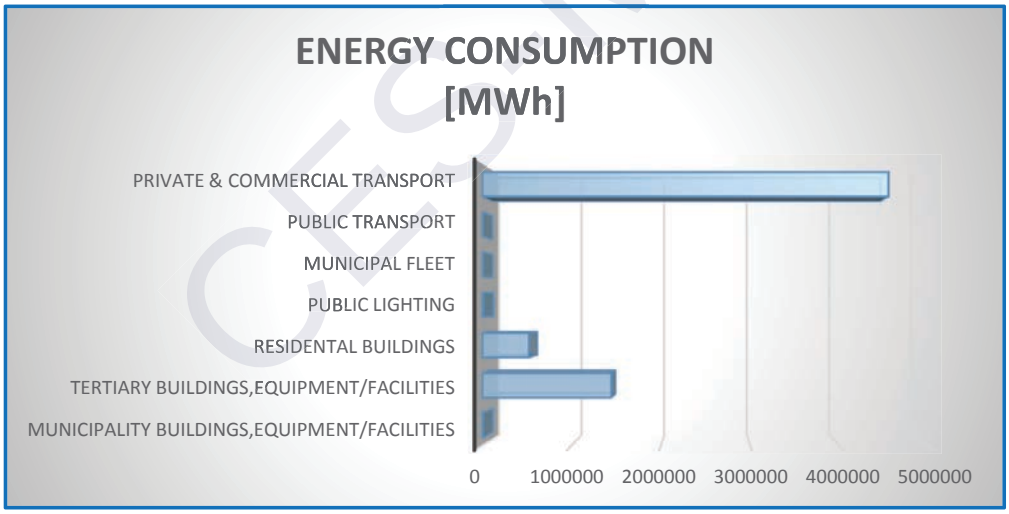


CHART 1: ENERGY CONSUMPTION IN MWH- THE MUNICIPALITY OF BEIRUT

The total emissions for Beirut for the year of 2013 are presented in Table 1 below

TABLE 1: CO_2 EMISSION FOR BEIRUT CITY RELATED TO 2013

Sector of Energy Consumptions	Electricity	Diesel	Gasoline	Total
Municipal buildings, equipment/facilities	3,935	635		4,570
Tertiary (non-municipal) buildings, equipment/facilities	821,389	132,537		953,925
Residential buildings	308,432	34,837		343,269
Municipal public lighting	6,890			6,890
Municipal fleet		127	483	610
Public transport		123		123
Private and commercial transport		181,430	964,512	1,145,941
Total in t CO_2				**2,455,329**

The municipality's representatives, through the BEI identification, acknowledged the most significant sectors affecting the Municipality's carbon footprint. The transportation sector contributes the most, with almost (47%) of the total emissions, followed behind by the Tertiary sector (39%).

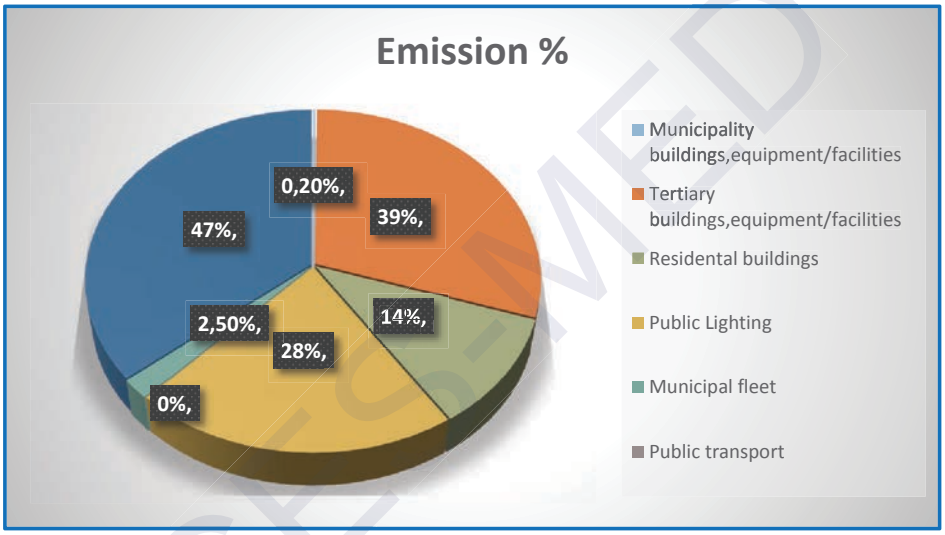


CHART 2: CO_2 EMISSION BY SECTORS IN %

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 Beirut was realised according to the **Business as Usual (BAU)** scenario.

For the Municipality of Beirut, the total emissions for the baseline year (2013) were 2,455,329 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) = 2,455,329 x 1.27 = 3,118,268 t CO_2

The actual reduction target undertaken by the municipality fulfils the CoM requirements and is set to 37% corresponding to an overall reduction of 1,157,673 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 3 below.

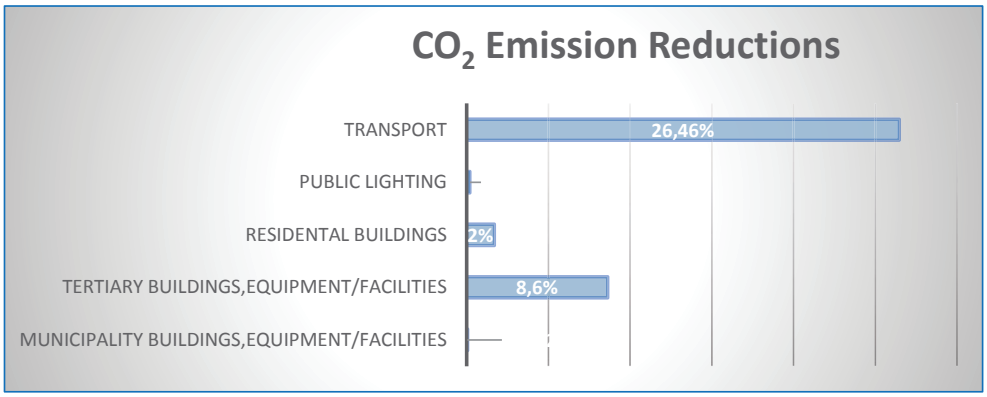


CHART 3: CO_2 EMISSION REDUCTION BY SECTORS IN %

The municipality of Beirut 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.

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

TABLE 2: TOTAL LIST OF ACTIONS IN MUNCIPALITY OF BEIRUT

SECTORS & fields of action	Action No.	KEY actions/measures	Mitigation in Energy		Mitigation in %	Costing in €
			MWh/a	t CO_2 /a		
MUNICIPAL BUILDING			**2,459**	**1,624**	**0.052%**	**667,600**
Short Term Action	1	Set up SEAP Unit inside the municipality				201,600
	2	Conduct energy auditing for municipality building and facilities				40,000
	3	Social media promotion plan				10,000
	4	Energy saving instruction in the municipality facilities	88	58	0.002%	1,000
	5	Awareness and Training Campaign for the municipality staff	88	58	0.002%	5,000
	6	Convert the municipality building A to green building	527	348	0.011%	100,000
Long Term Action	7	Convert the municipality building B to green building	527	348	0.011%	100,000
	8	Convert the municipality building C to green building	527	348	0.011%	100,000
	9	Convert the municipality building D to green building	527	348	0.011%	100,000
	10	Public procurement of products & services	175	116	0.004%	10,000
WATER SUPPLY			**6720**	**1794**	**0.058%**	**220,000**
Short Term Action	11	Awareness campaign				150,000

	12	Apply new role for recycling water in building and reuse it	This need to be developed and cannot be estimated also the role for municipality is limited however action should be taken with collaboration with the responsible concerned governorate department (EBML)			20,000
	13	Routine maintenance				50,000
	14	Install water meters in main feeders and main branches				
Long Term Action	15	Install water meter for each users with remote reading system	This needs to be developed and cannot be estimated also the role of municipality is limited however action should be taken in collaboration with the responsible concerned governorate department (EBML).			
WASTE WATER TREATMENT						
Short Term Action	16	Update the municipality policy				
Long Term Action	17	Infrastructure for wastewater management.				
SOLID WASTE MANAGEMENT			**1038**	**280.2**	**0.009%**	
Short Term Action	18	Create solid waste plan for sorting from source for Beirut city				
	19	Awareness campaign on solid waste sorting				
	20	Upgrade the local laws to insure the maximum recycle material to be used in the city				
	21	upgrade the existing waste treatment plant to increase the efficiency of sorting to reach maximum 10% non-recycling part				
Long Term Action	22	Start implementing the plan for city sorting with selected sectors in the city 1 to 10	173	46.7	0.0015%	
	23	Start implementing the plan for city sorting with selected sectors in the city 11 to 20	173	46.7	0.0015%	
	24	Start implementing the plan for city sorting with selected sectors in the city 21 to 30	173	46.7	0.0015%	
	25	Start implementing the plan for city sorting with selected sectors in the city 31 to 40	173	46.7	0.0015%	
	26	Start implementing the plan for city sorting with selected sectors in the city 41 to 50	173	46.7	0.0015%	
	27	Start implementing the plan for city sorting with selected sectors in the city 51 to 60	173	46.7	0.0015%	
PUBLIC STREET LIGHTING			**9422**	**6123**	**0.196%**	**40,761,000**
Short Term Action	28	Working drawing and tendering documents				750,000
	29	Maintenance check form	1346	875	0.028%	1,000
	30	Technical training				5,000
	31	Monitoring process				5,000
Long Term Action	32	Phase One of the implementation	2019	1312	0.042%	10,000,000
	33	Phase Two of the implementation	2019	1312	0.042%	10,000,000
	34	Phase Three of the implementation	2019	1312	0.042%	10,000,000

	35	Phase Four of the implementation	2019	1312	0.042%	10,000,000
LOCAL RENEWABLE ENERGY PRODUCTION			**1646**	**1087**	**0.035%**	**447,200**
Long Term Action	36	Above water tank storage 1	419	277	0.009%	650,000
	37	Above water tank storage 2	335	221	0.007%	520,000
	38	Above water tank storage 3	268	177	0.006%	416,000
	39	Main municipality building	121	80	0.003%	187,200
	40	Other Municipality buildings	168	111	0.004%	260,000
	41	Schools	335	221	0.007%	520,000
BUILDING RESIDENTIAL SECTOR			**80455**	**52911**	**1.697%**	**2,050,000**
Short Term Action	42	Workshops with local mosques/churches and clerks.	13258	8719.04	0.280%	300,000
	43	Workshops with local NGO'S	13258	8719.04	0.280%	300,000
	44	Group of public advertising in the outdoor banners for energy saving in homes.			0.000%	
	45	Fixed Temperature set for A/C in summer and winter	13258	8719.04	0.280%	600,000
	46	Replacement of lamps with efficient one	13258	8719.04	0.280%	150,000
	47	Replacement or purchase of efficient appliances	13258	8719.04	0.280%	300,000
	48	Support & participate the Earth Day in the city.	73	48	0.002%	300,000
Long Term Action	49	BUILDING CODE	14092.9	9268.2	0.297%	100,000
BUILDING TERTIARY SECTOR			**407400**	**268884**	**8.623%**	**160,000**
Short Term Action	50	Workshop on changing behaviour				
	51	Governmental and Public offices.	21300	14058	0.451%	10,000
	52	Hospitals.	12450	8217	0.264%	10,000
	53	Schools.	12450	8217	0.264%	10,000
	54	Institutions	6000	3960	0.127%	10,000
	55	Universities.	3000	1980	0.063%	10,000
	56	Hotels.	11400	7524	0.241%	10,000
	57	Certification for green cedar certification of the following sectors				
	58	Governmental and Public offices.	21300	14058	0.451%	10,000
	59	Hospitals.	12450	8217	0.264%	10,000
	60	Schools.	12450	8217	0.264%	10,000

	61	Institutions	6000	3960	0.127%	10,000
	62	Universities.	3000	1980	0.063%	10,000
	63	Hotels.	11400	7524	0.241%	10,000
Long Term Action	64	Awareness campaign using public advertising targeting the Shops offices on following				
	65	Fixed Temperature set for A/C in summer and winter	91400	60324	1.935%	10,000
	66	Replacement of lamps with efficient one	91400	60324	1.935%	10,000
	67	Replacement and purchase of efficient appliances	91400	60324	1.935%	10,000
	68	Implementing Building Codes in new buildings.				10,000
TRANSPORTATION			**3,277,791**	**824,970**	**26.456%**	**2,080,000**
Short Term Action	69	Smart master plan for transportation			0.000%	2,000,000
	70	Conduct an awareness campaign on Eco driving	2893	728	0.023%	10,000
	71	Participate in Beirut Marathon Day	17,358	4,368	0.140%	10,000
	72	Conduct a Bike day.	17,358	4,368	0.140%	20,000
Long Term Action	73	Coordination Committee for Transportation	0	0	0.000%	10,000
	74	Regulate the shared Taxi for transportation	289,302	72,813	2.335%	30,000
	75	Conduct an awareness campaign on Smart Shared Taxi for the drivers	289,302	72,813	2.335%	Cost to be defined
	76	Allocate and provide shared Taxi stop station	289,302	72,813	2.335%	
	77	Smart Phone Ticketing System for Shared Taxi	289,302	72,813	2.335%	
	78	Conduct an awareness campaign on Smart Shared Taxi for the Public	289,302	72,813	2.335%	
	79	Assign & provide Green/Smart Shared Taxi Stop Station	289,302	72,813	2.335%	
	80	Smart Phone Ticketing System for Smart Bike	289302	72,813	2.335%	
	81	Conduct an awareness campaign on Smart Shared Bike for the public	289,302	72,813	2.335%	
	82	Parking area supported with Shared Taxi outside the city	347,162	87,376	2.802%	
	83	Parking area for Bikes/Scooters	289,302	72,813	2.335%	
	84	Assign sector in roads for Bikes/Scooters	289,302	72,813	2.335%	
Total			**3,786,930.945**	**1157,673.376**	**37.126%**	**46,385,800**

Section I: Overall Strategy

1.1 Beirut 2020 Targets

The table below shows the amount of emission that the country contributes. Lebanon's emissions are much lower when compared with global emissions; 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		

There has been 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 transform their regions into a low carbon economy and create more sustainable communities.

The Municipality of Beirut, with a population of 500,000 citizens, is one of the Lebanese regions committed to the Covenant of Mayors on energy sustainability. It is supported by the CES-MED project that provides the place and space for low carbon leaders and networks from business, finance and the public sector to work together to deliver a low-carbon future.

The Mayor of Beirut Municipality will provide the leadership and commit resources for the actions to happen as the city council has agreed to be a signatory to the Covenant of Mayors. Beirut has set out its ambition to transform its energy system and infrastructure into a form that is increasingly managed and controlled locally which will contribute to a resilient and sustainable energy economy in the city.

The commitment to reduce GHG emission by 20% by 2020 constitutes a major challenge for the municipality which lacks prior experience in such a task. However, being supported by the work realised within the CES-MED framework, the municipality will set initiatives on a major scale for the reduction of energy consumption. The plan had considered 37.13% reduction for 2020 which will be subject to the availability of finance.

The overall target set by the municipality "**Get Smarter, Live Better**" demands an understanding of public purposes and interests and a close collaboration with community sectors. The municipality will undergo a set of

actions and measures on its facilities to define a better and planned city which supports creation of livelihoods and enhancement of economic growth.

1.2 Current Status

1.2.1 Geographical Location and Sites

Beirut, the capital city of Lebanon, is the seat of the government. The Lebanese parliament, all the ministries and most of the public administrations, embassies and consulates along with international organisations are centred there.

Beirut city sits on a peninsula extending westward into the Mediterranean Sea about 94 km occupying an area 20 square kilometres. It is divided into twelve neighbourhoods with sixty sectors, constituting an area of 20 Km² with approximately 500,000 inhabitants, within the limits of Beirut municipality.

Its coast is rather diverse with rocky beaches and sandy shores. The climate of Beirut is predominantly of Mediterranean type, which is characterised by warm, hot summers and mild, rainy winters. Most of the precipitation falls in the form of rain; snow is rare except in the mountainous eastern suburbs, where snowfall is common due to the region's high altitude.

The city's geographic location as the crossroads, linking the Mediterranean Basin with the great Asian hinterlands and Western ones, has conferred on it a cosmopolitan character and multicultural legacy. At different periods of its history dating back 5,000 years, Beirut has come under the dominion of a variety of foreign rulers. Their remnants lie beneath the city's downtown area: Ottoman, Mamluk, Crusader, Abbasside, Omayyad, Byzantine, Roman, Persian, Phoenician and Canaanite.

After the civil war, Beirut has regained its strength and became the focal point of Lebanon's economy. Its economy and markets are best described as liberal economic activity and openness to abroad with high capital and labour mobility. Beirut Port has an efficient and cost-effective multimodal facility in the Eastern Mediterranean, supporting local economic growth and serving as a transit base for shipping into the central Arab Peninsula, as well as offering competitive rates on transhipment.

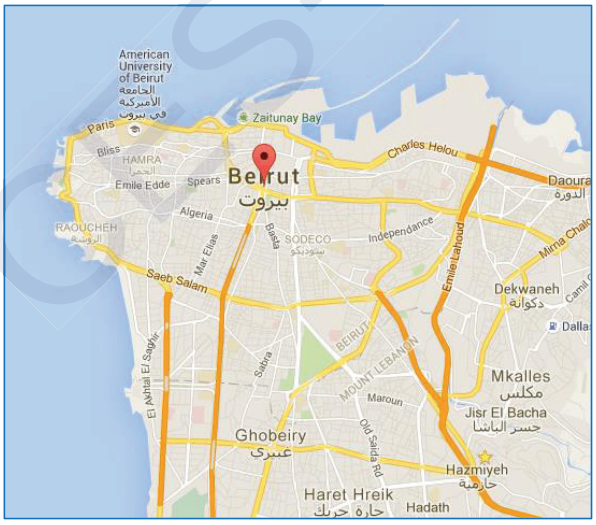


FIGURE 1: MAP OF BEIRUT CITY

The services sector has developed rapidly, making Beirut a major regional centre for trade, banking, air-sea-land transport and communication, tourism and professional services. The banking system is seen as having a key role as an entry point for capital inflows for the region's development. Several investment banks, with capital raised offshore, have been established in Beirut and offer a variety of traditional investment banking services, including debt and equity raising and a corporate finance advisory service. Beirut hosts the headquarters of Banque du Liban, Lebanon's central bank, the Beirut Stock Exchange, the United Nations

Economic and Social Commission for Western Asia, the Union of Arab Banks, and the Union of Arab Stock Exchanges.
Services and industry contribute an average of 73.2% and 20.5% respectively to the Lebanese Gross Domestic Product (GDP). Agriculture consumes over 60% of available water and employs over 20% of the labour force but only contributes an average of 6% per year to GDP.

In 2012, Lebanon's average GDP per capita was approximately USD 9,705. The service-based economy remains, however vulnerable to internal security and political challenges as well as external shocks and regional instability. While real GDP growth was 8% per year from 2007 to 2010, it slowed to 3% in 2011 reflecting spill over of the Arab Spring as well as the ongoing conflict in neighbouring Syria.

Despite its devastating political history, and the fact that it was completely destroyed 7 times during recorded history, Beirut has been a unique cultural and commercial centre for the region. In the 1960's Beirut was known as the "Paris of the Middle East". Among its historical places are:

- National Museum of Beirut;
- Sursouk Museum;
- Archaeological Museum of the American University of Beirut;
- Grand Serail;
- Mohammad Al Amin Mosque;
- Jeita Grotto;
- Beirut Art Centre;
- Beirut International Exhibition and Leisure Centre.

1.2.2 Demographic Tendencies

No population census has been taken in Lebanon since 1932, and estimates of Beirut's population range from as low as 938,940 to 1,303,129 to as high as 2,012,000 when including Greater Beirut. (wikipedia.org, n.d.)

House hold living condition: 3,755,034 individuals and 879, 854 households lived in Lebanon during the period 2004-2005. The average household size is equal to 4.27 individuals. The density is equal to 359 people/Km^2.

TABLE 4: RESIDENTS IN LEBANON

Mohafaza	People	% People	Households	% Households	Average Household	Density (people/Km^2)
Beirut	390 503	10.4	101 695	11.6	3.84	19 237
Mount Lebanon	1 501 570	40.0	371 289	42.2	4.04	763
North Lebanon	768 709	20.5	162 344	18.5	4.74	389
Bekaa	471 209	12.5	102 797	11.7	4.58	111
South Lebanon	401 197	10.7	84 293	10.2	4.49	434
Nabatiyeh	221 486	5.9	52 306	5.9	4.24	209
Total	*3 755 034*	*100.0*	*879 854*	*100.0*	*4.27*	*359*

Source: Central Administration for Statistics, Ministry of Social Affairs,UNDP (2004-2005)

50.4% of the residents or 53.8% of households live in Beirut and in Mount-Lebanon. Whereas, 20.5% of residents or 18.5% of households live in North Lebanon. 12.5% of residents or 11.7% of households live in Bekaa. Finally, 16.6% of residents or 16.1% of households live in South- Lebanon and Nabatiyeh. However, Beirut is overcrowded (19,237 people/Km^2). Contrary to Bekaa which is the least crowded region in Lebanon (111 people/ Km^2). Lebanese population is balanced between males (49.8%) and females (50.2%). However, 32.7% of residents belong to the 0-20 year age group. 55.3% of residents belong to the 20-65 years age group. Finally 7.4% of residents are 65 years or older (Central Administration for Statistics, Ministry of Social Affairs, UNDP, 2004-2005).

1.2.3 Climatic Characteristics

Beirut has a Mediterranean climate characterised by a hot, dry summer, a pleasant autumn and spring, and a cool, rainy winter. The warm season lasts from June 15 to October 12 with an average daily high temperature above 28°C. The hottest day of the year is August 9, with an average high of 31°C and a low of 25°C. The cold season lasts from December 10 to March 23 with an average daily high temperature below 19°C. The coldest day of the year is January 29, with an average low of 11°C and high of 17°C.

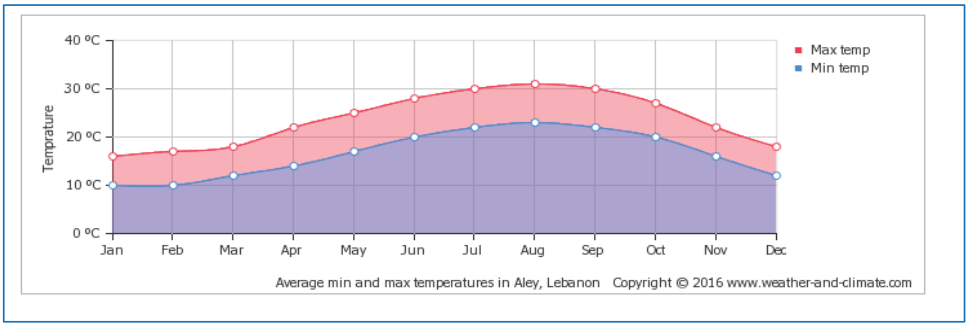


FIGURE 2: BEIRUT AVERAGE TEMPERATURE

1.2.4 Employment

The economic activity rate of the population of Lebanon has slightly increased across the past seven years. The highest rates were found among the young population. Despite the fact that women represent half of the population in the country, only 21% were considered economically active. This was three times lower than men's activity rate of 66%.

A slight rise in employment figures were observed for the previous two years. It is evident that the private sector takes up a larger share of the employment in general. With regard to gender differences in the labour market, it was noticed that women's activity reached its peak before the age of 35, and men remain active even after official retirement age. Among the older working population (65 years and above) both women and men are mostly occupied with agriculture jobs, specialists (such as lawyers, teachers, doctors, engineers ...) or general and corporate managers (Including grocery, shops ...). Differences in paid salaries from work were also noticed between women and men; a woman's average salary is lower than a man's salaries. Women's median salary, was 50 thousand LBP less than men's median salary each month.

Regional disparities with regard to salaries were also noticed. Beirut was ranked with higher salaries in general for both women and men while the average salary was generally lower in the South.

It is widely acknowledged in Lebanon that employment is the best route to escape from poverty. This means that one has to take any given job opportunity, even if it does not match an individual's qualification level. For this reason we looked at the level of education of working people and found that a quarter had low qualification levels and another quarter were highly skilled. Yet some of the people are highly qualified but have taken basic jobs, for instance some people are holding university degree but they are holding 'unskilled jobs' or jobs that require no qualification at all.

The economic activity rate (the proportion employed or unemployed), based on the population aged 15 years and above, reached 48% in 2009. In other words, approximately half of the population were working or available for work. More men were economically active (73%) and proportionally much fewer women were involved in economic activity. Women's economic activity rate increased slightly to 23% in 2009 from 21% in 2007. Some 18% of persons aged 15-19 were active, meaning they have joined the labour force very young. The activity rate for men aged between 25 and 60 was very high at over 90%. The activity rate for women, however, peaks at just 47% for those aged 25-29 and gradually declines thereafter for each subsequent age group.

50% of those in employment in 2009 were workers paid monthly, followed by own account workers at 31%. Next was the percentage of workers who receive weekly or hourly wages or those receiving wages according to their productivity at 10%. Employers accounted for 5% of all workers, followed by persons contributing to family businesses at 3%. There are some notable differences in these proportions between the genders. Around 79% of working women were employees (monthly paid employees or weekly, hourly or paid according to production) while, for males, only 55% were employees. Conversely, only 15% of working women were business owners or self-employed compared with 42% of working men. (cas-1, n.d.)

1.2.5 Existing Infrastructure

After the war, Beirut has regained its strength and became the focal point of Lebanon's economy. Its economy and markets are best described at the dawn of the new millennium by a private and liberal economic activity and

openness to abroad with perfect capital and labour mobility. Beirut Port has an efficient and cost-effective multimodal facility in the Eastern Mediterranean, supporting local economic growth and serving as a transit base for shipping into the central Arab Peninsula, as well as offering competitive transhipment services.

The services sector has developed rapidly, making Beirut a major regional centre for trade, banking, air-sea-land transport and communication, tourism and professional services. The banking system is seen as having a key role by being the entry point for capital inflows for the region's development where several investment banks, with capital raised offshore, have been established in Beirut and offer a variety of traditional investment banking services, including debt and equity raising and corporate finance advisory service. Beirut hosts the headquarters of Banque du Liban, Lebanon's central bank, the Beirut Stock Exchange, the United Nations Economic and Social Commission for Western Asia, the Union of Arab Banks, and the Union of Arab Stock Exchanges.

Services and industry contribute an average of 73.2% and 20.5% respectively to the Lebanese Gross Domestic Product (GDP). Agriculture consumes over 60 percent of available water and employs over 20% of the labour force but only contributes an average of six percent per year to GDP.

In 2012, Lebanon's average GDP per capita was approximately USD 9,705. The service-based economy remains, however vulnerable to internal security and political challenges as well as external shocks and regional instability. While real GDP growth was eight percent per year from 2007 to 2010, it slowed to three percent in 2011 reflecting spill over of the Arab Spring as well as the ongoing conflict in neighbouring Syria

Beirut is facing a number of challenges which couldn't be met without the active participation of local authorities. Among the challenges are energy management, solid waste management, and water management

ELECTRICITY

A major issue facing Beirut is the limited primary energy resources. The energy sector is dominated by the state-owned Electricité du Liban "EDL", which purchases power from four independent hydroelectric power producers. Hence, Beirut is forced to depend to a large extent on imported petroleum and natural resources.
The daily blackout period, even if short (3 hours daily) compared with other areas in the country (12 hours daily), makes the highly populated density areas that depend on the diesel generators on daily basis subject to high airborne pollution levels. Consequently, leading Beirut to be vulnerable to climate change impacts, especially the projected decrease in precipitation and increase in temperature.
The municipality's role in supporting the implementation of renewable energy use and activating the contribution to the reduction of emissions through energy conservation will be an important one to be considered.

TRAFFIC CONGESTION

Lebanon is ranked among the most densely populated countries in the world with averaging 391 persons per square kilometre (km^2). Over 2.2 million people (i.e. approximately half of the population) live in the Greater Beirut and Mount Lebanon (GBML) region, which only comprises 20% of the country's total land area. In administrative Beirut, the population density reached to 30,000 persons per square kilometre (km^2).
The GBML region is a major hub for public and private sectors, a tourist attraction and a centre for the majority of religious and ethnic Lebanese groups. Highly urbanised, the GBML is home to an estimated 506,000 people living below the poverty line (USD 4 per day).
The rapid growth in economic activities and the continuous increase of urban population and motorisation over the last decade, along with the absence of public transport services, have imposed additional demands on the city. Traffic congestion has become a real problem when the bulk of commuters use their cars for their daily movements in the absence of alternative and new public transport systems.
As per the study by the Ministry of Environment in 2005, the cost of Beirut's congestion to the country's economy is substantial. The study suggested it was costing approximately 8 % of Lebanon's GDP at that time; when traffic volumes would have been lower than today. Hence, transportation becomes a major sub-sector contributing to GHG emissions from fuel combustion. It is also the main source of CO, NOx and NMVOC emissions from this category.

SOLID WASTE MANAGEMENT

Before working on this report, the responsibility of Solid waste management was managed by the government. Due to the current issues of solid waste collection and management issues, the municipality of Beirut will become

a main contributor in solving this issue as a part of its responsibility, an estimated collection of 500 t/day has to be obtained.
The need for sustainable solution and sorting at source will reduce the percentage of non-recycled solid waste which needs to be embedded in a landfill.
For this reason, this report did not include the solid waste in the BEI for as it was beyond the scope of their main responsibilities.

STREET LIGHTING

The street lighting sector in Beirut city suffers from high maintenance cost and low efficiency. This is shown in the study which was conducted under the title "The Master Plan for the Organisation of Lighting in the City of Beirut" and was financed by Région Île-de-France. The study points out that the lamps in the majority of the roads are obsolete, in a condition of deterioration and suffering corroded trusses, with the absence of an aesthetic for pedestrians, with 21% references for manufacturers, in addition to 8% of non-site specific references.
Functional and technical specifications and addressed safety, with 10000 and 12000 light pillar point with 50% of the stents, are placed on interfaces on a very large comma-distance and at very high altitudes. 98% are illuminated with the high pressure sodium Site and the remainder of mercury lamps. Lighting controlled by about 375 cells present in the 375 feeder pillars, is an exaggerated tray for the size of the city in Beirut.
The study proposed the solutions, and by upgrading the street lighting data with the new technology available from the manufacturers, it would allow the plan to be executed in Beirut.

DRINKING WATER

Beirut Mount Lebanon Water Establishment (BMLWE) is the RWE responsible for the GBML area and serves a population of 2.2 million, established in 2000 through Law 221.
The BMLWE's service areas can be divided into three principal categories namely:

(i) The northern GBML;
(ii) The southern GBML;
(iii) Administrative Beirut.

The southern GBML further comprises four distribution zones (Zones A, B, C and D), housing an estimated 1.6 million people.
Water sources to the BMLWE currently include 30 springs, 157 public wells and the Shabrouh dam.
Greater Beirut receives its water from the Jeita spring (50 million m^3/year),which is the source of drinking water for about 1.5 million Lebanese, as well as fields in the Damour region (30 million m^3/year). Water is treated in the Dbayeh water treatment plant north of the city, with a capacity of 430,000m^3/day the equivalent of 157 million m^3/year.
During the six-month winter period spanning November - April, the BMLWE's springs and wells are recharged by snowmelt, precipitation and spring river discharge. Accordingly, the BMLWE delivers an average of 8 hours of water per day to the GBML region. However, during the six-month summer period, the water levels in the springs and wells sharply decrease, making the BMLWE only able to provide an average of 3 hours of water per day to its users.
The BMLWE charges users for water per flat a yearly fee of approximately 170 USD/year for 1 m^3/day of water. Despite the low levels of service delivery, BMLWE collections averaged 90% in 2013.
Besides the public network, around 1,000 mostly private wells are scattered throughout the area of Beirut. Their depth varies between 50m and 300m and their average individual discharge is 35 litres/second. Total water supply from these wells could be higher compared to the public water supply, depending on the number of hours the pumps run. Over pumping from wells in Beirut area has led to seawater intrusion into aquifers.
The government plans to tap the Awali River to the Southeast of Beirut to provide the growing capital with 90 million m^3/year of additional water, counting to more than double of the current resources. The project involves the construction of a dam at Bisri, a 3km tunnel from the river to a new water treatment plant at Ouardaniye, and a second 22 km tunnel to Khaldé south of Beirut, from where water will be transported through two twin pipelines, one going North to the centre of Beirut and the second northeast to Baabda.
The importance of regulating the water consumption in the municipality plan with monitoring will support the implementation of a national water savings subsidy programme to encourage the use of water efficient devices and water conservation.

WASTEWATER 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.

According to the report from the Ministry of Environment, there are seven wastewater outfalls flowing into the Mediterranean Sea .The wastewater treatment for Beirut administrative area is yet to be set.

1.2.6 Complementarity with Municipal Plans and other related actions

Since the Municipality Council of Beirut has been keen to protect and preserve the environment and has considered sustainable development a sacred duty for present and future generation, the council has been engaged in many programmes and developed many projects in cooperation and coordination with competent national and international parties to fulfil its responsibilities.

These parties are:

- World Bank;
- UNICEF;
- UN-Habitat;
- UN Women;
- ILLE DE France;
- The European Neighbourhood Partnership Instrument (ENPI) financially support CES-MED Programme, in which the Municipality Council part of, to face the challenges related to urban development, energy supply, and environmental management;
- The European Investment Bank under the EIB University Research Sponsorship Programme (EIBURS) that supports a research project by the ASCIMER programme (Assessing Smart City Initiatives for the Mediterranean Region)in which the city is part of as well.

All those in line with the governmental strategy which ratified the UNFCCC in 1994 and the 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.

1.2.7 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) in 1994 by virtue of Law 359, with a primary objective of achieving the stabilisation 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 our 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 focal point of the project, the Municipality of Beirut, has taken the opportunity to play a key role in supporting the city in its target for sustainability. The municipality of Beirut 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 20% 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 programme.

1.2.8 Vision for the Future: "Smart and Sustainable City"

Beirut's local authorities are providing a climate change identity card to the international community and are committed to actively participate in a comprehensive and global effort to address the challenge of climate change in parallel with the challenges of sustainable development and human well-being. The development of a Smart City Model, able to full fill its responsibilities and make changes to its infrastructure, becomes key.

Henceforth, "**Get Smarter, Live Better**" vision demands an understanding of public purposes and public interests to define a better and planned city which supports creation of livelihoods and enhancement of economic growth.

1.2.9 Organisational and Financial Aspects

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.

ADAPTATION OF ADMINISTRATIVE STRUCTURES

Beirut 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 37% 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 Beirut on track with a wide range of mitigation policies and strategies to become a pilot and sustainable, smart city. Therefore, it is essential that we act together with our partners to achieve a clean, and smart economy, resulting in sustainable living for our families, and the future generations to come.

The Municipality of Beirut provides great examples of how successful the partnership between the European Union and the local authorities of Lebanon functions. Beirut 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 the citizens. Its determination to be sustainable, environmentally friendly municipalities with broad democratic participation of their 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 the Baseline Emission Inventory

Introduction:

The methodology employed in this section shows how the Baseline Emission Inventory (BEI) will be processed along with the rules and standards for data collection. In addition to identifying the method of calculation following definite procedures and resources:

Method:

- The method used in the BEI calculation will be considered as 'standard' emission factors in line with the Intergovernmental Panel on Climate Change (IPCC) principles and comply with the 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_2 O 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).

Sectors

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

Procedures

Several procedures have been followed:

- Interview with data resources and evaluation of the available data;
- 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 are agreed on with the 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 and the 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 organisation 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 and validation of collected data;
- Checking level of accuracy and reality of collected data;
- Sorting the collected data.

Base Year

- The base year considered is 2013.

2.2 The Methodology of Calculation the Fuel Consumption for the Backup Diesel Generators

The electricity supply in Beirut is unreliable and is characterised by a daily cut-off, which accounts for around 3 hours on a daily basis. The demand on Backup Diesel Generators (BDG) use increases and becomes the main source of the city life especially during the summer.
Since the database of BDG is not comprehensive and not well-documented, the private sector is the main provider for this service and are not under any official control from the government. The municipality's role is restricted to giving advice on the positioning of generators under certain safety regulations.
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, including:

- 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 a load ratio:
www.dieselserviceandsupply.com
For example: a 250kw Generator consumes the following:

TABLE 5: 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, we need to define and assume some factors to help in calculating the GHG emission.
By consulting BDG provider and suppliers, the recommended maximum load share is 70% of the BDG capacity, for more efficient use and long term operation.
In our assumption, we will consider the 75% load ratio, which is: 13.6 Gal/hours for load of 187KW.
(One Gal = 3.78541 litres).
So, each KWh load consumption will consume 0.275 litre and the same figure had been given 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.

Knowing that, in Beirut, the only source available for data collection is the EDL. 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 residences 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 buildings can be obtained from EDL Database through daily average power consumption. It is supported by a model adapted by Ruble and Karaki 2013 which gave the daily electricity consumption of an average Lebanese household at 14.77 KWh.

For the **tertiary** sector, a similar methodology will be considered based on data obtained from the EDL**.**

2.3 Heating and Cooling power consumption BEI methodology for the residential sector

The weather in Beirut city is moderate in summer and cold in winter; the using of air-conditioning and the electrical heaters represent the majority of usage for heating. This is already covered in the EDL and BDG part.

2.4 Street Lighting Power Consumption BEI Methodology

Due to the shortage of power from EDL in daily base, the cut-off time in Beirut is 3 hours/day .Whereas, in 2013, there was no cut-off time after 6 PM. For that the calculated EDL power will be considered correct with no update.

Emission from EDL power
The EDL provided the actual power consumption in one year.
The calculation for GHG emission from power consumptions for the tertiary is as follows

$$ECO_2 = ET \times NEFE.$$

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

2.5 Tertiary BEI methodology for electricity

The EDL database can help calculating the power consumption during the EDL operation and can also 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.

2.5.1 Emissions from EDL power

The BEI methodology is the same as in Section 2.4

2.5.2 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 t CO_2-e
Fuel	Amount of Fuel of type a (Diesel) in litre consumed in a year
Eff	Emission Factor of Fuel (Diesel) in t CO_2-e/TJ Diesel = 74.1 t CO_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).*

2.5.3 Emissions from Transportation

In Beirut City, transportation accounts for a significant share for GHG emission.
The consumption data will be taken from Urban Traffic Control department in addition to the available data from previous study on Beirut city.

- 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 that will be used are:

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

The BEI methodology is the same as in Section 2.5.2

Section III: Baseline emissions inventory

3.1 BEI for Electrical Power Consumptions from EDL and BDG

In this section, we assess the effect 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%. However, the electrical supply is unreliable and characterised 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, translates into lengthy daily power cuts, has led to the gradual development of an off-grid parallel network. This network has been estimated at roughly 33% to 38% (in 2008) and about 60% by 2015 of electricity demand/consumption in Lebanon.

The electricity consumption of Beirut 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 6 shows the summary of electrical power consumption for different sectors in Beirut. The total electrical consumption for electricity from the two sources EDL and BDG is about 1984 GWh/a year in 2013, excluding the industrial sector, which represents a small amount. The BDG represents 11.5% of the total consumption. The total emission for electrification is about 1309 $MtCO_2$ in 2013, where the BDG consumes about 63 Million Litres of Diesel Oil counts for about 12.8% of total emission.

The residential sector represents the 26% of total electrification emissions; the tertiary and municipality sectors represent about 73% and 0.35% respectively.

TABLE 6 : ELECTRICAL POWER CONSUMPTION IN BEIRUT FROM EDL AND BDG FOR YEAR 2013 WITH CALCULATED GHG

Type of Load	Electrical Consumptions in KWh for			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	521,961,259	474510,235	47,451,024	13,049,031	308,432	34,837	343,269
Tertiary	1,444,199,833	1,263,674,854	180,524,979	49,644,369	821,389	132,537	953,925
Public Lighting	10,600,000	10,600,000	-	-	6,890		6,890
Municipality building	6,919,515	6,054,576	864,939	237,858	3,935	635	4,570
	1,983,680,607	1,754,839,665	**228,840,942**	**62,931,259**	**1,140,646**	**168,009**	**1,308,655**

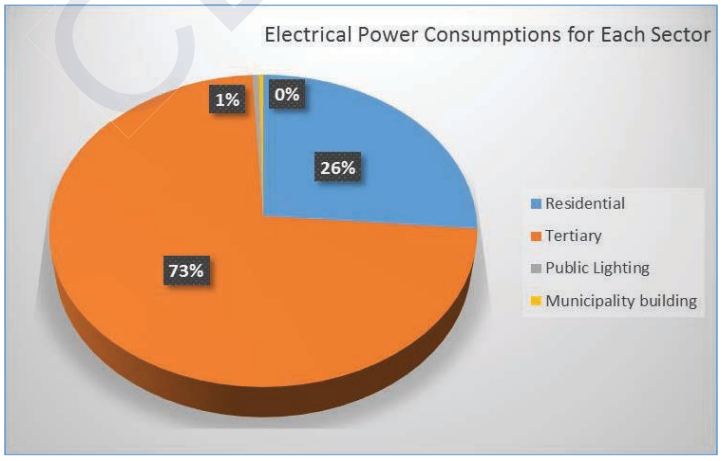


CHART 4: ELECTRIFICATION CONSUMPTION IN BEIRUT CITY

The methodologies followed for calculation:

The same methodology explained in section 2.4

The Power produced from BDG according to the actual power produced through BDG
The actual energy produced form BDG is not officially recorded. The information is obtained from BDG, which shows each KWh consumes 0.275 Litres of Diesel fuel. This information had been ascertained before in this report.

1 KWh =» 0.275 litre of Diesel.

Emission according to Gas Oil Diesel Fuel consumptions for BDG
To calculate the emission of Diesel Fuel consumption for generator, we applied two methods both of which gave almost identical results:

First method:
The following formula has been obtained from source Guide book for Covenant of Mayors for (5) p73, 62

ECO_2= Fuel x Ne x EFf / 1000.

ECO_2 Emissions of Fuel Consumption in year t CO_2

Fuel Amount of Fuel of type a (Diesel) in litre consumed in a year
Ne Conversion factor KWh/L from Table 7 (For diesel fuel 10.0KWh/L (5) p. 73)

EFf Emission Factor of Fuel (Diesel) in t CO_2 /MWh

Table 4 Gas Oil Diesel = 0.267 tCO_2-e/TJ t

Second method:
The same methodology explained in Section 2.5.2

3.2 BEI for Transportation

The continuous increase of urban population of Beirut and motorisation, together with the absence of public transport services contribute to the high traffic volumes in Beirut that has led to heavy traffic congestion.

As per the study by the Ministry of Environment in 2005, the cost of Beirut's congestion to the country's economy is substantial. It was sets about 8% of Lebanon's GDP at that time; when traffic volumes would have been lower than today. Hence, transportation becomes a major sub-sector contributing to GHG emissions from fuel combustion. It is also the main source of CO, NOx and NMVOC emissions from this category.

The table below summarises the annual consumption of fuel for transportation during the year 2013 with the calculated GHG emission in the city of Beirut, knowing that:

- **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 421.248 Million L
  Total Gas oil, diesel Consumption is 68.0448 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

TABLE 7: SUMMARY OF THE TRANSPORTATION EMISSIONS IN BEIRUT

Sector	Gasoline Fuel In litres	Emission in tCO_2/year	Diesel Fuel in Litres	Emission in tCO_2/year	Total Emission in tCO_2/year
Private Transportation cars & Trucks	421,037,050	964,512	67,951,237	181,430	1,145,941
Municipality Fleet	210,950	483	47,483	127	610
Public Transport			46,080	123	123
Total	421,248,000	964,995	68,044,800	181,680	1,146,674
		Total GHG emission for Transportation in 2013 in tCO_2			1,146,674

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 Emission in t CO_2 for Private Transportation

- Gasoline 421,037,050 L x 9.2 KWH/L x 0.249 t CO_2/MWh / 1000 to convert from KWh to MWh = 964,512 t CO_2
- Gas oil, diesel 67,951,237 L x 10 KWH/L x 0.267 t CO_2/MWh / 1000 to convert from KWh to MWh = 181,430 t CO_2

3.3 RESULTS AND SUMMARY

3.3.1 Residential Sector

The residential sector in Beirut counts for five hundred thousand inhabitants, with an estimated one hundred thousand flats. The database, provided by EDL for the power consumption of Beirut city for years 2012 & 2013 to be analysed and studied, covers the LV and MV consumptions.
The main advantage of EDL data was the perfection in setting it. The city has been divided into 59 sectors with defined load for each sector. Then each area in the city has been defined, with unique numbering given to the street and building.).

TABLE 8: EMISSION IN RESIDENTIAL SECTOR

Sector	Power Consumption in KWh	Emission in tCO^2
Residential	474,510,235	308,432
Diesel Generator	47,451,024	34,837
Total	521,961,259	343,269

The residential sector in Beirut consumes around 522GWh and produces 343 million tons of CO_2 emission for EDL and BDG, this sector represents 26% of the total city consumptions.
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).
Beirut households face three hours each day of cut-off time, for example the household which has a 30 A EDL connection will pay an average tariff of 0.094 USD per kWh; whereas, for a 10 A backup connection, the household will pay a monthly flat fee of about 200 USD amounting to an average electricity tariff between 0.40 USD and 0.46 USD per kWh (MEW, 2010b).

The BDG typically operates inside or directly abutting residential buildings, in areas characterised by a dense, vertical urban morphology with estimated power consumption 47GWh which count for emission of 34,837tCO_2.

A study made by AUB indicates that the emissions of generators, located in dense urban areas, may significantly increase the inhalation exposure to harmful substances. BDG alone accounts for 38% of the daily carcinogen exposure in one area of Beirut. This represents an increase exposure of approximately 60% over the background levels if no generators are present.

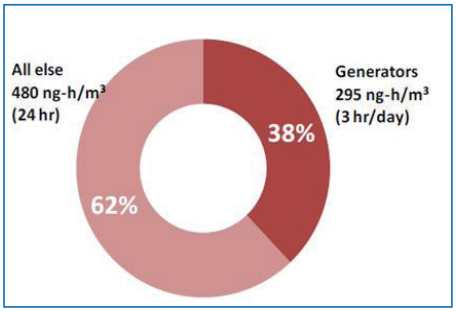


CHART 5: % OF EMISSIONS OF BDG

Summary of Residential Sector

Residential sector consumes 26% of the total energy consumption in the city and represents a key target in the city future plan to reduce energy consumption.
Knowing that Beirut city consumes:

- Around 12% of country demand for electricity;
- 41% of city electricity demands concentrating in areas less than 30% of the city area;
- 9%of Electricity demand confined to a specific sector and representing 3% of Beirut City area.

All those figures, mentioned above, raise the importance of implementing essential rules for planning the energy actions in line with converting Beirut into smart and sustainable city in the future.
In addition, to identifying the nature of the CO_2 emitter entities in the city's territory offers a significant potential to help select the actions to begin with.

3.3.2 Tertiary Sector

It is worth noting that Beirut represents the core financial, commercial, and administrative hub of the country. The city has been the home to numerous international organisations in addition to the Governmental and public administration buildings, main commercial, medical and financial centres, educational institutions and research centres.

The Port of Beirut, an important international trading station with the surrounding Arab countries, has preserved its commercial nature.
Local and international hotels, commercial malls and a wide variety of local and international restaurants are also considered the main components of the city's economy .
The tertiary sector consists of more than sixty thousands units, and consumes 73% of city power consumptions which is around 1,444 GWh for the year 2013.

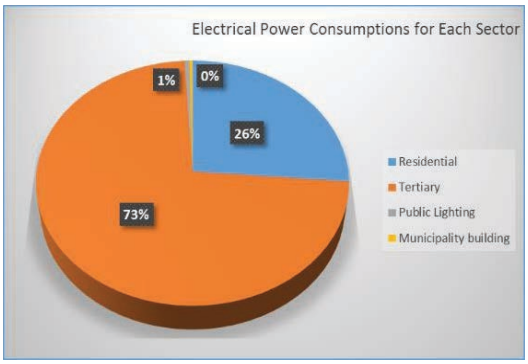


CHART 6: % OF EMISSIONS OF BEIRUT'S SECTORS

When this report was prepared, the office market in Beirut indicated 37 projects currently under construction, representing around 200 thousands square metres of office space.
The recorded power consumptions in the tertiary sector show that the commercial sector, such as shops, showrooms, and offices among others accounts for 64% for tertiary electrical consumptions, whereas hospitals account for 5%, hotels 4% and public or governmental offices, 6%.

Due to limitation in land spaces in the city and where the high demand for areas, the construction developer concentrate on the high rise building design.

Offices and commercial sector

By analysing the power consumption in offices and commercial sectors, Chart 7 explains the rise in consumption in summer and in winter which can be justified by the high demand and the usage of air conditioning systems for cooling or heating .

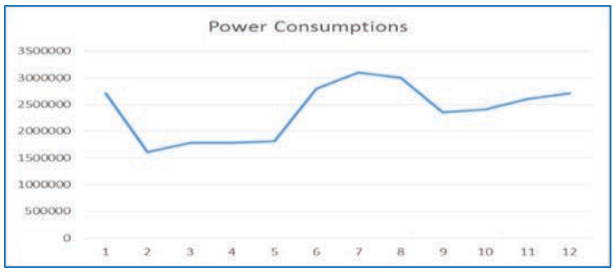


CHART 7: ELECTRICAL DEMAND DURING THE YEAR FOR OFFICES IN TERTIARY SECTOR

The graph which indicates the high demand for electricity would, on the other hand, provide an indiciation to support figuring out the suitable solution against such demands.
Solutions should be accurate and held from the design phase to the final project handover and to be continued after that in the operation phase .The key element for the rise in demand in summer and winter would be the design for cooling and heating system along with right insulation for the building and its efficiency.

The total demand is around 900 MWh /year for this segment, the highest demand been recorded for 10 months annually, which gave it priorities over all others.

Building heating insulation, passive cooling system, building orientation in addition to many other factors, like building materials and the rest, become essential elements in the design stage. But this not limited to consumption as operation and selection of appliances, efficient lighting and maintenance are another key elements in reducing the power consumption which are not monitored any more after building operation.

The main challenges that lie ahead will be critical on how to regulate the needs for sustainable building with high demand for construction and how to monitor the operation after completion.

Hospitals, Hotels and Public Offices

Hospitals, hotels and public offices departments count for around 15% of the total electricity demand. The Energy conservation and efficiency plan are so essential in these sectors.

The Hospitals count for around 3% of total consumptions. The below chart explains the EDL power consumptions in hospitals, the consumptions in summer, July and August is rated for 2.2 times the consumption in spring. This indicates the importance of actions needed in the Air-conditioning system and improving the building heating insulation.

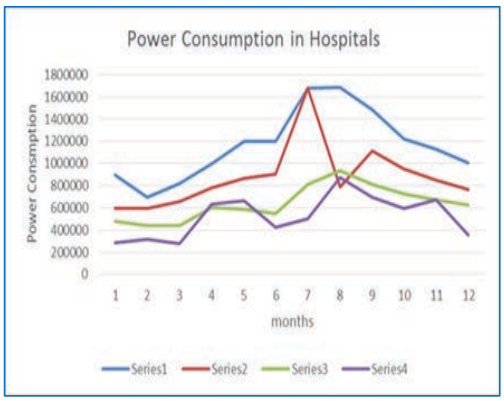


CHART 8: POWER CONSUMPTION IN HOSPITALS

The Hotel sector is in the main part of the city, comprising around 90 hotels. This sector also needs more attention as the use of rooms is seasonal and fluctuates according to the room's occupancy. Implementing a room management system, heat recovery system with high efficient lighting and occupancy lighting control will help in the reduction of the power consumption and support to the municipality action plan. Engaging the hotels in the awareness campaigns will help in improving the plan results and build up certain standard for power management in the hotel sectors where the municipality can lead the changes.

The Public offices are also another target to be approached as part of the awareness campaign, as they account for around 3 % of total consumptions. The chart below explains the variation in power consumption according to the months.

As shown, most of the consumption is in the summer time during which the Air-condition is heavily used. The importance of setting rules and regulations for Air Conditioning becomes a must.

Improving the energy efficiency, Optimum Energy, and optimising the performance of HVAC systems by 40-60%, would result in the reduction of energy usage, decrease in the operating costs, and enhancement of the occupant comfort.

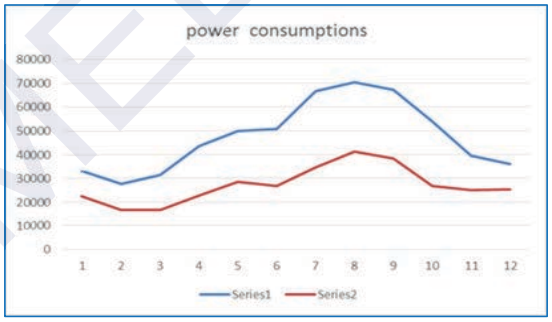


CHART 9: POWER CONSUMPTION IN PUBLIC OFFICES

Summary for Tertiary sector

The tertiary sector is responsible for 73% of electrification emissions. Without precise regulation and managed interaction from main parties, reducing the emission and reaching achievement may be limited and not well controlled. In addition, there is much work to be done on a national basis. For example, regulation of diesel generators would need certain rules, which the municipality may implement, but still there must be a need for authorities to control and monitor.

3.3.3 Municipality Buildings Sector

The municipality consumed around 7GWh in year 2013, which counts for 39% of electrification demand for the municipality. The need for power conservation and integrating a renewable energy source is essential in this sector.

3.3.4 Public Street Lighting Sector

The street lighting sector in Beirut city suffers from a high maintenance cost and low efficient lighting consumption. This is shown in the study which was conducted under the title "The master plan for the organisation of lighting in the city of Beirut" and financed by the Région Île-de-France. The study points out the lamps in the majority of the roads, with the absence of aesthetic for pedestrians with 21% references for manufacturers in addition to 8% of non-site specific references, are obsolete, in deteriorating condition and corroded trusses.

Functional and technical specifications and addressed safety with 10,000 and 12,000 light pillar point with 50% of the stents are placed on interfaces on a very large comma-distance and at very high altitudes. 98% of the lighting are high pressure sodium and the rest are of mercury lamps controlled by about 375 cells present in the 375 feeder pillars. The study proposed the solution that by upgrading the street lighting data with the new technology available from the manufacturers would allow the plan to be executed in Beirut.

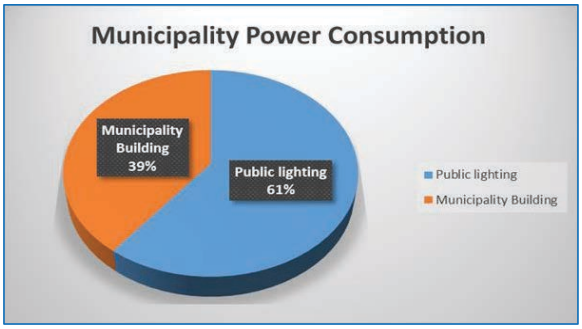


CHART 10: MUNICIPALITY POWER CONSUMPTION

3.3.5 Transportation

Introduction

Traffic volume growth

There has been tremendous increase in the number of cars used in Beirut. Motorised trips reach 1,500,000 in daily base, 50% of which are household owning one car and 25% owning two cars or more.

The following statistics show that in 1974, the car count was around 60,000 and increased to 1,200,000 cars in 2009 (Table 9). In 2002 there were 434 cars per 1,000 person.

The study on the traffic flow of the southern entrance of Beirut to that of the northern entrance (in both directions) shows the following:

- In 1998 the traffic flow on the southern entrance of Beirut (in both directions) reached 65,000 vehicles in 24 hrs to become 110,000 vehicles in 2011;
- In 1994 the daily traffic flow on the northern entrance of Beirut (both directions) was around 160,000 cars, and increased to 280,000 cars in 2011 with Annual Traffic Growth Rates for 3.25%. (CDR, may 2013)(Partners) GBA, which extends from Nahr-El-Damour south to Nahr-el-Kalb north, encloses more than 40%of the population of Lebanon.

TABLE 9: THE TRAFFIC SITUATION BETWEEN YEAR 1970 AND 2009

	1970	2009
Buses	8%	1.7%
Service Taxis	72%	18%
Private Cars	20%	80%

1.5 million of daily passenger trips estimated in 1994, is expected to reach 5 million in 2015 (MoE/UNDP/GEF, 2011).Traffic conditions in GBA can be described as mostly congested, with a daily traffic volume of 230,000 passenger-car-unit crossing the north coastal highway and 85,000 the southern highway (Afif, 2012; Waked et al., 2012) and delays at some intersections ranging from 5 to 30 minutes (MoE, 2015).

The Urban Traffic Control Department provides the following input for number of trips per one day traffic in Beirut which cover the main entrances of the city and they count for 1,089,701 /day. This covers only the administrative part of the city and doesn't include the GBA.

The first diagram below shows intersection counts for daily traffic 44,309 trips in all directions, and the other counts for 139,323 trips per day.

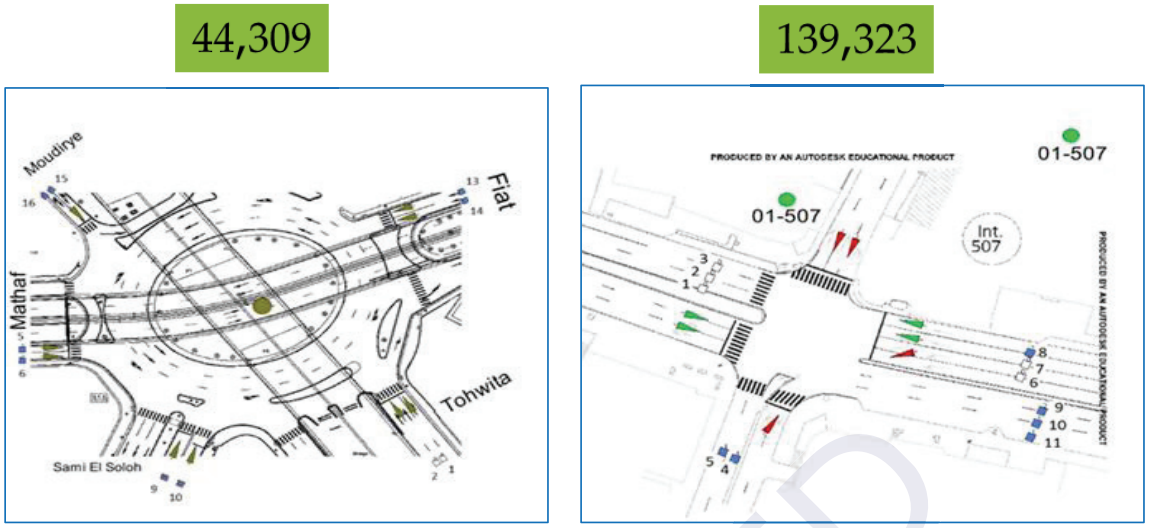


FIGURE 3: INTERSECTION COUNTS FOR DAILY TRAFFIC

TABLE 10: **INTERSECTION COUNT**

Intersection Count		
No.	Code	Count
1	01-516	63456
2	01-516b	38782
3	01-510	22214
4	01-502	32998
5	06-550	56855
6	06-509b	40065
7	02-226	52054
8	02-248	42774
9	02-250	7032
10	15-352	2638
11	15-352a	48561
12	08-365	61686
13	01-503	15258
14	01-507b	107345
15	03-211	52985
16	01-501	40107
17	BCD-24	7346
18	01-504_505	67772
19	03-200	41287
20	01-737	44309
21	01-508	40102
22	01-507	139323
23	01-506	64752
Total Count		1,089,701

Vehicle fleet overview

Number of trips per year:

According to the analysis, the daily traffic is considered 1,089,701 per day, as per adjacent table, which count for around 397,740,865 trips per year.

The trips may rise in weekends because most of the city dwellers drive to their homes in mountains. For this reason, the total average trips would be around 400 million per year.

Distance travels

According to (MoE 2011) the average trip distance is 9.6KM. Which count for 400million x 9.6Km equal to 3,840 million KM.

Distribution of cars according to number of trips

According to (MoE 2011) (MOE2006)

- Passenger cars 69%;
- Red Plat cars 15%;
- Minibuses 8%;
- Private buses 5%;
- Public buses 3%;
- Heavy Duty cars 1.7%;
- Two-Wheelers 0.3%.

The current land transportation system relies mainly on vehicles, particularly the private passenger cars that shared in 2007 around 80% of the 1.55 million vehicles of the Lebanese car fleet, as indicated below.
The rate of car ownership is estimated to be three persons per car in 2002, and the trend is to increase in the next decade with an annual rate of 1.5%.
The Lebanese vehicle fleet composition in 2007(MOE 2011) is indicated as follows:

- Passenger cars 1,247,57
- Red plate cars 47, 707
- Heavy duty vehicles 183,428
- wheelers 70,699-3/2
- Agriculture vehicles 210
- Total 1,549,616

The passenger cars fleet is old with an average age exceeding 13 years. 63% of the fleet is older than 20 years and 90% older than 10 years.

Moreover, the vehicle engine distribution shows that the fleet is mostly inefficient, since 60% of the cars have engine displacements exceeding 2.0 litres, while only 8% have engines less than 1.4 litres.

Public transport overview

Mass transport systems in Lebanon are generally characterised by being inefficient, unreliable and cost-ineffective. It relies on public and private buses, private vans and minibuses, and exclusive and shared ride taxis, operating without any coordination.
In 2002, the mass transport market share in GBA was 31%, split between modes (MoE, 2005). In 2007, the database of registered vehicles shows that the number of mass transport vehicles registered is 55,875, with 47,707 exclusive and shared taxis. Contrary to the high number of mass transport vehicles, occupancy rate of mass transport systems is low.

Driving conditions overview of passenger cars in GBA

Based on the collected data from on-road measurements in GBA through GPS survey with different drivers, the GBA driving conditions in 2011 are characterised by the following:

- 50% of total trips have a total distance lower than 5 km and 75% lower than 12 km, with an average trip distance of 9.6 km;
- 25% of stops are below 2 seconds and 75% below 10 seconds. Stop time corresponds to more than 15% of travel time.

This statistical survey reflects the low driving range in GBA with high rate of congestion and high rate of short time stops. Moreover, the speed acceleration frequency distribution shows that the acceleration rates are significant at very low speed, which result in an inefficient operation of internal combustion engines; thus leading to a high rate of fuel consumption and pollutant emissions in conventional gasoline powered vehicles. **(Source: Mansour and Zgheib, 2012)**

All these existing conditions have led the road passengers' transport sector to have high passenger transport energy intensity in 2007, estimated at 3.08 MJ/passenger-kilometre, in addition to having a high energy demand of 15.06 GJ/capita, exceeding the world average.

As a result, GBA passengers are suffering from high budget required for transport, high dependence on fossil fuels, in addition to alarming pollution rates particularly in urban areas. Therefore, road passengers' transport is a key sector for reducing the total fuel consumption and emissions of Lebanon.

The NAMA program, Nationally Appropriate Mitigation Actions (NAMAs)

The NAMA programme (NAMA), conducted a study for sample sizes (100, 400, and 100, respectively) that were distributed in Beirut, Byblos, Nabatiyeh, Saida, Tripoli, and Zahlé. The study found that the average fuel efficiency is:

- 160 km/tank (where 1 tank = 20 litres) for red plate cars manufactured pre-2000;
- 162 km/tank (where 1 tank = 20 litres) for white plate cars manufactured pre-2000;

- 175 km/tank (where 1 tank = 20 litres) for white plate cars manufactured year 2000 or newer.

The average daily distance covered is as follows:

- 152 km for red plate cars manufactured pre-2000. The number drops to 135 km if we remove those that reported that they drive 500 km or more per day;
- 37 km for white plate cars manufactured pre-2000;
- 39 km for white plate cars manufactured in year 2000 or newer.

Atmospheric Emissions of Transportation

The transportation sector is commonly known to result in significant atmospheric emissions of numerous GHG including carbon dioxide CO_2, methane CH_4, nitrous oxide N_2O, nitrogen oxides NOx, carbon monoxide CO, sulphur dioxide SO2 and non-methane volatile organic compounds NMVOC (FCCC, 1997; Faiz, 1993; TRB, 1997). Carbon dioxide emissions are by far the most significant. In Lebanon, the transportation sector contributes 25% as CO_2 equivalent of the total GHG emissions (UNDP, 1998) (M. El-Fadel a, 23 February 1999). In Lebanon, for instance, on-road vehicle emissions amount to 99% of total emissions from the transport sector (UNDP, 1998). (M. El-Fadel a, 23 February 1999). According to the municipality, the population number in Beirut city is estimated to be 500,000 in 20 Km^2 which is an extremely high population density.

Summary of Transportation Sector:

The following report indicates the Baseline emission inventory for the city of Beirut. CO_2 is the primary greenhouse gas emitted through human activities. In 2013, CO_2 emission accounted for a total of 2.46 million t CO_2 for an area of 20 Km^2 with an approximate 500,000 inhabitants. This amount of emission comes from two main sources consuming:

- 1.33 million t CO_2 for electrification
- 1.13 million t CO_2 for transportation

In addition to the municipality fleets consumption counting 578 litres of gasoline daily.
The cost of Beirut's congestion to the country's economy is substantial. It sets about 8 % of Lebanon's GDP, making the transportation sector a main source for CO_2 emission in large scale.
In 2005, the Lebanese State, in partnership with the World Bank, launched an Urban Transport Development Project (UTDP) that sets an action plan with four priorities:

1. Construction of infrastructure facilities on main thoroughfares: uneven crossings and crossroads;
2. Control system and traffic management through the establishment of a network of surveillance cameras and traffic signals. All these equipment are connected to the TMC that charge;
3. Parking management by the implementation of parking meters. Parking management returns to the TMO, but installation and maintenance of machines are managed by two private operators. More importantly, a reduction of 30% of parking rules violations was observed between 2008 and 2011;
4. Technical assistance for transport planning, for longer term operation, including the promotion of public transport.

The current situation reveals that congestion is still growing and is getting worse due to the absence of totalise vision for the city. The last UTDP was made fifteen years ago with no current updates made or followed. So several studies have been completed or are underway to propose solutions to revitalise public transport in Beirut.

Among these future plans:

- Implementing an integrated public transport system and a policy of effective circulation;
- Establishment of a clear system of governance in the field of urban planning as priority action
- Establishment of an institution with sufficient resources to implement a policy of sustainable transport. Its role is to rehabilitate public transport and improve the conditions for the use of motorised transport modes in order to decongest the Greater Beirut;
- Studying the behavior of the citizen in order to better judgment of the usage of public transportation;
- Making the service in public transportation at a level which encourages its use as the current situation for the private transportation looks week and doesn't encourage citizen to use it.

It is obvious that public transportation in the city suffers from the lack of plans to upgrade it and the shortage of new urban traffic plans, thus making this sector a main issue in the city.

Section IV: BAU Scenario

Beirut consumes 6,539,611 MWh/y as counted in year 2013 which corresponds to 8,305,306 MWh/year in 2020, according to JRC expectation in line with the BAU scenario for Lebanon if no action has been applied. Though this 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 Beirut.

TABLE 11: ENERGY CONSUMPTIONS IN BEIRUT WITH BAU 2020

	Energy Consumptions in MWh/year	
BUILDINGS,EQUIPMENT/FACILITIES &TRANSPORTAION	**Base 2013**	**2020 as BAU**
Municipal buildings, equipment/facilities	6,920	8,788
Tertiary (non-municipal) buildings, equipment/facilities	1,444,200	1,834,134
Residential buildings	521,961	662,890
Municipal public lighting	10,600	13,462
Municipal fleet	2,416	3,068
Public transport	461	585
Private and commercial transport	4,555,929	5,786,030
Total	6,539,611	8,308,957

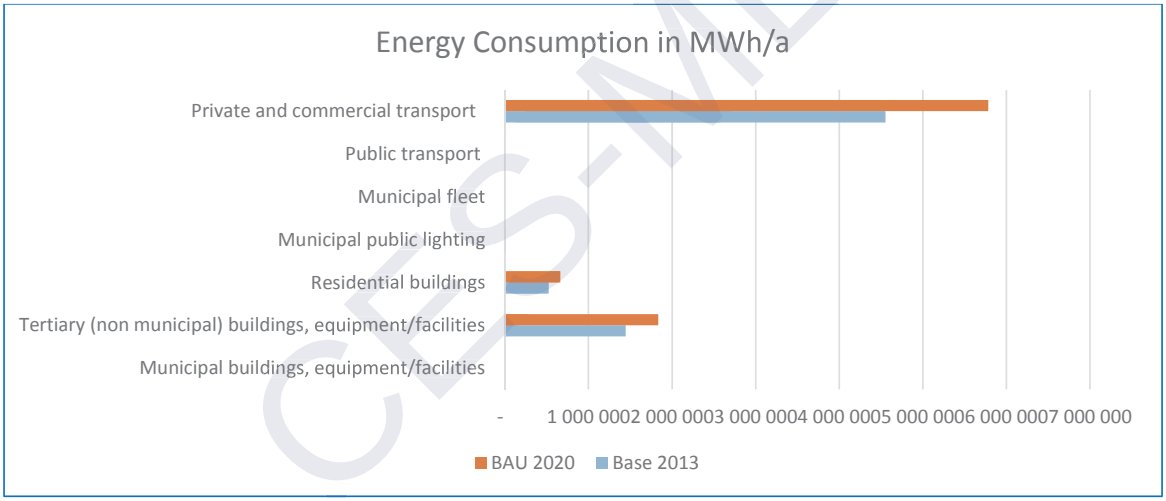


CHART 11 : ENERGY CONSUMPTIONS IN BEIRUT WITH BAU 2020

The corresponding GHG emission for the energy consumption of 2,455,329 t CO_2 (2013) and it is expected to reach 3,118,268 t CO_2 by 2020.Without applying any actions in energy conservation or increasing renewable energy sources, the emission per person will be 4.9 t CO_2/year.

TABLE 12 : GHG EMISSION FOR THE ENERGY CONSUMPTIONS WITH BAU

	Emissions in t CO_2	
BUILDINGS,EQUIPMENT/FACILITIES& TRANSPORTAION	**Base 2013**	**2020 as BAU**
Municipal buildings, equipment/facilities	4,570	5,804
Tertiary (non-municipal) buildings, equipment/facilities	953,925	1,211,485
Residential buildings	343,269	435,952
Municipal public lighting	6,890	8,750
Municipal fleet	610	775
Public transport	123	156
Private and commercial transport	1,145,942	1,455,346
Total	**2,455,329**	**3,118,268**

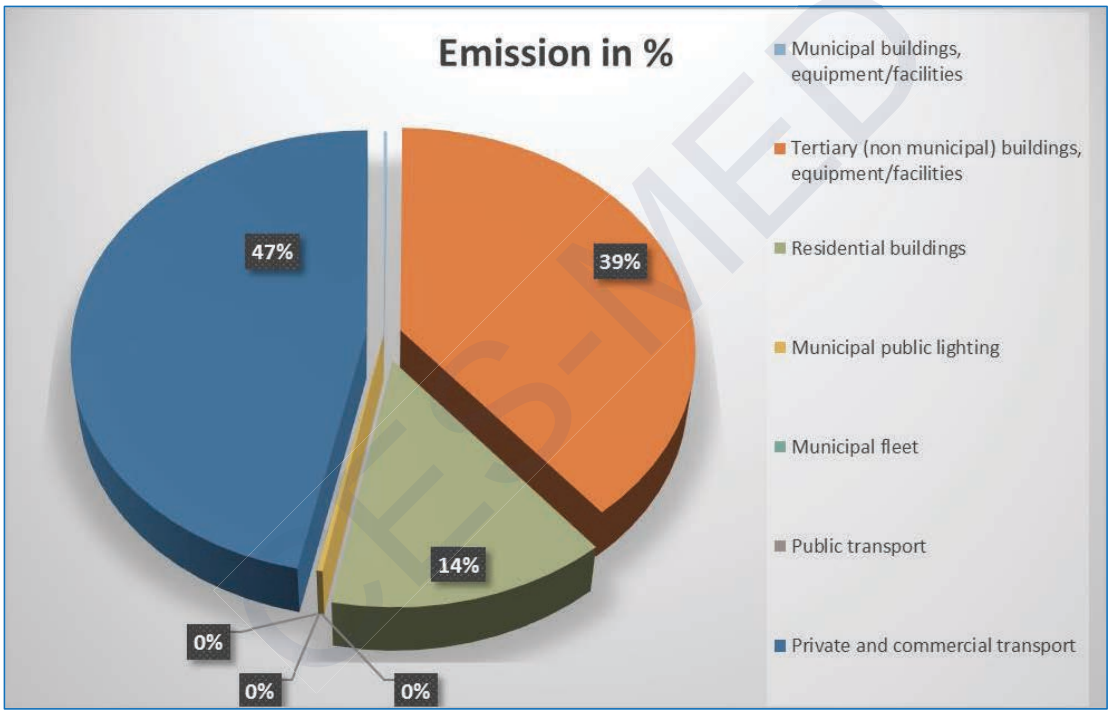
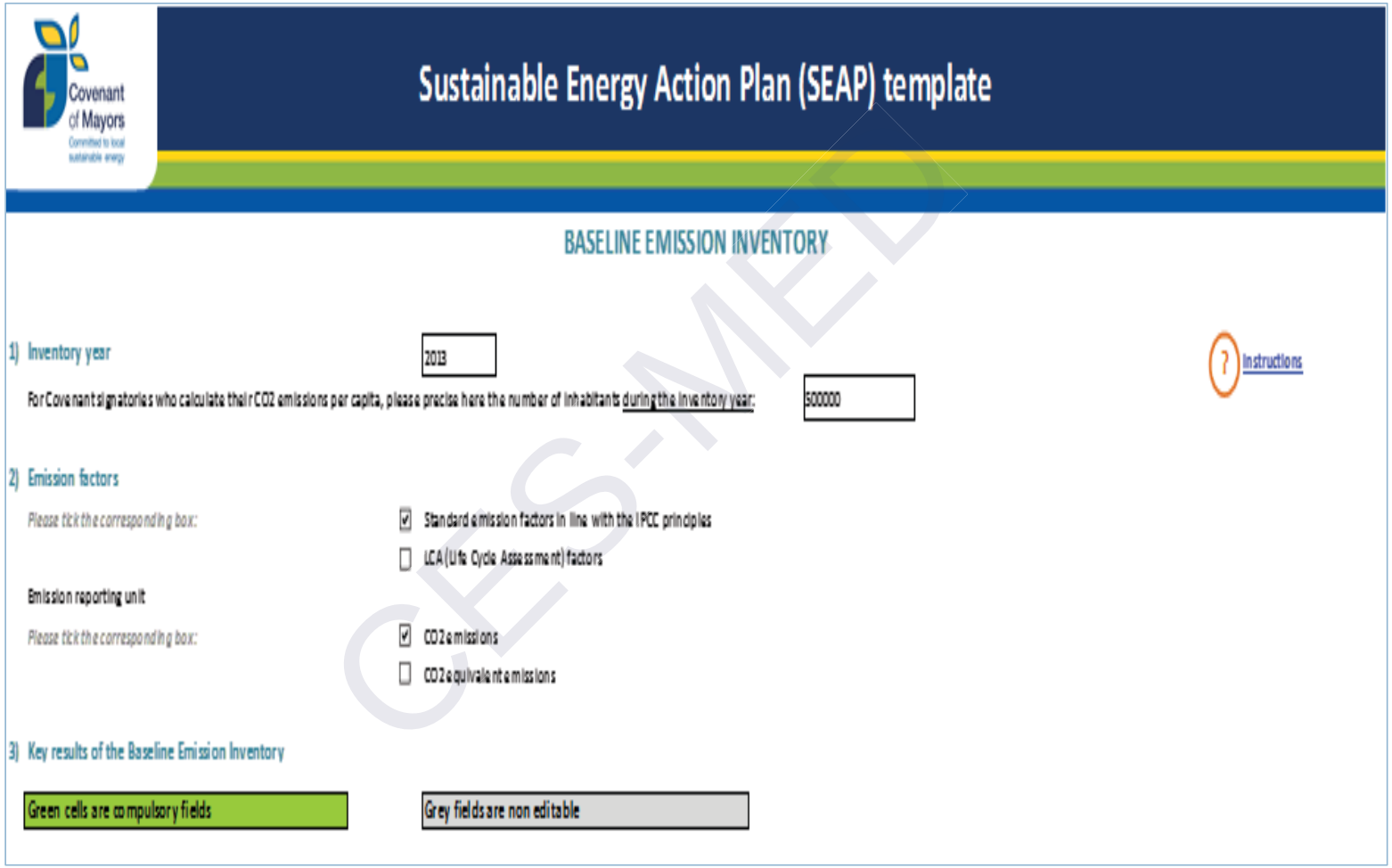


CHART 12 : PERCENTAGE OF GHG EMISSION FOR THE ENERGY CONSUMPTION OF EACH SECTOR IN THE CITY

TABLE 13 : 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

? Instructions

For Covenant signatories who calculate their CO2 emissions per capita, please precise here the number of inhabitants during the inventory year: 500000

2) Emission factors

Please tick the corresponding box:

- [x] Standard emission factors in line with the IPCC principles
- [ ] LCA (Life Cycle Assessment) factors

Emission reporting unit

Please tick the corresponding box:

- [x] CO2 emissions
- [ ] CO2 equivalent emissions

3) Key results of the Baseline Emission Inventory

Green cells are compulsory fields

Grey fields are non editable

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	6920															6920
Tertiary (non municipal) buildings, equipment/facilities	1444200															1444200
Residential buildings	521961															521961
Municipal public lighting	10600															10600
Industries (excluding industries involved in the EU Emission trading scheme - ETS)																
Subtotal buildings, equipments/facilities and industries	1983681															1983681
TRANSPORT:																
Municipal fleet						474.83	1940.74									2415.57
Public transport						460.8	0									460.8
Private and commercial transport						679512.37	3873541									4553053.23
Subtotal transport						680448	3875482									4555929.6
Total	1983681					680448	3875482									6539610.6

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	4570															4570
Tertiary (non municipal) buildings, equipement/facilities	953925															953925
Residential buildings	343269															343269
Municipal public lighting	6890															6890
Industries (excluding industries involved in the EU Emission trading scheme - ETS)																
Subtotal buildings, equipments/facilities and industries	1308654															1308654
TRANSPORT:																
Municipal fleet						127	483									610
Public transport						123										123
Private and commercial transport						181430	964512									1145942
Subtotal transport						181680	964995									1146675
OTHER:																
Waste management																
Waste water management																
Please specify here your other emissions																
Total	1308654					181680	964995									2455329

Corresponding CO2-emission factors in [t/MWh]	0.66					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 Beirut manages an area of around 20 Km². The energy consumption for the municipality building and facilities is 6.9 GWh/y. The total number of municipal facilities counts for more than sixteen. These facilities include:

- Governorate building;
- Financial building;
- Traffic Department and Supplies Department;
- Garage Department;
- Fire Brigade in two locations in the stadium and Karantina;
- Guard's regiment;
- Department of Public Works honest;
- Public health, which spread over three sites, Sabra and Alga neighbourhood dispensaries;
- Slaughterhouse (old);
- Temporary slaughterhouse;
- Municipal stadium.

In addition to other places which are rented ones such as chartered financial interest, engineering department, health department, bridges and tunnels.
The estimated total power consumptions recorded by EDL only is mentioned below:

TABLE 14 : POWER CONSUMPTION IN BEIRUT AREAS RECORDED BY EDL 2013

Area	Location	KWh
Marfaa	Majidiye	969,760
Zokak El Blat	Serail	137,031
Bachoura	Basta Tahta	18,698
Moussaytbeh	Dar AlFatwa	172,576
Mazraa	Mal'ab	213,884
	Tariq El Jeddide	77,959
Remeil	Hopital Orthodoxe	20,920
	Qobyat	583,923
Al Mdawar	Mar Mikhael	47,234
	Al Khodr	13,213
	Al Jisr	61,810
General	MV	3,737,568
Total		**6,054,576**

TABLE 15: GHG EMISSION FOR ELECTRIFICATION IN BEIRUT FOR YEAR 2013

Type of Load	Electrical Consumptions in KWh for			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	521,961,259	474510,235	47,451,024	13,049,031	308,432	34,837	343,269
Tertiary	1,444,199,833	1,263,674,854	180,524,979	49,644,369	821,389	132,537	953,925
Public Lighting	10,600,000	10,600,000	-	-	6,890		6,890
Municipal buildings	6,919,515	6,054,576	864,939	237,858	3,935	635	4,570
	1,983,680,607	1,754,839,665	**228,840,942**	**62,931,259**	**1,140,646**	**168,009**	**1,308,655**

The municipal buildings represent a key element in the implementation of the 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 to show 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 building had conventional lighting, and the usage of high efficient light has not been identified yet in the design study of the building. This issue raises the importance of replacing lamps with high efficient ones when the lamps reach the end of their life.

-Using a 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 PC and monitors on when they are out of office and turn off the air-conditioning or other electrical equipment or appliances.
-Identifying the set temperature for air-conditioning cooling and heating that will help reduce electricity consumption.
-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 the SEAP implementation plan.
-Installing a 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.

5.1.2 SHORT TERM ACTION

The stakeholders monitor the measures and actions for sustainable energy action plan implemented by the municipality in their facilities. The proposed short term actions for energy saving process are indicated as follows:

- **Set up SEAP Unit inside the municipality**.

With the absence of transportation plan and the state's role in finding solutions particularly in sloid waste crisis, the municipality encounters a set of challenges in traffic jam, water shortage and power outage, thus causing loss in investment opportunities and economic motivation.
The municipality does not have the basic components to withstand these challenges in light of the limited technical capacities, and limited capability to keep up with the urgent needs of the city.
The creation of a special unit within the municipality is essential to develop and monitor the implementation of the actions and supplement the municipality tenets in developing solutions to cope with the implementation of the Action Plan, and keep pace with the pressing needs through prior plans.

- **Conduct energy auditing for municipality building and facilities**

The energy auditing for municipality building will allow for proper evaluation of energy consumption and target the process for action to mitigate the energy consumptions. This action is applied for all municipality buildings.

- **Social Media promotion plan**

Setting up a social media plan for SEAP implementation is a core element for the plan. It helps keep pace, monitor the impressions, address failures and provide the main impetus for the success of the plan.

- **Energy saving instruction in the municipality facilities**

The municipality manages many facilities within its territories which consume a lot of energy, thus the plan for reducing the energy in those facilities becomes essential. Such actions should fall in general SEAP goals.
Implement Energy Saving Instruction 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;
- Utilise 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;
- Minimise the usage of printing as possible.

❖ **Awareness and Training Campaign for the municipality staff**

Conduct Awareness and Training Campaign for the municipality staff. This should include the representative of NGOs of the local community in order to increase the municipality capacity in the implementation of sustainable energy action plan. Raising awareness and holding training campaigns will be achieved through various and successive steps. The expectation for reduction in power consumption will vary according to the effectiveness of municipality staff behaviour, the monitoring tools and awareness campaigns. All of that will be well monitored and followed in regular base by the SEAP unit. Thus, setting the incentives and appreciation are fundamental in this endeavour.

❖ **Convert the municipality building A to green building**

a) REPLACING THE LAMPS WITH MORE EFFICIENT ONE

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. This process will count for 50% in power reduction for the lighting.

b) ENERGY MANAGEMENT

The motion lighting sensors will also support the mitigation of energy, as it will help in insuring the cut off of lights when no one is present.

C) ENERGY SAVING FOR AIR-CONDITION UNITS

Air-conditions 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 with Rated A+++ would be a good solution to be implemented by the end of the life cycle of the existing units.

5.1.3 LONG TERM ACTION

In the short term phase, the municipality would have the SEAP unit setup completed. Also the procurements department had also started processing the work in line with the municipality policy to mitigate the GHG emission and reduce the energy bill.
The municipality employees, through the short term phase, will expertise the approach being implemented in observing the reduction in consumption as a goal to be achieved.
At a second phase, with long term actions, the municipality will continue the instructions being implemented in the first phase and will support it with additional actions to achieve the final target, the reduction of power consumptions.

1. **Convert the municipality building B to a green building**
   - Replacing the lamps with more efficient ones;
   - Energy management;
   - Energy saving for air conditioning units.
2. **Convert the municipality building C to green building**
   - Replacing the lamps with more efficient ones;
   - Energy management;
   - Energy saving for air conditioning units
3. **Convert the municipality building D to green building**
   - Replacing the lamps with more efficient ones;
   - Energy management;
   - Energy saving for air conditioning units

5.1.4 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 a 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.The green procurement would also be promoted in local schools, central library and other local municipality or governor offices as possible. The expected results for such action would be an estimated reduction in around 3% in future increased demand. This figure is not actual but estimated where later measures will be given better estimation.

5.1.5 EXPECTED REDUCTION IN CONSUMPTIONS FOR SHORT & LONG TERM ACTIONS

TABLE 16 : EXPECTED REDUCTION IN CONSUMPTIONS FOR MUNICIPLAITY BUILDING IN SHORT & LONG TERM ACTIONS

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 BUILDING			**8,788**	**5,804**	**2459**	**1624**	**0.0521%**	**667,600**
Short Term Action	1	Set up SEAP Unit inside the municipality						201,600
	2	Conduct energy auditing for municipality building and facilities						40,000
	3	Social media promotion plan						10,000
	4	Energy saving instruction in the municipality facilities			88	58	0.002%	1,000
	5	Awareness and Training Campaign for the municipality staff			88	58	0.002%	5,000
	6	Convert the municipality building A to green building			527	348	0.011%	100,000
Long Term Action	7	Convert the municipality building B to green building			527	348	0.011%	100,000
	8	Convert the municipality building C to green building			527	348	0.011%	100,000
	9	Convert the municipality building D to green building			527	348	0.011%	100,000
	10	Public Procurements of Products and Services			175	116	0.004%	10,000

5.1.6 FINANCIAL ANALYSIS AND PROPOSAL SOLUTION

TABLE 17: FINANCIAL ANALYSIS AND PROPOSAL SOLUTION FOR MUNICIPALITY BUILDING

Local or Outsource Finance		Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%		0%	100%	4.50%	10
Fixed Financial amortisation costs				Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)		EUR 58,902	/year	EUR 589,024	EUR 466,000
Annual revenues in EUR	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(3 years) in €	PPA Tariff
565,570	57%	2,459	2 YEARS	470,101	EUR 0.23/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

The calculation considered without the SEAP unit as it serve all the SEAP actions.

5.2 WATER SUPPLY

The city of Beirut suffers from a shortage in water supply due to the increased pressure on water consumption, limited water resources, old infrastructure and a scarcity of rainfall. The municipality is trying to identify additional water resources to balance the supply with the demand.
According to World Bank report:
"*The water situation is particularly bad in the hot summer months. The problem is caused by the fact that there are only a few places to store water. Also, too much of the country's potentially drinkable water flows out to the Mediterranean. And these problems are coupled with growing demand and an old and leaky system of pipes and reservoirs.*
If Lebanon does not upgrade its water network, experts warn there could be chronic water shortages in the country as soon as 2020 .Economists figure that the lack of reliable water costs the country about $433 million in US dollars every year. And the environmental impact caused by the discharge of untreated sewer water is estimated at around 190 million USD. So the old and outdated water supply system ends up costing the country growth. In addition, there's the cost to individual families, many of whom can't afford the high price of private water.
Finally, because most households aren't metered, people aren't charged for what they actually use. So there's no incentive to save water (when there's plenty of it). So the current water supply system is inefficient by almost every standard". (Bank, n.d.).
The water supply in Beirut managed by Establishment of the Water for Beirut & Mount Lebanon (EBML), though the municipality have no role in managing the supply or distribution of water in the city. It is important for the municipality to take the initiative to regulate the water consumption in the city and monitor for leaks in the water supply to support the maintenance department in EBML. Also it would be good to push for installing water meters in the main city feeders, as well as the branches to monitor the supply and had prior alert for any leak in water.
Also to look for monitor the end users demand in order to manage better the demand.

5.2.1 SHORT TERM ACTION

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

- **Changing behavioural** Is important, so conduct awareness campaign to enhance the water conservation and regulate the consumption of water in the city will be an important step to increase the city capacity and push for more conservative behavioural related to water and could be pointed to different sector in the city, the following sectors are proposed to start with and may be other can be developed later on when action being planned in details.
  - **Schools:** The municipality of Beirut with the coordination with the Ministry of Education and Higher Education and with support from expert in communication, water management and NGO's can organise educational workshops for the school teachers within Beirut City, to enhance their know how and knowledge in water conservation supported with methods, tools and behaviour change and provide them with tools for demonstration and if possible short movies to support their work in converting what they had learned to the students in the schools. This action should allow to send the messages directly and could be repeated for in different years.
  - **Public Events**: Also the municipality could utilise the yearly events which held in Beirut to send a message to the people, this can be done by collaborate with communication and water experts and supported with NGO's.
  - **Billboards**: The municipality permit many Billboards, and they can take the advantage of this to display announcements or advertising related to the water conservation. This will require support from communication and water experts and could be supported by NGO's.

Others: in addition other ideas or ways can be developed at time of preparation for this action.

- **Recycle water:** The recycle of greywater, "*Greywater is gently used water from your bathroom sinks, showers, tubs, and washing machines. It is not water that has come into contact with faeces*". Reusing greywater in toilet bowls (flush toilet), or irrigation reconnects urban residents and backyard gardens. A basic greywater system utilises the source of the greywater (i.e. tubs, sinks and washing machines), a collection plumbing to move the separated greywater to a surge tank, a filter and a pump for said collection tank, and distribution plumbing to move the water to special tanks which are connected with the flushing of toilets in the building.
  Applying new city code as a roles for the new licensed buildings to use the recycling of Greywater would contribute to the water conservation in the city. This action need to conduct technical workshop for the concerned engineers in the city along with the Order of Engineering in Beirut and concerned municipality staff of Engineers along with specialist companies in this field, to create specific new rules in the recycling of greywater and applying the right mechanism to ensure proper monitoring and maintenance with the implementation.
- **Conduct routine maintenance** and check the water leak in main feeder piping, this can be achieved with proper coordination with the Establishment of the Water for Beirut & Mount Lebanon (EBML) and the Ministry of Energy and Water. This could rescue the loss of water by 30%.
- **Install water meters on the main water supply and main branches** to monitor water consumptions, this could be done with the coordination of the Establishment of the Water for Beirut & Mount Lebanon (EBML) and the Ministry of Energy and Water in order to obtain actual demand of the city sectors and enhance the plans for better maintenance and look for solutions for the city future plans related to the water supply.

5.2.2 LONG TERM ACTION

- Install water meters for each user with remote reading system.
  The feedback information which shows the actual consumption is required. It is not necessary to start billing for water, but knowing where water has been highly consumed is essential to start fixing it.
  This need to be developed and cannot be estimated. Also, the role for municipality is limited however action should be taken with collaboration with the responsible concerned governorate department (EBML)

5.2.3 EXPECTED REDUCTION IN ENERGY CONSUMPTION

The direct effect of water supply to the mitigation of emission is maintained through the reduction of water tanks movement in the city, which can be estimated as number of trips for water tanks.
Each building in Beirut will consume an average of one tank per week. Counting for around 20,000 buildings in an average 7 km distance around three months, then the trips of water tanks will count for 1,680,000 km.
The average fuel efficiency of the fleets was 40 L /100 km and this count for 672,000 L of Diesel fuel.
With estimated reduction in emission by 1,794 t CO_2 equal to 0.058 % of total city emissions for BAU.

TABLE 18 : EXPECTED REDUCTION IN ENERGY CONSUMPTION FOR WATER SUPPLY

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					**6720**	**1794**	**0.058%**	**220,000**
Short Term Action	11	Awareness campaign						150,000
	12	Apply new role for recycling water in building and reuse it						20,000
	13	Routine maintenance						50,000
	14	Install water meters in main feeders and main branches	This need to be developed and cannot be estimated also the role for municipality is limited however action should be taken with collaboration with the responsible concerned governorate department (EBML)					
Long Term Action	15	Install water meter for each users with remote reading system	This need to be developed and cannot be estimated also the role for municipality is limited however action should be taken with collaboration with the responsible concerned governorate department (EBML)					

5.2.4 FINANCIAL ANALYSE AND PROPOSAL SOLUTION

The NPV is negative as 90% of the actions are defined as infrastructure. A governmental establishment for water in Beirut & Mount Lebanon is officially responsible to provide water to the city. The municipality cannot stay silent without taking the initiative to look for solutions to handle the increase in water demand against the reduction in water supply. The reduction is expected to reach 50% by year 2020 according to the official reports.

TABLE 19 : FINANCIAL ANALYSE AND PROPOSAL SOLUTION FOR WATER SUPPLY

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

5.3 WASTE WATER TREATMENT

One of the city's barriers for wastewater treatment is the lack of implementing the project.
The estimated outfalls in Beirut into the Mediterranean Sea are around seven according to CDR report in year 2000; however, the main problem is still not completely solved.
There must be well- planned and sustainable actions in order to overcome the main issue in treating wastewater without affecting the city knowing that its demography is increasing.
The regulation of water supply will reduce part of the effect, but still there is a need to sort out the main issue either in increasing the treatment plant capacity or by building a new treatment plant for the city.

5.3.1 SHORT TERM ACTION

- Update the municipality policy to include a standalone water treatment plant in every new construction;
- Include a new construction in the reuse of treated water to feed the flush water supply in separate piping. This could save 30% of the supply and reduce waste water by 30%;
- Build an infrastructure for wastewater management. This action will aim to build up the total network which the city needs in order to connect the wastewater to the main treatment plant.

5.3.2 LONG TERM ACTION

Install two or three waste water treatment plants depending on the city's demand. This has to be prepared by a specialised consultant.
The estimated cost for these actions is defined below:

TABLE 20 : ESTIMATED COST FOR SHORT & LONG ACTIONS OF 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		
WASTE WATER TREATMENT								
Short Term Action	16	Update the municipality Policy.	This need to be developed and cannot be estimated also the role for municipality is limited however action should be taken with collaboration with the concerned responsible governorate department					
Long Term Action	17	Infrastructure for Waste Water treatment.						

5.4 SOLID WASTE MANAGEMENT

5.4.1 OVERVIEW

In 2013, Beirut had a population of 500,000 people producing 182,500 tons of Municipal Solid Waste per year with an estimated production of 500 t /day.
The solid waste collection and sorting in Beirut was managed by SUKLINE before its work stopped by the end of 2015. The municipality suffered from a lack of consistent solid waste disposal as many other cities in Lebanon due to this suspension, and this has become a national problem extending until 2016.
Effective management by the municipality begins at sorting at the source and reducing the demand on non-recycled materials. Creating such a sustainable system can benefit not only the municipality, but also the local community and the environment.

5.4.2 SHORT TERM ACTION

The short term action proposes a smart waste collection method. It focuses on changing behaviour in the management of solid waste and moving on to smarter ways 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; whereas, paper, cardboard, glass, metal, and plastics can be stored for days.
The short term action would be accomplished by:

- Creating solid waste plan for sorting from source for Beirut city, and developing waste strategy plan with waste management plan in order to overcome the high cost in collection and transportation;
- Conducting awareness campaign on solid waste sorting to ensure capacity development and enhance public awareness;
- Upgrading the local laws to ensure the maximum recycled materials to be used in the city;
- Upgrading the existing waste treatment plant to increase the efficiency of sorting to reach maximum 10% non-recycling part.

5.4.3 LONG TERM ACTION

Implementation Phase for the plan according to the city sector:

- Start implementing the plan for city sorting with selected sectors in the city 1 to 10;
- Start implementing the plan for city sorting with selected sectors in the city 11 to 20;
- Start implementing the plan for city sorting with selected sectors in the city 21 to 30;
- Start implementing the plan for city sorting with selected sectors in the city 31 to 40;
- Start implementing the plan for city sorting with selected sectors in the city 41 to 50;
- Start implementing the plan for city sorting with selected sectors in the city 51 to 60.

5.4.4 EXPECTED REDUCTION IN ENERGY CONSUMPTION

TABLE 21 : KEY ACTIONS OF SOLID WASTE 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		
SOLID WASTE MANAGEMENT					**1038**	**280.2**	**0.009%**	
Short Term Action	18	Create solid waste plan for sorting from source for Beirut city	This need to be developed and cannot be estimated also the role for municipality is limited, however, action should be taken in collaboration with the responsible concerned governorate department.					
	19	Awareness campaign on solid waste sorting						
	20	Upgrade the local laws to insure the maximum recycle material to be used in the city						
	21	upgrade the existing waste treatment plant to increase the efficiency of						

		sorting to reach maximum 10% non-recycling part					
Long Term Action	22	Start implementing the plan for city sorting with selected sectors in the city 1 to 10	This need to be developed and cannot be estimated also the role for municipality is limited however action should be taken with collaboration with the responsible concerned governorate department	173	46.7	0.0015%	
	23	Start implementing the plan for city sorting with selected sectors in the city 11 to 20		173	46.7	0.0015%	
	24	Start implementing the plan for city sorting with selected sectors in the city 21 to 30		173	46.7	0.0015%	
	25	Start implementing the plan for city sorting with selected sectors in the city 31 to 40		173	46.7	0.0015%	
	26	Start implementing the plan for city sorting with selected sectors in the city 41 to 50		173	46.7	0.0015%	
	27	Start implementing the plan for city sorting with selected sectors in the city 51 to 60		173	46.7	0.0015%	

5.4.5 Financial Analyse and Proposal Solution

The actions are part of building the infrastructure base for the solid waste collection and management, where the base for calculation was not part of the municipality's responsibility, but it was part of a national responsibility and management. The NPV is negative.
The time schedule of the short and the long term actions for the treatment of solid waste are tabulated below:

TABLE 22 : THE TIME SCHEDULE OF THE SHORT AND THE LONG TERM ACTIONS FOR THE SOLID WASTE TREATMENT

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

5.5 PUBLIC STREET LIGHTING

5.5.1 OVERVIEW

The street lighting sector in Beirut city suffers from high maintenance cost and low efficient lighting consumptions. This is shown in the study which was conducted under the title *"The Master Plan for the Organisation of Lighting in the City of Beirut" and financed by Région Île-de-France".* The study points out the lamps in the majority of the roads are obsolete, in deteriorating conditions and suffer corroded trusses, with the absence of aesthetic for pedestrians with 21% references for manufacturers in addition to 8% of non-site specific references. Functional and technical specifications and addressed safety with 10,000 and 12,000 light pillar point with 50% of the stents are placed on interfaces on a very large comma-distance and at very high altitudes. 98% of the high pressure sodium site illuminates it and the rest of mercury. Lighting controlled by about 375 cells present in the 375 feeder pillars, which is an exaggerated tray for the size of the city in Beirut. The study proposed the solutions. By upgrading the street lighting data with the new technology available from the manufacturers, this would allow the plan to be executed in Beirut.
The mitigation for GHG emission in public street lighting becomes essential with the increase in power demand. Applying a smart managing for this sector would help in reducing power consumption and maintenance cost.

5.5.1.1 LIGHT SOURCE

In Beirut, like other city in Lebanon, the High Pressure Sodium (HPS) lamps have been the conventional means of illuminating roadways and various public spaces for decades.
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 capable of producing a better quality white light with less energy consumption than HPS. 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 the 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 programmes 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 are 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.

5.5.1.2 ASTRONOMIC TIMER

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

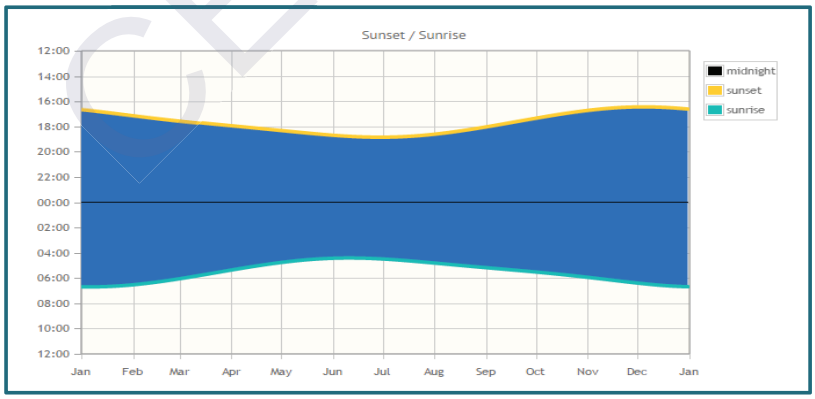


CHART 13 : EXPLAIN THE TIMING FOR SUNSET AND SUNRISE

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.
In Beirut there are 375 feeder pillars which control the 17000 street lights through photocells. Replacing 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 lamps, 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 an internal timer. It can dim the lights for 6 hours daily to 50% at midnight as shown on the chart below.
Although it could produce saving in power for around 25% reduction in power consumption, 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 at the time of writing the report.

The **second scenario** is to have a central control and monitoring system for all 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 the Beirut situation.

FIGURE 4: DIMMING SCHEDULE ONE

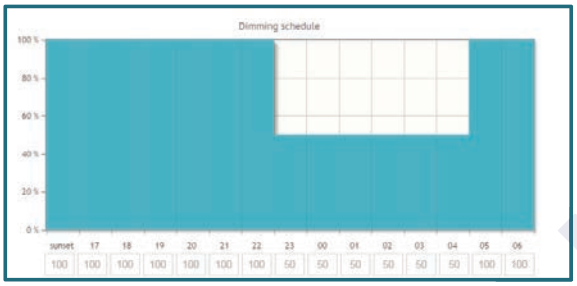
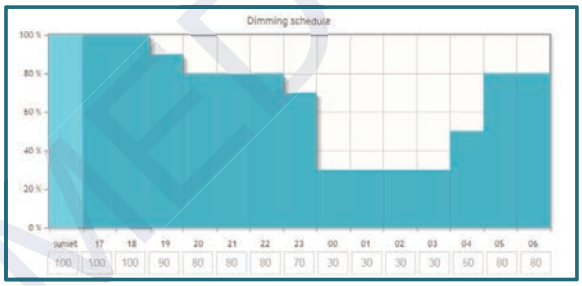


FIGURE 5: DIMMING SCHEDULE TWO



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 375 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 OVERALL PLAN

In the short term, the master plan had been completed for the city through the previous study financed by Région Île-de-France and approved by the municipality council through a well-defined vision. The next step is to conduct the working drawing and tendering documents for the project, and start implementing it in different phases. The

basic measures for consumptions and monitoring process will be established in order to monitor the achievements made with the implementation of these actions.
The core of the action will be establishing the public street lighting unit (PSLU) inside the municipality which will be responsible for carrying out the city vision, with actions in its various stages.
This unit will enhance the municipality capacity and capability to monitor the implementation and insure compliance with the city's vision. It will also insure smooth implementation and integration of the plan with municipality work.
The next step will be the preparation of the design drawing for execution of the work according to successive phases. In the first phase, it will set the baseline for actual consumptions in the city in order to monitor the results and achievement in the followed phases. The second phase will be the execution of the plan in selected sectors of the city according to the priorities and site's needs. In all phases, the PSLU will be able to monitor the results and update the plan for the next phases to match the total vision of the city.

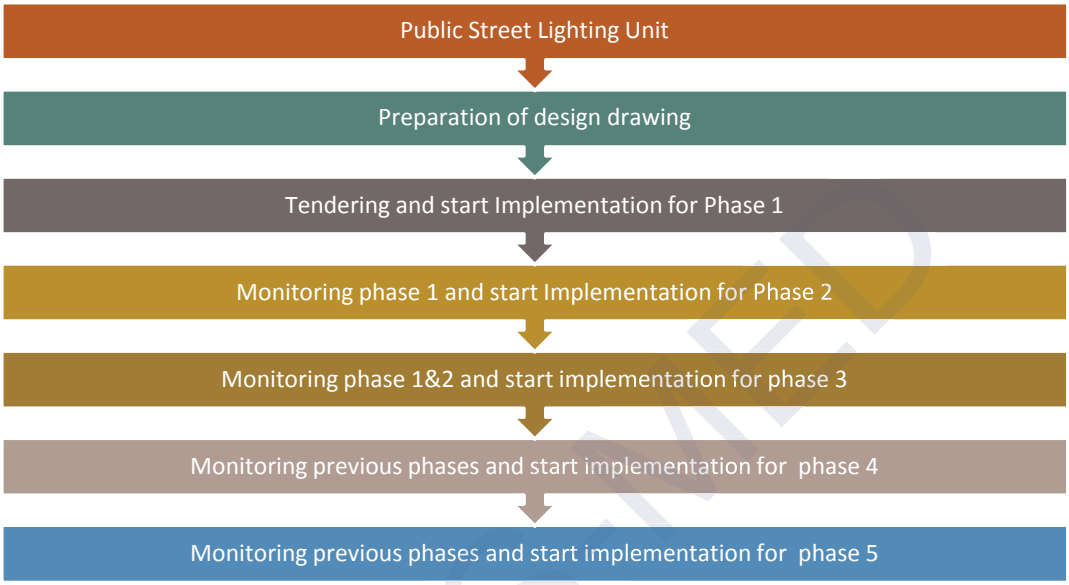


FIGURE 6: OVER ALL PLAN FOR PUBLIC STREET LIGHTING

5.5.3 SHORT TERM ACTION

1. Establish a street lighting unit to support the implementation of the SEAP for the street lighting sector;
2. Prepare the working drawing and tendering documents for the master plan for regulating the lighting in Beirut city;
3. 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;
4. Conduct a technical training for the maintenance staff to insure compliant with the technical and efficiency of work;
5. Monitoring process: Add a new page for the municipality web site to include the citizen's feedback on or complaint about any defective street lights as tool for monitoring the maintenance staff. Provide feedback complain with interactive map guide for precise feedback and monitoring.
   There will be a 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.

5.5.4 LONG TERM ACTION

The long term action will be implemented in four phases. Each phase will contain the platform for a smart city, despite the city's specific area, where the general plan will be able to 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, and 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.

5.5.5 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 minimised accordingly.

TABLE 23 : SHORT AND LONG 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		
PUBLIC STREET LIGHTING			**13,462**	**8,750**	**9,422**	**6,123**	**0.196%**	**40,761,000**
Short Term Action	28	Working drawing and tendering documents						750,000
	29	Maintenance check form			1,346	875	0.028%	1,000
	30	Technical training						5,000
	31	Monitoring process						5,000
Long Term Action	32	Phase One of the implementation			2019	1312	0.042%	10,000,000
	33	Phase Two of the implementation			2019	1312	0.042%	10,000,000
	34	Phase Three of the implementation			2019	1312	0.042%	10,000,000
	35	Phase Four of the implementation			2019	1312	0.042%	10,000,000

5.5.6 FINANCIAL ANALYSE AND PROPOSAL SOLUTION

The financing mechanism can be performed through either local or international finance mechanised which is to be defined. This action represents building infrastructure for Public Street lighting where invest in infrastructure represents the majority cost. The finance analyses even is showing negative NPV the action itself will create special entity to the city and enhance the safety conditions in the roads for pedestrians and drivers. This will also

reflect on improving the condition for encouraging walking. The actual calculation for NPV will consider the replacement of lamps and installation of Intelligent Feeder pillar which is in around €7,000,000.

TABLE 24 : THE FINANCE MECHANISM SCENARIO FOR PUBLIC STREET LIGHTING

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%	%	100%	4.50%	10
Fixed Financial amortisation costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)	EUR 884,480	/year	EUR 8,848,000	EUR 7,000,000
Annual revenues in € / IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(5 years) in EUR	PPA Tariff
2,167,060 / 7.158%	9,422	5	665,343	EUR 0.23/Kwh

Time schedule for implementation of the Short and long term action										
YEAR	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Short Term Actions		X	X	X	X	X	X	X	X	X
Long Term Action			X	X	X	X	X	X	X	X

5.6 LOCAL RENEWABLE ENERGY PRODUCTION

5.6.1 OVERVIEW

The municipality of Beirut depends on fundamental factors to ensure the success of generating electricity via 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.

The technical obstacles lie in the fact that the city suffers from a permanent power cut-off three hours a day and staggered across 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 Beirut 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 generation plant to the city which counts for around 10% of generated power.

As to **the 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 optimise some of the projects in the city, such as municipal buildings and the water pumping stations, from which it provides local needs of consumption that can be linked with backup diesel generators to provide power and save biofuels.

5.6.2 THE WATER TANK WITH RENEWABLE ENERGY SOURCE

The space within Beirut is very limited due to the high intensity and demand for building in the city. The only available space which could be utilised is the water storage areas in Beirut. There are three main storage areas one in Bourj Abi Haider and the others in Tallet Khayat and Mar Mitr. The top of the roof looks a suitable location to hold PV panels to generate green energy. The expected result according to the available space will be generating a minimum of 1,023 MWh /a, and mitigating the emission by 675 t CO_2/a, with a budget of EUR 1,586,000, 80% of project budget will be financed through international donors. This action could be proposed to the MOEW as they are managing the water tanks in Beirut, so that the cost will not be part of the Municipality.

FIGURE 7: MAIN WATER TANKS IN BEIRUT FROM GOOGLE MAP

Location	Space Area in m²	Expected production of green energy MWH/a	Mitigation in t CO_2/a	Estimated cost in €
Water Tank 1	2500	419	277	€ 650,000
Water Tank 2	2000	335	221	€ 520,000
Water Tank 3	1600	268	177	€ 416,000
Total	6100	1023	675	€ 1,586,000
The percentage in reduction in GHG emission as 2020 BAU scenario compared with total city emission 0.022%				

5.6.3 THE MUNICIPALITY BUILDING

The municipality building represents an important location where citizens can see a demonstration of renewable energy projects. It will support and encourage the city plan toward the implementation of renewable energy in most of the city area. The project will generate a minimum of 624 MWh /a, and mitigate the emission by 191 t CO_2/a with a budget of 447,200 Euro. 80% of project budget will be financed through international donors.

Location	Space Area in m²	Expected production of green energy MWH/a	Mitigation in t CO_2/a	Estimated cost in EUR
Main municipality building	720	121	80	187,200
Other Municipality buildings	1000	168	111	260,000
Total	1720	289	191	447,200
The percentage in reduction in GHG emission as 2020 BAU scenario compared with total city emission 0.007%				

TABLE 25 : LONG TERM ACTION FOR LOCAL RENEWABLE ENERGY

SECTORS & fields of action	Action No.	KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing in EUR
			MWh/a	t CO_2 /a	MWh /a	t CO_2 /a		
LOCAL RENEWABLE ENERGY PRODUCTION			**Applied cost for the Municipality part only**		**1646**	**1087**	**0.035%**	**447,200**
Long Term Action	36	Above water tank storage 1	These are optional project to be financed by the governorate or the MOEW		419	277	0.009%	650,000
	37	Above water tank storage 2			335	221	0.007%	520,000
	38	Above water tank storage 3			268	177	0.006%	416,000
	39	Main municipality building			121	80	0.003%	187,200
	40	Other Municipality buildings			168	111	0.004%	260,000
	41	Schools	This not part of Municipality role it can be part of MOE&HE		335	221	0.007%	520,000

TABLE 26 : THE FINANCE MECHANISM SCENARIO FOR WATER TANK WITH RENEWABLE ENERGY

Local or Outsource Finance		Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%		0%	100%	4.50%	10
Fixed Financial amortisation costs				Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)		EUR 200,470	/year	EUR 2,004,704	EUR 1,586,000
Annual revenues in €	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(11 years) in €	PPA Tariff
235,060	4.5%	1,022	11	103	€ 0.230/Kwh

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

TABLE 27 : THE FINANCE MECHANISM SCENARIO FOR MUNICIPALITY BUILDING

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%	0%	100%	4.50%	10
Fixed Financial amortisation costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)	EUR 56,526	/year	EUR 565,260	EUR 447,200

Annual revenues in EUR	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(11 years) in €	PPA Tariff
66,470	4.55%	289	11	1,657	€ 0.230/Kwh

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

5.7 BUILDINGS

5.7.1 OVERVIEW

The buildings in the residential and tertiary sectors are responsible for 53% of total city energy consumption and represent the largest energy consumer and CO_2 emitter in urban areas; therefore, it is crucial to derive efficient policies to reduce energy consumption and CO_2 emissions in this sector.
The municipality as a prime local authority can enact a leading role in implementing 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 noticeable 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 stick to the plan and carefully monitor the results.

5.7.2 RESIDENTAIL SECTOR

The residential sector represents 14% of total city emission. 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 emphasise promoting the usage of energy saving technologies and addressing the changing behaviour for citizen.

5.7.2.1 SHORT TERM ACTION

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

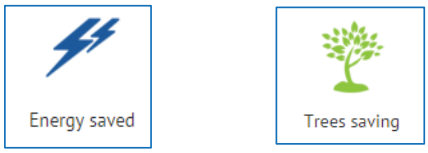
a) Workshops with local mosques/churches and religion men:

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.

b) Workshops with local NGO'S:

Meeting with local NGO's could help the municipality in explaining and clarifying the plan for implementing the SEAP. In the workshop, the municipality could target the changing behaviour and connect it with saving earth and planting trees. It is important to focus on the fact that each replacement of electrical water heater with solar one 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.

Replacing one electrical water heater = 20 trees/year



The NGO will be supported with experts who can train and give them the knowledge and the tools in conveying those to the citizen.

c) Group of public advertising in the outdoor banners for energy saving in homes

- Fixed Temperature set for A/C in summer and winter
- Replacement of lamps with efficient ones
- Replacement or purchasing of efficient appliances
- Switching off lights.

d) Support and participate in the annual Earth Day in the city

Such events will focus on the importance of saving the earth and provide projection on the importance of the events. The municipality could play good role in this day, by supporting the event and work with NGO in sending the right message during this day.

5.7.2.2 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 one by increasing the initiatives.

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 a building by addressing the equipment's energy efficiency and thermal requirements accordingly to 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.

5.7.2.3 SUMMARY AND EXPECTED RESULT FOR THE RESIDENTAL SECTOR

TABLE 28: EXPECTED RESULTS FOR SHORT & LONG TERM ACTIONS FOR RESIDENTAL 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		
BUILDING RESIDENTIAL SECTOR			**662890**	**435952**	**80455**	**52911.2**	**1.697%**	**130,000**
Short Term Action	42	Workshops with local mosques/churches and religion men.			13258	8719.04	0.280%	10,000
	43	Workshops with local NGO'S			13258	8719.04	0.280%	10,000
	44	Group of public advertising in the outdoor banner for energy saving in homes	This can be obtained by instruction to the advertising company to include part this part of rising awareness as policy in their work without any cost for the municipality					
	45	Fixed Temperature set for A/C in summer and winter	132,578	87,190.4	13,258	8,719.04	0.280%	10,000
	46	Replacement of lamps with efficient one	132,578	87,190.4	13,258	8,719.04	0.280%	10,000
	47	Replacement or purchase of efficient appliances	132,578	87,190.4	13,258	8,719.04	0.280%	30,000
	48	Support & participate the earth day in the city	1,816	1194	73	48	0.002%	30,000
Long Term Action	49	Building code	140,929	92,682	14,092.9	9,268.2	0.297%	10,000

5.7.2.4 FINANCIAL ANALYSIS AND PROPOSAL SOLUTION

Although the saving in energy is not part of the municipality cost, the municipality with the support of local community, NGO's and government could play an essential role in promoting the events and produce good results.

TABLE 29 : THE FINANCE ANALYSIS FOR RESIDENTAL SECTOR

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%	0%	100%	4.50%	10
Fixed Financial amortisation costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)	EUR 16,432	/year	EUR 164,320	EUR 130,000
Annual revenues in EUR / IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(2 years) in EUR	PPA Tariff
18,504,650 / 11161%	80,455	2	17,543,479	EUR 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

5.7.3 TERTIARY SECTOR

The tertiary sector is responsible for 39 % of the total city emission, and represents a key element in the mitigation process.

5.7.3.1 THE SHORT TERM ACTION IN TERTIARY SECTOR

a) Workshop on changing behaviour, concentrating on Energy Conservation and Renewable energy Usage:

A workshop on energy conservation and renewable energy usage will be held for the tertiary sector 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 change.
The awareness campaign will be started with workshop delivered to the owners and administrative staff of the tertiary sector, followed by instruction leaflets posted in locations and annual meetings to compare the results and get support from experts for any obstacles. The areas covered are:

- Governmental and Public offices
- Hospitals
- Schools
- Universities
- Hotels
- Show rooms and shops
- Private offices

b) Certification for Green Cedar Certification

The action aims at implementing an innovative mechanism to create a kind of competition between society components and the tertiary sector to indicate its commitment, role, participation and sense of responsibility towards the environment and community.
The municipality will publish a Green Cedar Certification (GCC) to be presented in the tertiary sectors like offices, shops, showrooms, companies, establishments etc.., which are willing to participate in this programme. The certification will show in metaphorical way the quantities of trees which have been saved in an annual base.
The municipality with coordination from the local NGO's and experts in energy and social behaviours will set the standards to motivate the implementation of the action. They will provide the tools for training and proper implementation, supported with workshops and flyer, brochures.
This action will have the impact to motivate the social and civil society in reducing the footprint and address energy conservation with behavioural changes.

5.7.3.2 LONG TERM ACTION IN TERTIARY SECTOR

a) Awareness campaign using public advertising targeting the Shops and offices

- Fixed Temperature set for A/C in summer and winter;
- Replacement of lamps with efficient ones;
- Replacement and purchasing of efficient appliances.

b) Implementing building codes in new buildings

This action should be developed in order to reduce the expected consumption in energy and support the future plan.

5.7.3.3 SUMMARY AND EXPECTED RESULT FOR THE TERTIARY SECTOR

TABLE 30 : EXPECTED RESULTS FOR SHORT & LONG TERM ACTIONS FOR 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		
BUILDING TERTIARY SECTOR			**1834134**	**1211485**	**407400**	**268884**	**8.623%**	**160,000**
Short Term Action	50	**Workshop on changing behaviour**						
	51	Governmental and Public offices.	142,000	93,720	21,300	14,058	0.451%	10,000
	52	Hospitals.	83,000	54,780	12,450	8217	0.264%	10,000
	53	Schools.	83,000	54,780	12,450	8217	0.246%	10,000
	54	Institutions	40,000	26,400	6,000	3960	0.127%	10,000
	55	Universities.	20,000	13,200	3,000	1980	0.063%	10,000
	56	Hotels.	76,000	50,160	11,400	7524	0.241%	10,000
	57	**Certification for green cedar certification of the following sectors**						
	58	Governmental and Public offices.	142,000	93,720	21,300	14,058	0.451%	10,000
	59	Hospitals.	83,000	54,780	12,450	8,217	0.264%	10,000
	60	Schools.	83,000	54,780	12,450	8,217	0.264%	10,000
	61	Institutions	40,000	26,400	6,000	3,960	0.127%	10,000
	62	Universities.	20,000	13,200	3,000	1,980	0.063%	10,000
	63	Hotels.	76,000	50,160	11,400	7,524	0.241%	10,000
Long Term Action	64	**Awareness campaign using public advertising targeting the Shops offices on following**						
	65	Fixed Temperature set for A/C in summer and winter	457000	301620	91400	60324	1.935%	10,000
	66	Replacement of lamps with efficient one	457000	301620	91400	60324	1.935%	10,000
	67	Replacement and purchase of efficient appliances	457000	301620	91400	60324	1.935%	10,000
	68	Building Codes in new buildings						10,000

5.7.3.4 FINANCIAL ANALYSE AND PROPOSAL SOLUTION

TABLE 31 : THE FINANCE ANALYSIS FOR TERTIARY SECTOR

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%	0%	100%	4.50%	10
Fixed Financial amortisation costs in EUR			Total loan repayment due in EUR:	Loan (principal) capital in EUR:

Loan repayment (annualised)		20,224	/year	202,240	160,000
Annual revenues in EUR	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(2 years) in EUR	PPA Tariff in EUR
39,721,550	19540%	407,485	2	37,808,813	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
Long Term Actions			X	X	X

Although the saving in energy is not part of the municipality cost, the municipality with the support of local community, NGO's and government could play an essential role in promoting the events and produce good results.

5.8 TRANSPORTATION

5.8.1 OVERVIEW

The transportation sector is responsible for the majority of the city emission and counts for 47 % of the city total emission as it produces 1,146,675 t CO_2/ year (2013). The municipality fleets produce 0.025 % (610 t CO_2) of transportation emission and the remaining part is caused by private transportation.
Public transport in Lebanon is primarily provided by taxis and microbuses, with no proper regulations on most of such vehicles. This results in high operational and maintenance costs incurred by car owners. These costs include fuel consumption, taxes, insurance and car service. Commercial investment in cars as a mass transportation system, including the import of vehicles, replacement parts, fuel and related costs, was estimated to be over 7.5% of the country's GDP.
The city of Beirut suffers from a stifling traffic crisis which has turned into a daily ordeal for commuters. With the lack of sustainable and efficient transport system exacerbates the level of congestion on the roads.
The city has high population density and relatively short distances which generally favour of adopting "Bicycle Taxi". This in turn reduces stress levels and lost time due to congestion, allowing employees to be more productive and able to focus on tasks ahead. Relying on public transport, company costs would decrease as there would be no need for building underground parking or renting parking spaces. In addition, an effective transportation system would decrease accidents, air pollution and noise pollution.
Transportation is a key factor in fighting against emission and important action needs to be executed. The lack of availability for public transportation and poor service for the remaining part of it leaves the city with serious pollution that could be detected in daytime through the smog, no much wind and crowdedness.

5.8.2 MUNICIPALITY FLEET/ PRIVATE TRANSPORTAION

Municipality transportation show high figures of emission of approximately 610 t CO_2; hence, there is a need to prevent further increase due to the non-consideration of the future increase. Private transportation has been widely affected, in a sense that collective efforts have to be obtained.

5.8.3 SHORT TERM ACTION

(i) MASTER PLAN FOR SMART TRANSPORTATION

The city of Beirut identifies a vision as a "**Get Smarter, Live Better**". To achieve such vision, many obstacles encountering economy, sustainability, and community have to be resolved.
It is noteworthy that the community wants more access to real-time, reliable and accurate travel information than ever before. Transportation plays an essential role in the economic growth of the city. In the case of Beirut city, traffic congestion leads many international and local companies to look for alternative locations for their offices outside the city since it takes labourers and employees a lot of time to reach their offices on time and makes them face logistic costs.
The city of Beirut has many properties that can be characterised by:

- An estimated road length, around 200 Km in area of 20 Km², which can be remoulded with smart and sustainable plan;

- The traffic control centre which utilises intelligent movement count for the street to control many traffic lights in the city.

Thus the need to plan a long-term transportation strategy for the city that will help guide the city's transportation to 2040 and beyond should focus on improving mobility for local residents of the city by providing viable choices through all modes of travel. The plan should cover the daily city visitors; carry rethinking growth to support the transportation master plan, taking transit to the next level, and actively managing transportation demand. It should also make greater investment in cycling and walking infrastructure, handling more strategic programmes of road network improvements.
The plan should identify the strategic outcomes to guide future planning and contribute to a continuation of the high quality of life in the city, and assess the viability of implementing a rapid transit system for the city. The city is witnessing significant congestion roads, due to the increase in population from expatriates and tourists in addition to holding social events which are on the increase those periods. So the need to rehabilitate and expand the roads and create new short or double links for main roads will support reducing the crowding in main roads. The smart master plan in creating the safe areas for walking and riding bike, linking different areas inside the city, creating short links and promoting short cuts between the areas would reduce the travelling distance. This will reflect in reducing the fuel consumptions and mitigating the emission due to congestion and long distance traveling.

(II) CONDUCT AN AWARENESS CAMPAIGN ON ECO DRIVE

Conducting an awareness campaign for the municipality staff concentrates on eco-drive and explains the recommended drive technique as modern, smart and efficient way to save fuel and reach destination. Specific local NGO's & volunteers will attend training given by qualified driving instructors allowing them to share the experience with others.

(III) PARTICIPATE IN BEIRUT MARATHON DAY

Every year, the Beirut Marathon Association organises the Beirut Marathon Day, which attracts 60,000 runners from all walks of life, including national political leaders. The municipality could become sponsor for this event and facilitate part or whole of the event. Beirut Marathon Day aims to promote the concept of sports, especially walking, contribute indirectly to break the shyness that haunts many of the young people to walk in the city and promote changing in their behaviour. The action will inspire unity, positively change lifestyles, promote wellness, and provide an experience of challenge, achievement, joy, and glory; for the benefit of Lebanon, both now and for generations to come.

(IV) CONDUCT A BIKE DAY

The municipality has tested bike day before in part of the city roads, where it converted the movement of cars to another roads allowing bikes to be used in that area. This step has shown very interesting results that motivates citizens to walk while shopping and stimulates economic activity in that area according to the feedback received from traders. Such an action could be repeated in different areas in the city supported with Bike facility to encourage people ride bicycles and promote changing behaviour. The Bike day in Beirut aims to promote the concept of sports, especially riding bicycles. It aims to contribute indirectly to break the shyness that haunts many of the young people to use the bicycles in the city and promote changing in the behaviour.

5.8.4 LONG TERM ACTION

The long term action will be built with coordination between the municipality of Beirut and the neighbour municipalities under the Grand Beirut City and one union.

The success of the long-term action in sorting out the main issues in transportation will rely on such coordination within the framework in the various stages of the working plan.

(i) COORDINATION COMMITTEE FOR TRANSPORTATION

Establishing a coordination committee with various experts from different municipalities will be the first important step in enhancing the general plan for regulating the transportation sector. This step should be also supported by the Ministry of Public Work and Transportation and Ministry of Interior. This will help in implementing the master plan for smart transportation.

(II) REGULATE THE SHARED TAXI FOR TRANSPORTATION

Beirut suffers from lack of public transport in the city, the unique role of private transport that replaces public one and the lack of central role for institutions and state departments. This brings more pressure on the municipality to act in order to regulate, organise and control the quality of service in order to improve the transportation sector. The action will concentrate on starting with implementation of the plan to regulate the shared taxi transport work in coordination with various state departments.

The plan will include minimum the following needs:

- Regulate the shared taxi operation, direction, and covered roads and cost of service;
- Provide the map with direction and places;
- Provide each shared Taxi with sign for Telephone number for feedback and complaints;
- Provide the schedule of shared taxi in all days of the week.

(III) CONDUCT AWARENESS CAMPAIGN ON SMART SHARED TAXI FOR THE DRIVERS

The aim of this campaign is to facilitate the smooth implementation of the transportation plan where the key element in this plan is the drivers who will be in touch in daily base with the rider. The service should be built to the high level which the plan is looking for.

(IV) ALLOCATE AND PROVIDE SHARED TAXI STOP STATION IN THE CITY

- Assign proper places with shared taxi station. This would be very important like in public services, governmental building, schools supermarkets, main souk, down town...etc., to insure the service is available and encourage people to use it;
- Provide safety regulations to insure the service is safe protecting from car accident by using barriers around the station;
- Provide a pedestrian crossing road with marking and stop signs to insure safe crossing the roads;
- Install shared taxi stop station in all locations;
- Provide the shared taxi stop with proper lighting;
- Provide maps with timing schedules;
- Provide advertising signs to insure covering the maintenance cost in the future;
- Conduct awareness campaign to enhance using the shared taxi transport supported with flyers and brochures.

(V) SMART PHONE TICKETING SYSTEM FOR SHARED TAXI

The service will be supported with payment through smart phone application in order to insure the speedy in operation and secure the payment. The smart phone application will give high push to the service and bring encouraging offers to the users. The fixed prices will be applied for the users and the daily users will be able to benefit from many offers that can be applied through using smart application.

(VI) CONDUCT AWARENESS CAMPAIGN ON SMART SHARED TAXI FOR THE PUBLIC

The implementation will include the advertising to the service through media and advertising banners in addition to have big launching of the operation.

(VII) ASSIGN AND PROVIDE GREEN/SMART SHARED TAXI STOP STATION

One of the main obstacles which prevent the use of private shared taxi transportation is standing in the middle of the roads waiting for them, without comfortable and safe seats or rain or sun shelter. This action will concentrate on assigning Green/ Smart shared taxi stop station in selected places to encourage the usage of shared taxi transportation. The shared taxi stop is an attractive design provided with multi-function services, which reflect the daily needs from mobile charger system, lights, security camera, charging station for electric bikes and scooters,

with bike stand and security lock; in addition to shared taxi schedules and timing with direction and map, comfortable and safe seats, and photovoltaic renewable, all integrated with the station. This action will improve the shared taxi service and encourage many people to use the service and will bring more users and break the ice among citizens as the service quality will be high.

(VIII) PARKING AREA FOR BIKES /SCOOTER

Another issue which the city suffers from is having bike/scooter parking. To those who are willing to use their bikes in transportation in Beirut city, creating new parking areas with security becomes an important action. It will reduce the usage of private cars in transpiration and supports smooth movement. The parking should be secure and provided with rechargeable unit for electrical scooter.

(IX) ASSIGNING SECTOR IN ROADS FOR BIKES /SCOOTER

The other issue which the city suffers from is the bike/scooter parking to those willing to use their bike in transportation in Beirut city. This action is to regulate their movement and ensure the safe movement of the pedestrians.

(X) SMART PHONE TICKETING SYSTEM FOR SMART BIKE

The service will be supported with payment through a smart phone application to ensure speedy operation and to secure the payment. The smart phone application will give high push to the service and bring encouraging offers to the users. The fixed prices will be applied for the all users and the daily users will be able to benefit from many offers that can be applied through using smart application.

(XI) CONDUCT AWARENESS CAMPAIGN ON SMART SHARED BIKE FOR THE PUBLIC

The implementation will include the advertising to the service through media and advertising banners in addition to have big launching of the operation.

5.8.5 SUMMARY AND EXPECTED RESULT FOR THE TRANSPORT SECTOR

TABLE 32 : EXPECTED RESULTS FOR SHORT & LONG TERM ACTIONS FOR THE TRANSPORT 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		
TRANSPORTATION			**5,789,683**	**1,456,277**	**3,277,791**	**824,970**	**26.456%**	**2,080,000**
Short Term Action	69	Smart master plan for transportation					0.000%	2,000,000
	70	Conduct an awareness campaign on Eco driving			2,893	728	0.023%	10,000
	71	Participate in Beirut Marathon Day			17,358	4368	0.140%	10,000
	72	Conduct a Bike day			17,358	4368	0.140%	20,000
Long Term Action	73	Coordination Committee for Transportation			0	0	0.000%	10,000
	74	Regulate the shared Taxi for transportation			289,302	72,813	2.335%	30,000
	75	Conduct an awareness campaign on Smart Shared Taxi for the drivers			289,302	72,813	2.335%	Cost to be defined
	76	Allocate and provide shared Taxi stop station			289,302	72,813	2.335%	Cost to be defined
	77	Smart Phone Ticketing System for Shared Taxi			289,302	72,813	2.335%	Cost to be defined

	78	Conduct an awareness campaign on Smart Shared **Taxi** for the Public			289,302	72,813	2.335%	Cost to be defined
	79	Assign & provide Green/Smart Shared Taxi Stop Station			289,302	72,813	2.335%	Cost to be defined
	80	Smart Phone Ticketing System for Smart Bike			289,302	72,813	2.335%	Cost to be defined
	81	Conduct an awareness campaign on Smart Shared **Bike** for the public			289,302	72,813	2.335%	Cost to be defined
	82	Parking area supported with Shared Taxi outside the city			347,162	87,376	2.802%	Cost to be defined
	83	Parking area for Bikes/Scooters			289,302	72,813	2.335%	Cost to be defined
	84	Assign sector in roads for Bikes/Scooters			289,302	72,813	2.335%	Cost to be defined

5.8.6 FINANCIAL ANALYSE AND PROPOSAL SOLUTION

TABLE 33 : FINANCIAL ANALYSIS FOR TRANSPORTATION

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%	0%	100%	4.50%	10
Fixed Financial amortisation costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)	EUR 32,247 /year		EUR 410,016	EUR 324,379
Annual revenues in EUR / IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(3 years) in €	PPA Tariff
236,000 / 9.92%	3,277,788	3	31,934	EUR 0.072/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

Although the saving in energy is not part of the municipality cost, the municipality with the support of local community, NGO's and government could play an essential role in promoting the events and produce good results.

5.9 SUMMARY FOR THE SUSTAINABLE PLAN

SECTORS & fields of action	Action No.	KEY actions/measures	BAU Scenario		Mitigation in Energy		Mitigation in %	Costing in EUR
			MWh/a	t CO_2 /a	MWh/a	t CO_2 /a		
MUNICIPAL BUILDING			**8,788**	**5,804**	**2459**	**1624**	**0.052%**	**667,600**
Short Term Action	1	Set up SEAP Unit inside the municipality						201,600
	2	Conduct energy auditing for municipality building and facilities						40,000
	3	Social media promotion plan						10,000
	4	Energy saving instruction in the municipality facilities			88	58	0.002%	1,000
	5	Awareness and Training Campaign for the municipality staff			88	58	0.002%	5,000
	6	Convert the municipality building A to green building			527	348	0.011%	100,000
Long Term Action	7	Convert the municipality building B to green building			527	348	0.011%	100,000
	8	Convert the municipality building C to green building			527	348	0.011%	100,000
	9	Convert the municipality building D to green building			527	348	0.011%	100,000
	10	Public procurement of products & services			175	116	0.004%	10,000
WATER SUPPLY					**6720**	**1794**	**0.058%**	**220,000**
Short Term Action	11	Awareness campaign						150,000
	12	Apply new role for recycling water in building and reuse it						20,000
	13	Routine maintenance						50,000
	14	Install water meters in main feeders and main branches	This need to be developed and cannot be estimated also the role for municipality is limited however action should be taken with collaboration with the responsible concerned governorate department (EBML)					
Long Term Action	15	Install water meter for each users with remote reading system	**This need to be developed and cannot be estimated also the role for municipality is limited however action should be taken with collaboration with the responsible concerned governorate department (EBML)**					
WASTE WATER TREATMENT								
Short Term Action	16	Update the municipality policy.	This need to be developed and cannot be estimated also the role for municipality is limited however action should be taken with collaboration with the responsible concerned governorate department					
Long Term Action	17	Infrastructure for wastewater management						
SOLID WASTE MANAGEMENT					**1038**	**280.2**	**0.009%**	

Short Term Action	18	Create solid waste plan for sorting from source for Beirut city	This need to be developed and cannot be estimated also the role for municipality is limited however action should be taken with collaboration with the responsible concerned governorate department					
	19	Awareness campaign on solid waste sorting						
	20	Upgrade the local laws to insure the maximum recycle material to be used in the city						
	21	upgrade the existing waste treatment plant to increase the efficiency of sorting to reach maximum 10% non-recycling part						
Long Term Action	22	Start implementing the plan for city sorting with selected sectors in the city 1 to 10			173	46.7	0.0015%	
	23	Start implementing the plan for city sorting with selected sectors in the city 11 to 20			173	46.7	0.0015%	
	24	Start implementing the plan for city sorting with selected sectors in the city 21 to 30			173	46.7	0.0015%	
	25	Start implementing the plan for city sorting with selected sectors in the city 31 to 40			173	46.7	0.0015%	
	26	Start implementing the plan for city sorting with selected sectors in the city 41 to 50			173	46.7	0.0015%	
	27	Start implementing the plan for city sorting with selected sectors in the city 51 to 60			173	46.7	0.0015%	
PUBLIC STREET LIGHTING			**13,462**	**8,750**	**9,422**	**6,123**	**0.196%**	**40,761,000**
Short Term Action	28	Working drawing and tendering documents						750,000
	29	Maintenance check form			1346	875	0.028%	1,000
	30	Technical training						5,000
	31	Monitoring process						5,000
Long Term Action	32	Phase One of the implementation			2,019	1,312	0.042%	10,000,000
	33	Phase Two of the implementation			2,019	1,312	0.042%	10,000,000
	34	Phase Three of the implementation			2,019	1,312	0.042%	10,000,000
	35	Phase Four of the implementation			2,019	1,312	0.042%	10,000,000
LOCAL RENEWABLE ENERGY PRODUCTION					**1,646**	**1,087**	**0.035%**	**447,200**
Long Term Action	36	Above water tank storage 1	These are optional project to be financed by the governorate or the MOEW		419	277	0.009%	650,000
	37	Above water tank storage 2			335	221	0.007%	520,000
	38	Above water tank storage 3			268	177	0.006%	416,000

	39	Main municipality building			121	80	0.003%	187,200
	40	Other Municipality buildings			168	111	0.004%	260,000
	41	Schools	This not part of Municipality role it can be part of MOE&HE		335	221	0.007%	520,000
BUILDING RESIDENTIAL SECTOR			**662,890**	**435,952**	**80,455**	**52,911**	**1.697%**	**2,050,000**
Short Term Action	42	Workshops with local mosques/churches and religion men.			13,258	8,719.04	0.280%	300,000
	43	Workshops with local NGO'S			13,258	8,719.04	0.280%	300,000
	44	Group of public advertising in the outdoor banners for energy saving.in homes					0.000%	
	45	Fixed Temperature set for A/C in summer and winter	132,578	87,190.4	13,258	8,719.04	0.280%	600,000
	46	Replacement of lamps with efficient one	132,578	87,190.4	13,258	8,719.04	0.280%	150,000
	47	Replacement or purchase of efficient appliances	132,578	87,190.4	13,258	8,719.04	0.280%	300,000
	48	Support & participate the Earth Day in the city	1,816	1,194	73	48	0.002%	300,000
Long Term Action	49	BUILDING CODE	140,929	92,682	14,092.9	9,268.2	0.297%	100,000
BUILDING TERTIARY SECTOR			**1,834,134**	**1,211,485**	**407,400**	**268,884**	**8.623%**	**160,000**
Short Term Action	50	Workshop on changing behaviour						
	51	Governmental and Public offices.	142,000	93,720	21,300	14,058	0.451%	10,000
	52	Hospitals.	83,000	54,780	12,450	8,217	0.264%	10,000
	53	Schools.	83,000	54,780	12,450	8,217	0.264%	10,000
	54	Institutions	40,000	26,400	6,000	3,960	0.127%	10,000
	55	Universities.	20,000	13,200	3,000	1,980	0.063%	10,000
	56	Hotels.	76,000	50,160	11,400	7,524	0.241%	10,000
	57	Certification for green cedar certification of the following sectors						
	58	Governmental and Public offices.	14,2000	93,720	21,300	14,058	0.451%	10,000
	59	Hospitals.	83,000	54,780	12,450	8,217	0.264%	10,000
	60	Schools.	83,000	54,780	12,450	8,217	0.264%	10,000
	61	Institutions	40,000	26,400	6,000	3,960	0.127%	10,000
	62	Universities.	20,000	13,200	3,000	1,980	0.063%	10,000
	63	Hotels.	76,000	50,160	11,400	7,524	0.241%	10,000
Long Term Action	64	Awareness campaign using public advertising targeting the Shops offices on following						

	65	Fixed Temperature set for A/C in summer and winter	457,000	301,620	91400	60324	1.935%	10,000
	66	Replacement of lamps with efficient one	457,000	301,620	91400	60324	1.935%	10,000
	67	Replacement and purchase of efficient appliances	457,000	301620	91400	60324	1.935%	10,000
	68	Implementing Building Codes in new buildings						10,000
TRANSPORTATION			**5,789,683**	**1,456,277**	**3277791**	**824970**	**26.456%**	**2,080,000**
Short Term Action	69	Smart master plan for transportation					0.000%	2,000,000
	70	Conduct an awareness campaign on Eco driving			2,893	728	0.023%	10,000
	71	Participate in Beirut Marathon Day			17,358	4,368	0.140%	10,000
	72	Conduct a Bike day			17,358	4,368	0.140%	20,000
Long Term Action	73	Coordination Committee for Transportation			0	0	0.000%	10,000
	74	Regulate the shared Taxi for transportation			289,302	72813	2.335%	30,000
	75	Conduct an awareness campaign on Smart Shared Taxi for the drivers			289,302	72813	2.335%	100,000
	76	Allocate and provide shared Taxi stop station			289,302	72813	2.335%	Cost to be defined
	77	Smart Phone Ticketing System for Shared Taxi			289,302	72813	2.335%	
	78	Conduct an awareness campaign on Smart Shared Taxi for the Public			289,302	72813	2.335%	
	79	Assign & provide Green/Smart Shared Taxi Stop Station			289,302	72813	2.335%	
	80	Smart Phone Ticketing System for Smart Bike			289,302	72813	2.335%	
	81	Conduct an awareness campaign on Smart Shared Bike for the public			289,302	72813	2.335%	
	82	Parking area supported with Shared Taxi outside the city			347,162	87376	2.802%	
	83	Parking area for Bikes/Scooters			289,302	72813	2.335%	
	84	Assign sector in roads for Bikes/Scooters			289,302	72813	2.335%	
Total			**8308,957**	**3118268**	**3,786,930.945**	**1,157,673.376**	**37.126%**	**46,385,800**

5.10 KEY PERFORMANCE 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 his work.	• Formal announcement by the municipality council for developing the SEAP. • Number of years the SEAP manager is contracted. • The percentage of municipal facilities supervised by the SEAP manager.
2	Conduct energy auditing for municipality building and facilities	• Conduct the energy auditing	• Work completed
3	Social media promotion plan	• Publish announcements about the plan on local TV channels & Social Medias	• Number of Feedback from citizens
4	Energy Saving Instructions	• Publish the energy saving instructions in the municipal buildings.	• Energy consumptions measurements in KWh and savings in %
5	Awareness raising and Training Campaign	• Conduct training for the municipality staff	• Number of campaigns • Number of attendants
6	Convert the municipality building A to green building	• Replace CFL lamps with LED lamps • Install Motion Light Sensors • Replace old A/C with A+++ Inverter type	• Number of lamps replaced • Energy reduction in KWh • Number of A/C replaced
7	Convert the municipality building B to green building	• Replace CFL lamps with LED lamps • Install Motion Light Sensors • Replace old A/C with A+++ Inverter type	• Number of lamps replaced • Energy reduction in KWh • Number of A/C replaced
8	Convert the municipality building C to green building	• Replace CFL lamps with LED lamps • Install Motion Light Sensors • Replace old A/C with A+++ Inverter type	• Number of lamps replaced • Energy reduction in KWh • Number of A/C replaced
9	Convert the municipality building D to green building	• Replace CFL lamps with LED lamps • Install Motion Light Sensors • Replace old A/C with A+++ Inverter type	• Number of lamps replaced • Energy reduction in KWh • Number of A/C replaced
10	Public procurement of products & services	• 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			

11	Conduct awareness campaign to enhance the water conservation regulate the water consumption	• Number of awareness campaigns conducted	• Number of attendants
12	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 a water saving faucet
13	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 feedback and complain from citizen after fixing leaks.
14	Install water meters in main feeders and main branches	• Fix water meters on main feeders and sub feeders. • Count the number of users on each sub feeders and compare average consumptions per users. • Maintain feeders • Compare water consumptions	• Water consumptions on main feeders • Water consumptions on sub feeders • Average water consumption per users • Water consumptions on main feeders after maintenance • Average water consumption per users after maintenance
15	Install water meters for each user with remote reading system.	• Fix water meters for each user	• Count the number of users
Waste water treatment			
16	Update the municipality policy to include in every new construction a standalone water treatment plant.	• Update the police through municipality council.	• Number of new construction which include new polices for standalone water treatment plant.
17	Infrastructure for wastewater management.	• According to the strategic plan for waste water the treatment plant to be defined location and capacity • 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
Solid waste Management			

18	Create solid waste plan for sorting at source	• Design the leaflet and marketing material for solid waste sorting • Print the marketing materials	• Implement the plan
19	Awareness campaign on solid waste sorting	• Conduct the awareness campaign	• Number of attendances
20	Upgrade the local laws to insure the maximum recycle material to be used in the city	• Upgrade started	• Work completed
21	Upgrade the existing waste treatment plant to increase the efficiency of sorting to reach maximum 10% non-recycling part	• Upgrade started	• Work completed
22	Start implementing the plan for city sorting with selected sectors in the city 1 to 10	• Apply Plan	• Number of trips of the solid waste trucks • Reduction in fuel in Litres • Reduction in maintenance cost
23	Start implementing the plan for city sorting with selected sectors in the city 11 to 20	• Apply Plan	• Number of trips of the solid waste trucks • Reduction in fuel in Litres • Reduction in maintenance cost
24	Start implementing the plan for city sorting with selected sectors in the city 21 to 30	• Apply Plan	• Number of trips of the solid waste trucks • Reduction in fuel in Litres • Reduction in maintenance cost
25	Start implementing the plan for city sorting with selected sectors in the city 31 to 4	• Apply Plan	• Number of trips of the solid waste trucks • Reduction in fuel in Litres • Reduction in maintenance cost
26	Start implementing the plan for city sorting with selected sectors in the city 41 to 50	• Apply Plan	• Number of trips of the solid waste trucks • Reduction in fuel in Litres • Reduction in maintenance cost
27	Start implementing the plan for city sorting with selected sectors in the city 51 to 60	• Apply Plan	• Number of trips of the solid waste trucks • Reduction in fuel in Litres • Reduction in maintenance cost

Public street lighting			
28	Working drawing and tendering documents	• Preparation of drawing and tendering documents	• Number of poles being assigned with number • Number of feeder pillar with KWH meter
29	Maintenance check form	• Check form prepared and launched	• Number of check forms been executed after launching the process
30	Technical training for the maintenance staff	• Training conducted	• Number of attendants
31	Monitoring process	• Create the monitoring process • Establish PSLU unit inside the municipality	• Number of complaints received to the municipality for defective lights • The power consumptions in KWH
32	Phase One of the implementation	• Start implementation &set baseline for actual consumption	• Results from PSLU
33	Phase Two of the implementation	• Start implementation &set baseline for actual consumption	• Results from PSLU
34	Phase Three of the implementation	• Start implementation &set baseline for actual consumption	• Results from PSLU
35	Phase Four of the implementation	• Start implementation &set baseline for actual consumption	• Results from PSLU
Local Renewable Energy			
36	Above water tank storage 1	• Installation of PV system • System installed capacity	• KWp • KWh/a
37	Above water tank storage 2	• Installation of PV system • System installed capacity	• KWp • KWh/a
38	Above water tank storage 3	• Installation of PV system • System installed capacity	• KWp • KWh/a
39	Main municipality building	• Installation of PV system • System installed capacity	• KWp • KWh/a
40	Other municipality building	• Installation of PV system • System installed capacity	• KWp • KWh/a
41	Schools	• Installation of PV system • System installed capacity	• KWp • KWh/a

Residential buildings			
42	Workshops with local mosques/churches and religion men.	• Conduct workshop	• Number of participants
43	Workshop with local NGO'S	• Conduct workshop	• Number of staff attended the workshop
44	Group of public advertising in the outdoor banners for energy saving.	• Advertisement started	• Work completed • Feedbacks
45	Fixed Temperature set for A/C in summer and winter	• Enhance fixing A/C temperature process	• Energy reduction in KWh
46	Replacement of lamps with efficient one	• Installation of efficient lamps	• Number of lights replaced
47	Replacement or purchase of efficient appliances	• Installation of efficient appliances	• Number of efficient appliances
48	Support & participate the Earth Day in the city.	• Conduct earth day	• Number of participants
49	Building Code	• Apply new building codes	• Number of new residential building with new code
Tertiary buildings			
50	Workshop on changing behaviour	• Conduct workshop	• Number of attendances of owners & administrative staffs
51	Governmental and Public offices.	• Conduct awareness meetings	• Number of Governmental and Public offices
52	Hospitals.	• Conduct awareness meetings	• Number of Hospitals.
53	Schools.	• Conduct awareness meetings	• Number of Schools.
54	Institutions	• Conduct awareness meetings	• Number of Institutions
55	Universities.	• Conduct awareness meetings	• Number of Universities.
56	Hotels.	• Conduct awareness meetings	• Number of Hotels

57	Certification for green cedar certification of the following sectors	• Conduct awareness campaign • Number of participant	• Number of certificate issued
58	Governmental and Public offices.	• Conduct awareness meetings	• Number of Governmental and Public offices
59	Hospitals.	• Conduct awareness meetings	• Number of Hospitals.
60	Schools.	• Conduct awareness meetings	• Number of Schools.
61	Institutions	• Conduct awareness meetings	• Number of Institutions
62	Universities.	• Conduct awareness meetings	• Number of Universities.
63	Hotels.	• Conduct awareness meetings	• Number of Hotels
64	Awareness campaign using public advertising targeting the Shops offices on following	• Apply the new codes	• Number of new tertiary building with new code
65	Fixed Temperature set for A/C in summer and winter	• Enhance fixing A/C temperature process	• Energy reduction in KWh
66	Replacement of lamps with efficient one	• Installation of efficient lamps	• Number of lights replaced
67	Replacement and purchase of efficient appliances	• Installation of efficient appliances	• Number of efficient appliances
68	Implementing Building Codes in new buildings.	• Apply new building codes	• Number of new tertiary building with new code
Transportation Sector			
69	Smart master plan for transportation	• Develop the master plan for transportation	• Develop the master plan for transportation
70	Conduct an awareness campaign on Eco driving	• Conduct training in eco driving	• Number of trained staff

71	Participate in Beirut Marathon Day	• Conduct marathon day	• Number of participants
72	Conduct a Bike day.	• Conduct a bike day	• Number of participants
73	Coordination Committee for Transportation	• Construct Coordination Committee for Transportation	• Number of members of experts & municipalities
74	Regulate the shared Taxi for transportation	• Regulate the shared taxi operation, direction, and covered roads and cost of service • Provide the map with direction and places • Provide each shared Taxi with sign for Telephone number for feedback and complaints • Provide the schedule of shared taxi in all days of the week	• Develop the regulation • Develop the map with direction & places • Number of shared taxies joint the plan • Number of locations with schedule of shared taxies
75	Conduct an awareness campaign on Smart Shared Taxi for the drivers	• Conduct awareness campaign	• Number of participants
76	Allocate and provide shared Taxi stop station	• Construct shared Taxi stop stations	• Number of stations
77	Smart Phone Ticketing System for Shared Taxi	• Establish the service of Smart Phone Ticketing System for Shared Taxi	• Number of users
78	Conduct an awareness campaign on Smart Shared Taxi for the Public	• Conduct awareness campaign	• Number of participants
79	Assign & provide Green/Smart Shared Taxi Stop Station	• Construct Green/Smart shared Taxi stop stations	• Number of stations
80	Smart Phone Ticketing System for Smart Bike	• Establish the service of Smart Phone Ticketing System for Smart Bike	• Number of users
81	Conduct an awareness campaign on Smart Shared Bike for the public	• Conduct awareness campaign	• Number of participants
82	Parking area supported with Shared Taxi outside the city	• Construct Parking area	• Parking capacity in number of Taxies
83	Parking area for Bikes/Scooters	• Construct parking area	• Parking capacity in number of Bikes/Scooters
84	Assign sector in roads for Bikes/Scooters	• Construct Sectors	• Sector capacity in number of Bikes/Scooters

ANNEXES

ANNEX I – PROJECT FICHES

Beirut Priority Action of SEAP (1)

1- General presentation

Title : Building Capacity with New SEAP UNIT with Energy Auditing for Municipality building and Facilities

Summary of the Action:

Traffic congestion, water shortage and power outage significantly undermine the city of Beirut. With the absence of transportation plans, limited technical capacities and the incapability to keep up with the urgent needs, Beirut city has lost much of its investment opportunities and economic motivation.
The impact of these challenges leads the municipality of Beirut to break new ground by setting a practical and accurate approach through a SEAP unit. The creation of the SEAP unit would help develop and monitor the implementation of actions planned and supplement the municipality tenets in finding straightforward measures related directly to its comprehensive vision to convert it into a smart and sustainable city.
The SEAP unit will provide the essential technical support to the municipality through its professional team of engineers and experts who will show their best practice and employ awareness methods to change the citizens' behaviour towards their environment.
The SEAP unit will also consist of a unit manager with experts in the field of energy, sustainability, transportation, urban design, water, waste water, and solid waste in addition to communication experts skilled in social awareness.
The SEAP unit should consist of the main group of Municipality technical staff and other experts and stakeholders and NGO's who will be participating in implementation of SEAP.
They should represent the technical departments of the governorate. Representatives from the National institutions could also be part of the SEAP unit.
In addition to the above it would be good to conduct energy auditing for municipality building and facilities in order to have a clear picture on the current statesus of the buildings and facilities.

Contact person in the local authority	Project owner	State of Action	Location
Municipality Mayor /Governor	Beirut Municipality	NEW	Beirut City

General Objectives of the project

The SEAP unit will build up municipal capacity to withstand the expected increase in climate hazards and improve the energy and emission performance of the environment though enhancing energy efficiency and the use of local renewable energy sources. The unit will also support the development, implementation, and monitoring of the actions needed to address both adaptation to potential climate change effects and mitigation of the city's impact on climate.
To maintain a successful SEAP, key steps have to followed:

- Organise the structures created / assigned to prepare and implements the SEAP;
- Insure compliance with the national actions and municipal plans;
- Monitor and control the SEAP;
- Develop incentives and legal frameworks that promote SEAP with modern/existing buildings, municipal buildings ,public lighting , transport ,waste and industry;
- Implement the Energy conservation in Local municipalities facilities and buildings;
- Involve the stakeholders and citizens in the implementation of SEAP;
- Create and implement Citizen Awareness Plan & develop the public awareness for energy conservation;
- Develop Laws applicable to rationalise the use of energy;
- Develop a mechanism to work with the population to achieve SEAP goals;
- Foreseen financing sources for the investments within the action plan.

In addition to above conducting The energy auditing for municipality building will allow for proper evaluation of energy consumption and target the process for action to mitigate the energy consumptions. This action is applied for all municipality buildings.

Principal partners and stakeholders	Ultimate beneficiaries of the project

Municipality of Beirut ,Municipal Council, NGO's, Universities	Municipality of Beirut, Stakeholder of Beirut, Great Beirut 500,000 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.	Municipality of Beirut	EUR 201,600

2- Technical description

Main Technology to implement and equipment to use	**Previous or linked studies**
The SEAP unit employs competent and professional engineers in specific fields. They will invest their knowledge in new technologies in municipality buildings and enhance the conversion of the city to a sustainable city, by utilising up-to-date technologies.	The city suffers from insufficient capacity and expertise in professional tasks like in transportation, green energy, and social behaviours. The availability of specialised staff will help in the implementation of the SEAP in the municipality and will allow the proper monitoring and controlling of the actions.

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

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	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 BUILDING			**8,787**	**5,804**	**2459**	**1624**	**0.0521%**	**241,600**
Short Term Action	1	Set up SEAP Unit inside the municipality						201,600
	2	Conduct energy auditing for municipality building and facilities						40,000

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 SEAP UNIT
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 Beirut** to launch and implement the actions. **NGOs** to support the municipality work in participation **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
EUR 241,600	EUR 40,000	NA	NA

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

Local or Outsource Finance		Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%		0%	100%	4.50%	10
Fixed Financial amortisation costs				Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)		EUR 30,538	/year	EUR 305,382	EUR 241,600
Annual revenues in EUR	IRR in %	Reduction in consumptions in MWh/a	Payback time in year	NPV(2 years) in EUR	PPA Tariff
566,570	122%	2,459	2 YEARS	287,350	EUR 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	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			

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
2,459		1,624	NOV. 2020
Percentage of net reduction on the territory	**Reduction as related to BAU scenario**	**Per capita calculated reduction**	
0.0524%	2,459 MWh/a	0.004918 t CO_2/a	

7- Summary of related Awareness Raising (AR)actions

AR related to the action	AR related to community
• Increasing the Municipal staff capacity	• Linking the actions to the associations and NGOs and their social networks. • Publish the results of the energy Auditing and possible achievement and costing with saving results. • Participation of NGO, Experts and other community representative

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 the municipal will not appoint right expert for the work.

9- Key success factors

The proper planning, learning from others, involves the municipality staff in implementation and a monitoring process

10- Next steps

Short and long term actions

11- Annexes

Refer to the CAPP

Beirut Priority Action of SEAP (2)

1- General presentation

Title : Solid Waste Management

Summary of the Action:

Beirut has seen major population growth reaching 500,000 people in 2013. This has presented a challenge to the city in terms of production of 182,500 tons of municipal solid waste per year estimated to 500 t /day.
Currently the city of Beirut suffers from a lack of landfill space for waste disposal and from the limited absorption of landfill waste. This urges the city to review its plans and think carefully about what needs to be done to manage waste successfully and contribute to the ongoing sustainable and long term success of the city.
The city of Beirut, whose target is to find sustainable solutions for solid waste management, will set a number of measures which the council needs to reflect , including sorting at the source, reducing the use of non-recycled materials, developing laws and legislations for solid waste and raising citizens' awareness towards the issue.

SHORT TERM ACTION

The short term action focuses on proposing a smart waste collection. This is attained by implementing and insuring the sorting at the source, reducing the consumption of fuel related to the solid waste collection, and changing behaviours in solid waste management.
The main drivers behind such initiatives like these are cost efficiency, reduced daily trips, reduced waste and emissions.
The short term action would be accomplished by:

- Creating solid waste plan for sorting from source for Beirut city, and developing waste strategy plan with waste management plan in order to overcome the high cost in collection and transportation;
- Conducting awareness campaign on solid waste sorting to ensuring capacity development and enhancing public awareness.

LONG TERM ACTION
Implementation phase for the plan according to the city sector

- Start implementing the plan for city sorting with selected sectors in the city.

Contact person in the local authority	Project owner	State of Action	Location
Municipality Mayor/ Governor	Municipality of Beirut	NEW	Beirut City

General Objectives of the project

This action aims at creating a sustainable environment to mitigate climate change in the city. The smart plan includes reducing the impact of solid waste, promoting the usage of recycled materials and reducing the daily trips for the solid waste trucks, the fuel consumption and the maintenance cost for the collection. The action will also contribute to reduce the energy consumptions on municipality level, thus reducing municipality energy demand, energy losses and GHG emissions.

Principal partners and stakeholders	Ultimate beneficiaries of the project	
Municipality of Beirut, NGO, LU, AUB, LAU, ALU,	Municipality of Beirut, Stakeholder of Beirut, Great Beirut 500,000 inhabitants	
Link to municipal development plan	**Area(s) of Intervention**	**Estimated investment cost**

The action needs to be approved by the municipality council	Municipality of Beirut	49,666€

2- Technical description

Main Technology to implement and equipment to use	Previous or linked studies
To be defined	NA.

Project lifetime : exploitation or use duration	Implementation timeframe and Start date if set	Engineering studies	Other previous studies (if any)
18 months	Nov 2016	Not available	Not applicable

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

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					**17.3**	**4.67**	**0.00015%**	**49,666**
Part of the plan	18	Create solid waste plan for sorting from source for Beirut city						16,666
	19	Awareness campaign on solid waste sorting						33,000
	22	Start implementing the plan for city sorting with selected sectors in the city 1 to 10			17.3	4.67	0.00015%	Support from the local companies

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

The project itself focuses to a significant degree on sorting and managing solid waste which has its impact on the city's environment if not controlled.

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 SEAP UNIT

Technical assistance needs	Role of Partners
The action will need full technical assistance in order to set the plan for the city and implement it.	The **Municipality of Beirut** to launch and implement the actions. **NGOs** to support the municipality work in participation **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
49,666€	16,666 €		3,979

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

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%	%	100%	4.50%	10
Fixed Financial amortization costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)	EUR 6,277 /year		EUR 62,777	EUR 49,666
Annual revenues in EUR IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(20 years) in EUR	PPA Tariff
3,979 -	17.3	>20	-	EUR 0.23/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
Long term Action			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	To be defined	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
Not required	To applied	Not applied	3,979 €

Other

6- Projected Energy Estimates in 2024

Energy savings MWh/a	Renewable energy production MWh/a
17.3 MWh/year	NA

CO_2 reduction t CO_2/a Reduction as related to BAU scenario	Percentage of net reduction on the municipality consumption	Per capita calculated reduction	Target Year
4.67 tCO_2/a	0.00015%	0.00000934 tCO_2	2020

7- Summary of related Awareness Raising (AR)actions

AR related to the action	AR related to community
Practice solid waste management and separation Consume energy more responsibly Reduce the city's energy bills Reduce the impact of greenhouse gas emissions	• Promote separation of solid waste and educate people to start practicing it. • Provide citizens with some practical tips on how to save energy in their homes. • AR campaign of being eco-citizen: Explain the side effect of greenhouse gas emission and the usage of sorting at the source; (see priority action n°1).

8- Assumptions and risks

Assumptions: the best selection for the city sector for start implementation and support provided by the Solid waste company in providing the promotion materials and support from the NGO's.
The risk: If the solid waste management company did not cooperate with the plan or refuse it.

9- Key success factors

The citizen awareness and availability of the NGO who could support this plan in addition to the Municipality capacity in covering this action

10- Next steps

Replicate the plan in other sectors

11- Annexes

Refer to the CAPP

Beirut Priority Action of SEAP (3)

1- General presentation

Title : Bright City and Brilliant Beirut with intelligent public street lighting

Summary of the Action:

- The public street lighting in Beirut city consists of 10150 luminaries (5,000 street lights in BCD, 5,150 outside of the BCD area). They consume 10,600MWh/ year and emit 6,890 t CO_2/year.
  The action concentrates on the implementation of a previous study financed by Région Île-de-France and Bureau of United Cities and Local Governments Lebanon-Syria-Jordan for **"SCHÉMA DIRECTEUR D'AMÉNAGEMENT LUMIÈRE DE LA VILLE DE BEYROUTH".**
  Beirut city is experimenting with intelligent systems. Its master plan study focuses on regulating and managing lighting in the city of Beirut to fulfil its vision as Brilliant Beirut. The strategy has been set to provide better lighting distribution with proper management, monitoring and overall reduction in power consumption. It also includes applying international road safety measures, by adding 7500 new street lights and replacing the old 5150 street lights (outside the BCD) by new one.
- By the end of project, the total consumption will become 8,805 MWh/year for 22,650 street lighting, yet the expected power consumption could reach 18,430MWh/year if this action has not been applied. The estimated reduction in power consumptions will be 9,578MWh/year.
  The total saving in power consumptions counts for 52% if we consider business as usual (BAU).
- The action will also include new infrastructure for cabling (190Km for underfloor cables, 206Km overhead cables) for the streetlights with new feeder pillars stations, which fulfil the new requirement of lighting management with monitoring the power consumptions and efficient control of lights.
- A new a control room will be located in the municipality where all the monitoring and control can be monitored.

This project will give the city its own entity as smart and sustainable city.

- The benefits of deploying the action for the public street lamps fall into two categories:, energy savings and operational savings

Energy savings:

Typically, the light management system will lower energy costs, which results from the following features:

Low wattage: LEDs provide significant energy savings by delivering the same or enhanced quality light at lower wattages than legacy bulbs.

Dimming: Due to their high light output, LED lamps can be dimmed as much as 50 percent when first installed with minimal compromise in light output. In addition, operators can schedule lamps to dim as circumstances allow, such as at low traffic times, in unpopulated areas the middle of night, etc.

Reduced burn time: With using astronomical timer, the street light coincides with changing sunrise/sunset times, thus reducing lamp burn time.
As a result of these features, this action can reduce energy use for street lighting by 52 percent.

Operational savings:

The operational savings from this action will vary depending on the costs the street light operator currently incurs to maintain their lights.
Long lifetimes: LED lamps life operate for 50,0000 hours which count for 10 years last longer than legacy lamps, so require replacement less often, which reduces hardware and installation costs.
Remote monitoring and management: Street light management software gives operators visibility into street light operations (for example, how much energy a lamp is using) as well as controls over dimming and on/off schedules, reducing the need to run lamps for long periods.
Automatic outage detection: Management software provides instant outage notification, dramatically reducing the number of calls (and related costs) to the call centre and cutting downtime up to 90 percent. With accurate outage information, operators can eliminate truck rolls due to false alarms, pinpoint non-working lamps and quickly dispatch crews to specific lights.
Proactive maintenance: Street light management software also provides predictive information, alerting operators to lamps approaching end-of-life, so replacements can be scheduled proactively. Utilities that periodically conduct manual surveys of their lights can eliminate this cost entirely for even greater ROI.

Contact person in the local authority	Project owner	State of Action	Location
Municipality Mayor / Governor	Municipality of Beirut	NEW	Beirut City

General Objectives of the project

The action will give the city its own entity with new vision for the city as “Brilliant Beirut”. It also will provide safe roads for cars and pedestrians .It will increase the efficacy of the light, reduce the consumption of power and mitigate the emission for the GHG.
The objectives can be summarised as follows:

- Insure the compliance with the international standard for public street lighting;
- Increase the road and city safety standard;
- Create an image to the city at night in order to attract more visitors to the city and insure comfortable feeling;
- Encourage the walking habitant by increasing the safety and lighted roads and sidewalks and reduce the car traffic;
- Increase the lighting efficiency and reduce the energy consumptions;
- Reduce the maintenance cost with time consumed in maintaining the public street lighting
- Reduce the GHG emission due to energy consumptions;
- Enhance the municipality capacity in managing projects.

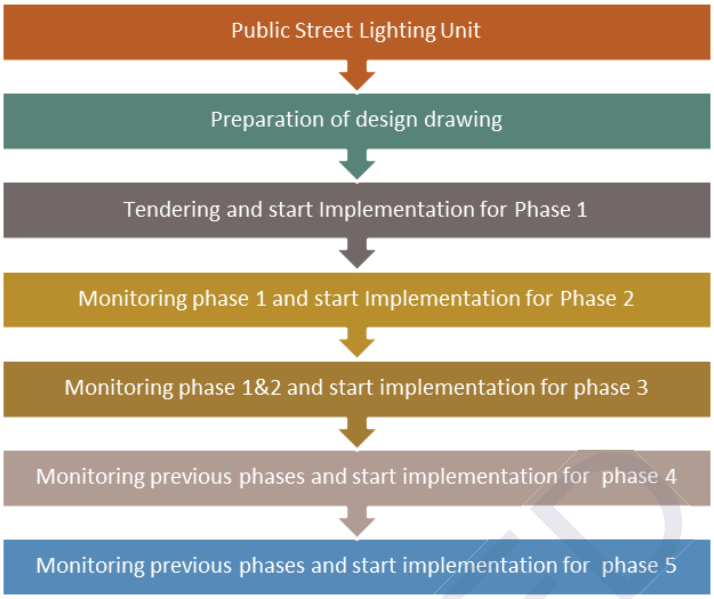
Principal partners and stakeholders	Ultimate beneficiaries of the project	
Municipality of Beirut	Municipality of Beirut, Stakeholder of Beirut, Great Beirut 500,000 inhabitants	
Link to municipal development plan	**Area(s) of Intervention**	**Estimated investment cost**
The action is approved by the municipality council	Municipality of Beirut	EUR 751,000

2- Technical description

Main Technology to implement and equipment to use	Previous or linked studies
The latest technology will be used in street lighting LED with 120 lumen/watt and long life ones. The street lighting control gear will be dimmable to achieve reduction in light output after midnight. The control system will monitor the defective lamps for quick response for maintenance; the system will keep recording the consumption of power for proper monitoring. The control system will be monitored through control room in the municipality.	There were two phases of studies for the projects conducted with consultants and have been verified before. Both studies were financed through Idl France. The study points out the high reduction in power consumptions along with providing better service to the city. The study includes new infrastructure for the street lighting which replaces the old existing one.

Project lifetime : exploitation or use duration	Implementation timeframe and Start date if set	Engineering studies	Other previous studies (if any)
Nine Years	Jan 2017	As stated before, there was study which set the strategic approach and the financial analyses for the project	Not applicable

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



SHORT TERM ACTION

1. Prepare the working drawing and tendering documents for the master plan for regulating the lighting in Beirut city.
2. 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.

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		
PUBLIC STREET LIGHTING			13,462	8,750	1,346	875	0.028%	751,000
Short Term Action	28	Working drawing and tendering documents						750,000
	29	Maintenance check form			1346	875	0.028%	1,000

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

The project is part of reducing the power consumptions in the city and doesn't have any impact on the environment.

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
Legal responsible body (is) for:	Municipality Lawyer	**Municipal of city staff training needs**	Will be part of the SEAP UNIT

Technical assistance needs	**Role of Partners**
This action needs consultant offices to monitor the execution of work.	The **Municipality of Beirut** to launch and implement the actions. **NGOs** to support the municipality work in participation **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**
EUR 751,000	EUR 250,000	NA	EUR 309,580

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

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%	0%	100%	4.50%	10
Fixed Financial amortisation costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)	EUR 94,926 /year		EUR 949,264	EUR 751,000
Annual revenues in EUR / IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(5 years) in EUR	PPA Tariff
309,580 / 11.5%	1,346	5	161,362	€ 0.23/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
Long term Action			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	To be defined	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**
Suggested to be : PPP partnership public and private sectors	To applied	Not applied	1346 €
Other			

6- Projected Energy Estimates in 2024

Energy savings MWh/a	Renewable energy production MWh/a
1,346 MWh/year	Not applied

CO_2 reduction t CO_2/a Reduction as related to BAU scenario	Percentage of net reduction on the territory	Per capita calculated reduction	Target Year
875 t CO_2/a	0.028%	0.00175 t CO_2	2020

7- Summary of related Awareness Raising (AR)actions

AR related to the action	AR related to community
Increase the municipal staff capacity Increase the knowhow on usage of LED lights	Citizen participation in the project Posters nailed on street lamps to alert citizens on municipality action Promoting the usage of efficient lighting

8- Assumptions and risks

The Risks which affect the life time of the system and doesn't pay back it is invest:

- Low quality and low efficient product;
- Missing the protection for over current and short circuits and surge;
- No maintenance;
- Poor installation;
- Poor network.

The assumption which considered in this action:

- High quality of product with long life operation and low maintenance needs;
- Qualified maintenance staff;
- Availability of spare parts.

9- Key success factors

- The municipal council had approved the public lighting plan for Beirut and had set the vision;
- The possibility to start the implementation in sectorial base in order to learn from obstacles and increase the municipality capacity in next phase of plan.

10- Next steps
Review the new technologies in street lighting to implement the latest one.
11- Annexes
Refer to the CAPP

Beirut Priority Action of SEAP (4)

1- General presentation

Title : WORKSHOP ON CHANGING BEHAVIOUR, CONCENTRATE ON ENERGY CONSERVATION AND RENEWABLE ENERGY USAGE

Summary of the Action:

The tertiary sector is responsible for 39 % of total city emission, and represents a key element in mitigation process.

A workshop on changing behaviour that focuses on energy conservation and renewable energy usage will be held for tertiary sectors. Its ultimate goal is to address 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, thus leading to effective and long-term behavioural changes.

The awareness campaign starts with workshops delivered to the owners and administrative staff of the tertiary sectors followed by instruction leaflets posted in locations .Annual follow up meetings will be held to compare and evaluate the results and get support from experts to solve any obstacle. The areas covered are:

- Governmental and Public offices;
- Hospitals;
- Schools;
- Universities;
- Hotels;
- Show rooms and Shops;
- Private offices

Contact person in the local authority	Project owner	State of Action	Location
Municipality Mayor / Governor	Municipality of Beirut	NEW	Beirut City

General Objectives of the project

The action aims at implementing an innovative mechanism to create a kind of competition between society components and the tertiary sector to indicate its commitment, role, participation and sense of responsibility towards the environment and community. The municipality with coordination from the local NGO's and experts in energy and social behaviours will set the standards to motivate the implementation of the action. They will provide the tools for training and proper implementation, supported with workshops flyers and brochures. This action will have the impact to motivate the social and civil society in reducing the footprint and address energy conservation with behavioural changes.

Principal partners and stakeholders	Ultimate beneficiaries of the project	
Municipality of Beirut, NGO, LU, AUB, LAU and ALU	Municipality of Beirut, Stakeholder of Beirut, Great Beirut 500,000 inhabitants	
Link to municipal development plan	**Area(s) of Intervention**	**Estimated investment cost**
The action needs to be approved by the municipality council	Municipality of Beirut	60,000€

2- Technical description

Main Technology to implement and equipment to use		Previous or linked studies	
To be defined		NA.	
Project lifetime : exploitation or use duration	**Implementation timeframe and Start date if set**	**Engineering studies**	**Other previous studies (if any)**
18 months	Nov 2016	Not available	Not applicable

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

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		
BUILDING TERTIARY SECTOR			**444,000**	**293040**	**66,600**	**43,956**	**8.623%**	**60,000**
Short Term Action	50	Workshop on changing behaviour						
	51	Governmental and Public offices.	142000	93720	21300	14058	0.451%	10,000
	52	Hospitals.	83000	54780	12450	8217	0.264%	10,000
	53	Schools.	83000	54780	12450	8217	0.246%	10,000
	54	Institutions	40000	26400	6000	3960	0.127%	10,000
	55	Universities.	20000	13200	3000	1980	0.063%	10,000
	56	Hotels.	76000	50160	11400	7524	0.241%	10,000

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

NA

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
Legal responsible body (is) for:	Municipality Lawyer	**Municipal of city staff training needs**	Will be part of the SEAP UNIT
Technical assistance needs		**Role of Partners**	
The action will need full technical assistance in order to set the plan for the city and implement it.		The **Municipality of Beirut** 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 **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
EUR 60,000	EUR 30,000	NA	EUR 15,318,000 as saving but not for the municipality

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

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%	0%	100%	4.50%	10
Fixed Financial amortisation costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)	EUR 7,584	/year	EUR 75,840	EUR 60,000
Annual revenues in EUR	IRR	Reduction in consumptions in MWh/a	Payback time in year	NPV(2 years) in EUR	PPA Tariff
15,318,000	200097	66,600	2	14,582,533	EUR 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
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	To be defined	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**
Not required	To applied	Not applied	49,049€

Other

6- Projected Energy Estimates in 2024

Energy savings MWh/a	Renewable energy production MWh/a
66,600 MWh/year	NA

CO_2 reduction t CO_2/a Reduction as related to BAU scenario	Percentage of net reduction on the Territory	Per capita calculated reduction	Target Year
43,956 tCO_2/a	8.623%	0.087912 t CO_2	2020

7- Summary of related Awareness Raising (AR)actions

AR related to the action	AR related to community
Communication Tools Launch posters with strong call-to-action message to build interest Produce rewarding certificates for participants and an educational kit to give away;	Produce Leaflets to be distributed in all concerned locations (Universities, hotels, public offices…) to motivate participation. Promote the workshop through social media and text messages Write a press release and send it out to relevant media in order to create a buzz.

8- Assumptions and risks

The assumption response from the tertiary sectors and availability of support from the central bank and other financing facilities.
The risk with wrong approach and implementation of the plan.

9- Key success factors

The Government support the electricity cost and implementing such action would contribute in reducing the national cost for supporting the electricity cost.
The tertiary sector represent the main driver for the economy in the city by reducing their billing cost for energy would support their income and provide better stability to the city.

10- Next steps

Continue the plan in tertiary sector

11- Annexes

Refer to the CAPP

Beirut Priority Action of SEAP (5)

1- General presentation

Title : MASTER PLAN FOR SMART TRANSPORTATION

Summary of the Action:

Transportation plays an essential role in the economic growth of the city. Traffic congestion has its impact on the labourer and employee that costs them lot of consumed time to reach the offices due to long travel time in addition to logistic cost. It is also a repellent factor for economic growth and business investment.
The city of Beirut suffers from stifling traffic crisis in different timing which has turned into a daily ordeal for commuters. The lack of a sustainable and efficient transport system exacerbates the level of congestion on the roads. In order to sort out this problem, a master plan for smart transportation should be created to fulfil the needs of the city.
The city of Beirut has many properties that can be characterised by its estimated road length - around 200 Km in area of 20 Km², which can be remoulded with smart and sustainable plan.
Also the city had traffic control centre which utilises intelligent movement count for the street to control many traffic lights in the city.
Thus the need to plan a long-term transportation strategy for the city that will help guide the city's transportation to 2040 and beyond should focus on improving mobility for local residents of the city by providing viable choices through all modes of travel. The plan should cover the daily city visitors; carry rethinking growth to support the transportation master plan, taking transit to the next level, and actively managing transportation demand. It should also have greater investment in cycling and walking infrastructure, handling more strategic programs of road network improvements.
The plan should identify the strategic outcomes to guide future planning and contribute to a continuation of the high quality of life in the city, and assess the viability of implementing a rapid transit system for the city.
The other actions related to the plan are as follows:

SHORT TERM ACTION

- Conduct a Master Plan for Smart Transportation.

Contact person in the local authority	Project owner	State of Action	Location
Municipality Mayor / Governor	Municipality of Beirut	NEW	Beirut City

General Objectives of the project

The transportation sector is responsible for the majority of the city emission and counts for 47 % of the city's total emission as it produces 1,146,675 t CO2/ year (2013).
The high operational and maintenance costs are incurred by car owners. These costs include fuel consumption, taxes, insurance and car service. Commercial investment in cars as a mass transportation system, including the import of vehicles, replacement parts, fuel and related costs, was estimated to be over 7.5% of the country's GDP.
The smart master plan aims at creating the safe areas for walking and riding bike, linking different areas inside the city, creating short links and promoting short cuts between the areas to reduce the travelling distance. This will reflect in reducing the fuel consumptions and mitigating the emission due to congestion and long distance traveling.
The plan should identify the strategic outcomes to guide future planning and contribute to a continuation of the high quality of life in the city, and assess the viability of implementing a rapid transit system for the city.

Principal partners and stakeholders	Ultimate beneficiaries of the project
Municipality of Beirut, NGO, LU, AUB, LAU, ALU,	Municipality of Beirut, Stakeholder of Beirut, Great Beirut 500,000 inhabitants

Link to municipal development plan	Area(s) of Intervention	Estimated investment cost
The action needs to be approved by the municipality council	Municipality of Beirut	2,000,000€

2- Technical description

Main Technology to implement and equipment to use	Previous or linked studies
To be defined.	NA.

Project lifetime : exploitation or use duration	Implementation timeframe and Start date if set	Engineering studies	Other previous studies (if any)
18 months	Nov 2016	Not available	Not applicable

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

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		
TRANSPORTATION			**5789683**	**1456277**	**3277791**	**824970**	**26.456%**	**2,000,000**
Short Term Action	69	Smart master plan for transportation						2,000,000

The above results will be achieved with end of the project implementation as start will be with the planning

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

NA

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
Legal responsible body (is) for:	Municipality Lawyer	**Municipal of city staff training needs**	Will be part of the SEAP UNIT

Technical assistance needs	Role of Partners
The action will need full technical assistance in order to set the plan for the city and implement it.	The **Municipality of Beirut** to launch and implement the actions. **NGOs** to support the municipality work in participation **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
EUR 2,000,000	EUR 1,000,000	NA	NA but in general it will be 236,000 not part of municipality

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

Local or Outsource Finance	Private (or own) funds	Bank Loan	Interest rate	Amortisation period in years
0%	0%	100%	4.50%	10
Fixed Financial amortisation costs			Total loan repayment due:	Loan (principal) capital:
Loan repayment (annualised)	EUR 7,904,527.23	/year	EUR 2,528,000	EUR 2,000,000
Annual revenues in EUR	Reduction in consumptions in MWh/a	Payback time in year	NPV(15 years) in EUR	PPA Tariff
236,000	3,277,791	15	EUR 6,533	EUR 0.072/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

The study will not produce reduction in emission but it will be the first step to start implementation of the traffic plan in the city, above result show the expected results of the plan.

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	To be defined	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
Not required	To applied	Not applied	EUR 236,000 applied for the citizen, this will be after implementation of total actions
Other			

6- Projected Energy Estimates in 2024

Energy savings MWh/a	Renewable energy production MWh/a
3,277,786 MWh/year not part of municipality reduction	NA

CO_2 reduction t CO_2/a Reduction as related to BAU scenario	Percentage of net reduction on the territory	Per capita calculated reduction	Target Year
824,970 tCO_2/a this will be after implementation of total actions	26.456% this will be after implementation of total actions	1.649 tCO_2 this will be after implementation of total actions	2020

7- Summary of related Awareness Raising (AR)actions

AR related to the action	AR related to community
City capacity	Awareness

8- Assumptions and risks

- The assumptions: The TOR for the consultant contract should be well produced and special attention should be considered for the methodology and monitoring of plan;
- The Risks: The low profile and experience of the consultant and low city staff capacity.

9- Key success factors

- The transportation is main city problem and starting with proper planning is the key part in the solution.

10- Next steps

Review the new technologies in street lighting to implement the latest one

11- Annexes

Refer to the CAPP

ANNEX II – CITIZENS AWARENESS PROMOTION PLAN (CAPP)

Beirut

Get smart, Live better Beirut

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 in the SEAP document and other similar awareness raising actions.

Preparation of COMMUNITY AWARENESS PROMOTIONAL PLAN (CAPP)

Template 1- Situation analysis of Beirut

Aim

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

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

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

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

Specific objectives:

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

(ii) Help to identify the most appropriate a) **awareness raising campaigns** that would accompany the 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 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.

In the case of Beirut, the SEAP consultants have filled the templates based on their understanding and perception of the city's inhabitants and their knowledge of the field.

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

II. Identification of priority issues to be addressed by a sustainable energy action and their level of importance			
Issue	**Level of importance**		
	Very important	**Important**	**Not important**
High price of energy	X		
Availability/lack of energy	X		
Availability of transport	X		
Waste management			X
Clean environment		X	
Other			

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

IV. Previous awareness actions conducted by the city/municipality or by other actors	
Has the city or local authority done previous actions	Yes
If yes, who conducted the actions (the city/municipality, NGO, national authority…)	NGO “Beirut Marathon Association"
If yes, describe the action	Beirut Marathon conducted a sports event on national celebration of hope, unity, and peace.
If yes, what was the budget and how did you fund it	Don’t know but it looks like USD 3 m
If yes, outcome, impact and feedback	This event brought together 37, 811 runners on the streets in 2015.

V. Public consultation	
Does the city practice public consultation?	No
Has the city done public consultations for SEAP?	No
Is it part of the legislative process?	No
Foreseen consultation(s)	No
Does the city liaise with national institutions, stakeholders?	No

Situation analysis

From this study concerning the target, it appears that the groups that are aware of and informed about energy challenges are the middle age and senior population. The youngest respondents don’t seem to give any importance to sustainable energy. Therefore, they should be considered as the audience that needs more persuasion most and should be targeted by the awareness raising campaigns and actions. It would be recommended to enforce the communication with them, change their behaviour and get their involvement and engagement.

The template shows that the important leverages on which we can use and base our communication upon are: The high price and (non) availability of energy, the cleanliness of the environment and the unavailability of transports. The ambiguity in the survey lays in the fact that Beirut’s citizens in general are very impacted by the bad management of energy and waste and the issues resulting from that, but they don’t seem to be aware of, or educated to energy related issues or convinced about the level of importance they represent (Lebanon has been facing a shortage of electricity for many years and a shortage of water lately coupled with a major waste collection crisis).

Nevertheless, the municipality of Beirut has lately conducted an awareness raising action that was not necessarily focused on Sustainable Energy or Energy Efficiency. It was able to assess its positive impact by the high level of participation of civil society as well as the expression of their interest. It has been organised in partnership with an NGO and benefited from a worthy budget.

Finally, the municipality of Beirut has not conducted any public consultation with its citizens yet, and none are forecasted soon.

At this stage of the survey, we cannot confirm who the target is in order to define an appropriate message and delivery mechanisms and develop effective messages, activities and plans that will address the needs of each group.

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
The city of Beirut suffers from shortage of electricity which brings the diesel generator as a permanent entity to the city.	Reduce power consumption and electricity bills and increase renewable energy sources Reduce CO_2 emissions. Practice responsible behaviour toward our planet. Encourage people to switch to solar systems.	**Topic:** **CO_2 emissions are dangerous for the planet and for your environment.** **Activities:** Raise awareness about the benefits in saving power and using efficient appliances in house and work Raise awareness about simple efficient daily behaviour (Usage of led lights, A+++ appliances, switching off lights, and a fixed air-conditioned temperature); Set a department within the municipality to provide energy advice to the citizens Promote the usage of full solar system through fairs, direct communication;
Water consumption (lack of water due to overload on usage)	Promote and practice controlled water consumption (to save water and reduce the water bills). Promote treated waste water to be reused.	**Topic:** **Save water as a collective heritage: adopt better social behaviour towards water consumption** **Activities:** Encourage and educate to a better social behaviour towards water consumption - Raise awareness, educate and inform users on water resources, and their limitations. Provide facts sheets to explain the risks of water scarcity and the negative effects of high water consumption and how overcoming water scarcity is possible as a collective action Provide practical tips on how to reduce water consumption with stickers, educational films,

		documentaries, distribution of water stream reducers. Introduce them to new methods and procedures (to be adopted by the municipality) to control water consumption: water meters to be installed on water sources delivering the needed quantity for every neighbourhood according to the number of citizens.
Solid waste issues	Practice solid waste management and separation Consume energy more responsibly Reduce the city's energy bills Reduce the impact of greenhouse gas emissions	**Topic:** **Sort, reuse and recycle for a better environment;** **Activities:** Promote separation of solid waste and educate people to start practicing it; Provide citizens with some practical tips on how to save energy in their homes. AR campaign of being eco-citizen: Explain the side effect of greenhouse gas emission and the usage of sorting at the source; (see priority action n°1).
Road congestion	Encourage people to use common transportation vehicles.	**Activities:** Raise awareness about decreasing CO_2 emissions by introducing citizens to renewable energy technologies through leaflets, carpooling, a day without cars. (see priority action n°5).

Template 3.2

CAPP activities as related to SEAP Priority Actions of Beirut

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:
Solid waste management and sorting (collection, transportation and treatments).	**Target Audience:** - Civil society - Private and public operators **Key Message:** - Don Message:public operat - Waste should not grow with population: Reduce the amount of solid waste and save your environment. **Objectives :** - Implement awareness actions to insure the sorting at the source, and practice responsible and integrated waste management within the city. - Reduce the consumption of fuel costs related to the solid waste collection and transportation - Change behaviour in solid waste management by increasing the awareness and reducing the use of non- recycled materials. **Communication Tools** Launch AR regarding the SEAP and the municipalityreasing within the city Provide practical tips to reduce solid waste at its source, to re-use and recycle: production of a small guidebook and calendar. Launch awareness operations in collaboration with NGOs and associations: In the neighbourhoods: cleaning and sorting day; Issue a «Clean» certificate for deserving ones. In the schools: Educational kits and activities - with a view to teaching young people how to recycle and reuse waste. Activities mostly targeted at children showing them how much organic waste is being discarded, where does it go, why is it important. Organise special events for school children (competitions and compost days). Conduct environmental projects and trips to the waste management facility to give students the opportunity to learn and explore new technologies and concepts that could aid environmental sustainability. Installation by the municipality of recycling bins in all municipal buildings and facilities promoting recycling of plastic bottles, paper batteries. Launch a global awareness campaign: messages through radio programmes, newspapers and television, to explain the negative effects of

	solid waste accumulation; produce promotional material (leaflets, brochures, posters) and billboard advertisements. Produce posters on pick-up trucks for high visibility.
Building Capacity with New SEAP UNIT	**Target Audience:** - Civil society - Municipal council and staff at all levels - NGOs - Universities and Academia **Key Message:** - Beirut is getting smarter, live better Beirut **Objectives:** - Support the implementation of actions within the SEAP scope - Involve the stakeholders and citizens in the implementation of SEAP - Build municipal capacity and promote the creation of a genuine dialogue and partnership between the Serbian authorities and the Civil Society - Improve local services to citizens **Communication Tools** Disseminate the municipality unit expertise with seminars and conferences about green energy and renewable energy. Launch training activities together with civil society, media and business, governmental representatives, to facilitate communication between different sectors. In recognition of the importance of youth this target should be included. Organise round tables, talk shows, quizzes and competitions to be screened on local TV stations, involving local politicians, municipal staff and a TV audience (schools, citizens, NGOs and institutional representatives) as two competing teams in a best-practice debate.
"Bright City and Brilliant Beirut" with intelligent public street lighting	**Target Audience:** - Civil society - Private and public operators **Key Message:** - Creating a bright image and a new vision of the city at night will attract more visitors and insure a comfortable feeling. - Applying renewable energy to urban areas is important and will benefit the city at both environmental and economic levels. **Objectives:** - Promoting the installation of similar equipment in other urban common areas - both public and private - Double the benefits of deploying the action for the public street lamps: 1) energy savings and operational savings; 2) Increase the lighting efficiency and reduce the energy consumptions.

	- Reduce the maintenance cost with time consumed in maintaining the public street lighting - Increase the road and city safety standard **Communication Tools:** Awareness raising documentary on TV. Posters nailed on street lamps to alert citizens on municipality action Promoting the usage of efficient lighting through distribution of led lamps in several boroughs. Setting-up training to the students in college on using the energy correctly. Installation of a pilot installation that all citizens can visit. Distribute fact sheets with electricity bills that include data on the importance of solar energy, its advantages and the savings expected in %. Appoint a fact sheets that includes NGOs who have a wide range of skills, interests and knowledge in various areas of energy-consuming activities to lead the citizens toward new best practice initiatives. Produce information packages for employees and promotional items (T-shirts, buttons, coffee mugs, stickers…). Encourage and reward creative suggestions for energy efficiency improvements: Ask employees to design and produce an energy efficiency poster, a poem, a song or a jingle, a mascot or an energy efficiency awareness character.
Workshop on changing behavior, concentrating on energy conservation and renewable energy usage	**Target Audience:** - Civil society - Tertiary sector stakeholders (private and public) - NGOs and Energy experts **Key Message:** - Be responsible: Let yourself in for Energy conservation! - You can make a difference: commit! **Objectives:** - Encourage tertiary sector and civil society to commit and take action in the environment and community. - Motivate the social and civil society in reducing the footprint through behavioural changes. **Communication Tools** Produce Leaflets to be distributed in all concerned locations (Universities, hotels, public offices…) to motivate participation. Launch posters with strong call-to-action message to build interest

	Produce rewarding certificates for participants and an educational kit to give away; Promote the workshop through social media and text messages Write a press release and send it out to relevant media in order to create a buzz;
Master plan for smart transportation	**Target Audience:** - Civil society, all vehicle drivers, specifically young people - Private and public operators **Key Message:** - For a cleaner, safer and quieter city - If you care (about the environment), share (your car) **Objectives:** - Reduce the fuel consumptions and congestion - Increase sustainable mobility and eco-driving - Increase roads capacity - Encourage car/cab sharing **Communication Tools** Awareness campaigns to young people (to whom mobility is important) on car sharing Build AR campaigns to transport decision makers and other community groups, in particular the disabled and the elderly (shared taxi called "service"). Use all media forms and produce imaginative posters, local TV and radio press articles about the issue. Promote a car pooling scheme run on the Internet and co-financed by the municipality, at the disposal of all employees and city dwellers. 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, and access to the repair shop, etc.). Launch national posters and TV campaign Bike day and/or marathon day Define and promote practical advantages for car sharers (public or private sector).

Recommendations:

These tables aim to promote in a particularly innovative and ambitious way local community's response to current challenges identified in the SEAPs, notably in the management of energy and the promotion of renewable energies. They are meant to identify the most appropriate communication actions to reach the local community.

Overall, and in the case of Beirut specifically, there is a fairly low level of awareness by consumers and, to some extent, it is one of the main behavioural barriers. Additionally, there is a lack of experience, and in some cases of trust, of the targeted consumers regarding the performance and quality of new energy efficient products on top of the higher upfront costs compared to the alternatives with lower efficiency.

Clearly, the citizens are not exposed to the right information and there are no government-driven incentives towards energy efficiency market. On the other hand, young people and students are found to be high dynamic and face changing situations; if properly educated to the energy issues and climate change, they could influence the policy-making process while reshaping the general public interests and specific constituencies.

It is therefore important to confirm: 1) who the target audience is, recognise and consider the varying circumstances, needs and concerns that each group may have; and 2) what would be the best way to anticipate the barriers that affect their choices and preferences for their environmental behaviours. The actions will be seen as a credible and effective messages if promoted through the proper insight in terms of “what’s in it for me?” in other terms, potential cost savings to be translated into concrete benefits that they can relate to.

Beirut municipality 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. Awareness-raising should be carried out in an interconnected manner between the municipality and its citizens to create cohesion and therefore persuasion concerning the ongoing projects and the future ones.

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

Establish a well-thought-out and executed communications plan as an effective tool for implementing an energy efficiency awareness programme within the SEAP, as well as stick to the vision slogan in every communication to highlight the goal aimed at (Get Smart, live better Beirut); 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 (including the ones from the union of municipalities); communicate and promote at the municipality level about actions and measures toward energy saving and energy efficiency that improves the quality of life in the city.

As for the key players, it is vital to make use of the many active NGOs and associations resources to support and enhance the communications efforts and help citizens to understand the importance of energy efficiency in terms of reduced operating costs. Similarly, it is essential to consider as well other resources such as scout boys and girls (for neighbourhood actions), media arts students (in developing posters and other materials), municipal employees organised in an “energy team”, a spokesperson to be an “energy hero”, etc.; that could reduce costs while also involving the local community.

The creation of a communication cell within the municipality, will be the final action. With the plan to set up its structure, strengthen its capabilities and its human resources developed. It can carry its actions at the level of the municipality, in order to connect with its citizens, implement the concept of eco-responsibility and promote the idea that the actions of individuals can make a difference.

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