

IDAL

INVEST IN **LEBANON**

CLEAN TECH SECTOR IN LEBANON

► 2018 FACTBOOK



CONTENT

▶ ALL YOU NEED TO KNOW ON LEBANON	p 4
▶ ECONOMIC PROFILE AND SYSTEM	p 5
▶ SECTOR OVERVIEW	p 6
Global Overview	
Regional Overview	
Local Overview	
▶ LEBANON'S COMPETITIVE ADVANTAGES	p 8
Strong Human Capital Base	
Highly Skilled and Cost Competitive Labor Force	
Access to Growing Regional Markets	
A Flourishing Scientific Community	
Rising Regional Demand for Clean Tech Innovation	
Supportive Ecosystem	
▶ INVESTMENT OPPORTUNITIES	p 13
Clean Technologies in Water And Wastewater Management	
Clean Technologies in the Agriculture Sector	
Clean Technologies in Solid Waste Management	
Clean Technologies in the Transportation Sector	
Clean Technologies in the Energy Sector	
▶ CLEANTECH SUCCESS STORIES	p 24
▶ USEFUL ADDRESSES & CONTACTS	p 26

ALL YOU NEED TO KNOW ON LEBANON

Invest in Lebanon and enjoy the most hospitable MENA destination for business, culture and leisure with a Mediterranean climate, cosmopolitan lifestyle and a variety of touristic attractions and activities across breath-taking natural landscapes. Strategically located at the intersection of Europe, Asia and Africa, Lebanon can provide companies easy access to regional and global markets. Lebanon also boasts state-of-the-art health care services, internationally renowned for the quality medical centers and staff. A historic melting pot for multiple civilizations, Lebanon is a small, multilingual haven of culture and diversity that is worth the journey.

Lebanon, with its official non-interventionist stance toward private investments, offers one of the most liberal investment climates in the Middle East. The economic openness of the country is harnessed through the absence of legal restrictions on the entry or exit of many firms, encouraging free market competition and furthering the development of the private sector. Liberal trade and investment policies have allowed foreign direct investments to account for a considerable share of Lebanese GDP.



ECONOMIC PROFILE AND SYSTEM

GDP at current prices (2017): USD 52.7 Billion

GDP/Capita (2017): USD 11,680

Real GDP growth (proj-2018): 2.0%

GDP composition by sector (2015):

Agriculture: 3.5%

Mining, Manufacturing, and Utilities: 11%

Financial Services: 8%

Professional and Administrative Services: 7%

Education and Health Services: 11.5%

Real Estate: 14%

Public Administration: 9.3%

Trade: 13%

Current Account balance (Sept. 2017): USD -0.72 Billion

Balance of Payments (2017): USD -156 Million

Domestic credit to private sector (2017): 102.8% of GDP

Corporate tax rate: 17%

Main Import Partners (2017): USA, Greece, Russia, Italy, Spain, Ukraine

Main Export Partners (2017): Turkey, Syria, KSA, Egypt, Kuwait, UAE, Iraq

FDI inflows (2017): USD 2.62 Billion

Airport passengers (2017): 8.24 Million

Source: International Monetary Fund (IMF), World Bank, Bank Audi, Central Administration for Statistics (CAS), Ministry of Economy and Trade, Lebanese Customs Administration

Note: Latest available figures in the time of publication.



SECTOR OVERVIEW

GLOBAL OVERVIEW

In 2016, the global clean tech sector reached a market size of USD 3.78 trillion¹, representing about 5% of global GDP, and is expected to double in size by 2025².

The Clean Tech sector is growing from a niche market to a market that has the potential to impact an array of different sectors, including ICT, Healthcare, Food, and Electronics.

An estimated USD 41 billion of venture capital funds have been injected in clean tech startups worldwide from 2009 to 2014, almost double the amount of the previous five years³.

The number of venture capital clean tech deals also reached 455 in 2016,

accounting for 7.6% of total venture capital deals worldwide⁴.

The clean tech sector is a driving force for innovation: around 207,147 patents in environmental technologies had been given in 2014, registering a 20% increase from 2010⁵. Switching to a clean technology environment is also favorable for job creation. By 2030, up to 20 million jobs could be created worldwide in clean technologies, the majority of which will be in biofuels-related agriculture (USD 12 million), followed by solar photovoltaics (USD 6.3 million), and wind energy production (USD 2.1 million)⁶. These jobs tend to be more skilled, safer, and better paid than jobs in similar sectors.

REGIONAL OVERVIEW

MENA is facing many disconcerting environmental challenges which requires an urgent strategic planning. The demand for energy in the region will increase 114% by 2050 despite the existing lack, and the waste production will reach 135 million tons per annum up from 63⁷. These obstacles have turned on to become major opportunities in the hands of cleantech entrepreneurs, to take advantage of the sector's growth. Even when excluding

China, India, Russia and Middle-Income Europe, investments are expected to be over USD 4.1 trillion in developing countries until 2024⁸, with USD 900 billion expected to go specifically to the MENA region⁹, and USD 1 trillion expected to be accessible to SMEs¹⁰. Knowledge of local markets, the need for specialization, and lower financial and technical barriers to entry make these activities especially accessible to SMEs.

¹ Plunket Research, 2018

² Energy Vortex, Study commissioned by the German Government, 2018

³ WWF International & the Cleantech Group, 2014

⁴ Brookings Analysis, 2018

⁵⁻⁶ OECD, 2015

⁷ Wamda, 2016

⁸ (For 15 clean tech sectors in 145 developing countries) InfoDev and World Bank, 2014

⁹ InfoDev and World Bank, 2014

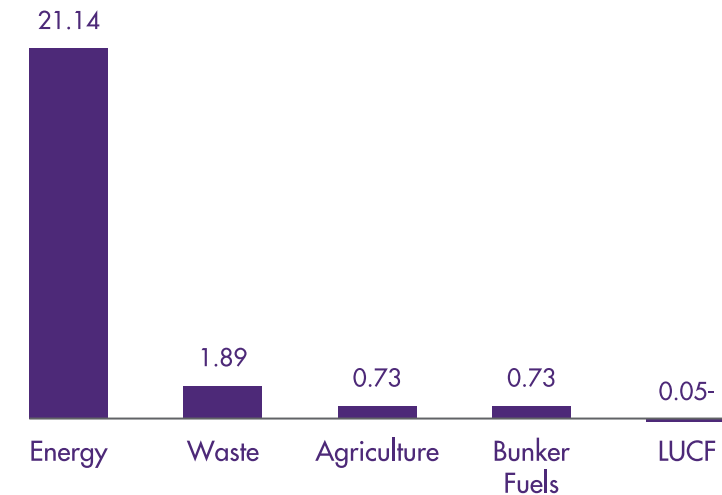
¹⁰ (For 15 clean tech sectors in 145 developing countries) InfoDev and World Bank, 2014

LOCAL OVERVIEW

Where does the clean tech sector in Lebanon stand? Analyzing this sector will require looking at the various sub-sectors and activities that involve the use of clean technology such as water and waste water, agriculture, agro food and the environment. Like many countries in the world, Lebanon is suffering from environmental pressures due to

climate change, population growth, and urbanization, which require more optimal resource management plans and water and waste management systems. Greenhouse Gas (GHG) emissions increased at a rate of 229% from 1990 to 2012¹¹, contributing to 0.06% of global GHG emissions, with the energy sector accounting for the largest emitter (Figure 1).

Figure 1: Lebanon's GHG Emissions by Sector MtCO₂e | 2015*



*Latest Available Data

Source: USAID, Greenhouse Gas Emissions, Lebanon 2016

On the other hand, with the presence of a number of natural resources (including wind, solar, and water), Lebanon has been witnessing a surge of high tech companies specialized in clean technologies.

Innovations in the clean tech sector can help Lebanon both preserve its natural resources, as well as benefit from them through renewable energy systems.

¹¹ USAID, 2016

LEBANON'S COMPETITIVE ADVANTAGES

01. STRONG HUMAN CAPITAL BASE

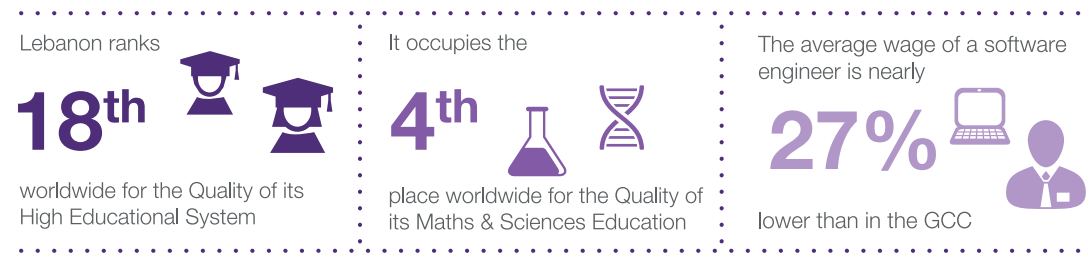
Lebanon's solid educational system is at the basis of the country's highly qualified labor force. Lebanon ranks 18th worldwide for the Quality of its Higher Educational System, while it occupies the 4th place globally for the Quality of its Math and Science Education¹².

Lebanon ranked 8th in the MENA region in 2015 on the ICT Development Skills Index (IDI), which measures ICT capabilities and skills¹³. Lebanon was also

ranked as the 3rd most dynamic countries as it upped 21 ranks between 2010 and 2015¹⁴.

More than 30% of the country's workforce is employed in knowledge intensive activities¹⁵.

The majority of the labor force is trilingual, and possesses one of the most competitive technical skills in the region.

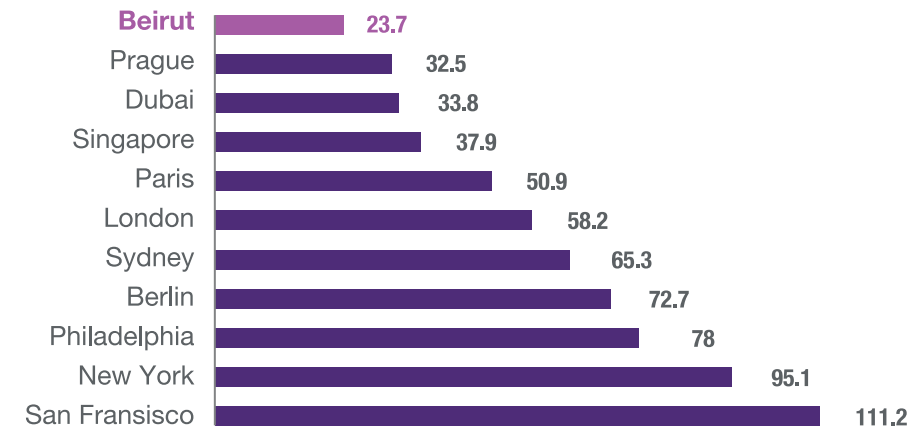


02. HIGHLY SKILLED AND COST COMPETITIVE LABOR FORCE

The Lebanese workforce is not only adequately skilled, but highly cost competitive as well. The labor base is relatively cheaper than the US, Europe and GCC countries,

with the average wage of a software engineer nearly 27% lower than in the GCC and 55% lower than in selected developed economies (Figures 2).

Figure 2: Median Annual Wages of Software Engineers in Selected Countries USD Thousands | 2018



Source: Payscale 2018

03. ACCESS TO GROWING REGIONAL MARKETS

The technology market in the Arab world is far from being saturated and is witnessing a fast increase. The value of high technology exports recorded a 122% increase from 2007 to 2016, reaching around 14 billion in 2016.

Lebanon's strategic position, located at the crossroads of Europe, North Africa and the Middle East allows it to serve expanding markets. In 2016, Lebanon's high technology exports reached a value of USD 32 million¹⁶.

12 Global Competitiveness Report, 2017-2018
13-14-15 ITU, 2013

16 World Bank, 2018

04. A FLOURISHING SCIENTIFIC COMMUNITY

► A growing number of research and training centers are being established mainly in the fields of environmental technologies, medical science and agriculture.

► Both private and public sector institutions are working on clean technology and environmental issues through dynamic research programs. There are more than 5 public institutions working on environmental research and issues, including:

- Industrial research institute
- Lebanese Agricultural Research Institute
- National Council for Scientific Research
- Tripoli Environment and Development Observatory
- Lebanese Center for Energy Conservation
- On the other hand, universities also have a number of research centers working on these issues. There are more than 16 environmental centers and institutes spread across 5 universities.

05. RISING REGIONAL DEMAND FOR CLEAN TECH INNOVATION

► In the MENA, economic growth, rising population and increased urbanization and industrialization is powering the demand for clean technologies. It's expected to have an 8.3% surge in MENA energy demand through 2013-2019 (more than 3

times the global average) and a 114% rise in MENA energy consumption between 2010 and 2050¹⁷. This shows the need for sustainable energy program, and renewable energy in the region¹⁸.

06. SUPPORTIVE ECOSYSTEM

Established companies and startups in the sector can benefit from a wide range of public and private initiatives aimed at the development of the country's digital ecosystem. These include fiscal incentives, financing options, as well as incubation and acceleration programs.

► FISCAL INCENTIVES

The country has one of the lowest tax rates globally. **The Investment Development Authority of Lebanon** offers **tax breaks** for up to 10 years, as well as other incentives to local and foreign companies operating in the ICT sector and meeting specific requirements. You can check out IDAL's full range of incentives here.

► FINANCING

Today, 8 **venture capital firms** have operations in Lebanon in addition to various regional VCs which have backed a number of local pioneering companies. These include the Berytech Fund, Cedrus Ventures, MEVP and LEAP. VC funds in Lebanon account for around 10% of VC transactions in the region and Lebanon is currently among the top 3 most active VC markets in the Arab World²¹.

The Central Bank of Lebanon issued Circular No. 331 in 2013, through which an amount of up to USD 650 Million will be dedicated for Lebanese banks' equity investments into startups, incubators, accelerators, and funds operating in Lebanon. These investments will be 75% guaranteed by the Central Bank.

Other financing options include the Kafalat loan guarantee scheme. **Kafalat** provides financial guarantees for loans of up to USD 400,000 granted by commercial banks to SMEs.

► INCUBATION AND ACCELERATION

Today, there are **9 incubators and accelerators** that provide training, technical & financial assistance to new and existing businesses across Lebanon. They include Berytech, the South Business Innovation Center (SouthBIC), the Business Incubation Association in Tripoli (BIAT), Alt City, the UK Lebanon Tech Hub, speed@BDD, Smart-ESA, and Flat6labs. Other programs offer a wealth of mentorship and networking opportunities including Endeavour, LebNet, Lebanon for Entrepreneurs, Lebanese League of Women in Business, and more.

► CLUSTERING

Physical and virtual clusters equally seek to capitalize and expand on the vibrant digital community. These include the Beirut Creative Cluster and the Lebanon Softshore Cluster. Together with industry associations like the Association for Lebanese Software Industries, these associations help companies expand their market reach and develop their businesses.

► BUSINESS PARKS

New business parks are being developed to host companies in the digital industry, and include large-scale developments like the Beirut Digital District (BDD) which provides state of the art facilities and services at reduced rates, in addition to clustering opportunities within a friendly business environment.

► BUSINESS SUPPORT UNIT

New Business Support Unit (BSU) was launched in 2018 by the Investment Development Authority of Lebanon (IDAL), providing startups operating in productive sectors with market information, free legal and tax/accounting advice as well as licensing support in order to help them establish and grow their company in Lebanon.

For more information on available financing schemes for ICT companies, please check out our "Financing your Business" fact sheet [here](#).

► SUMMER OF INNOVATION PROGRAM

Launch of the Summer of Innovation Program at the Prime Minister Office created ample opportunities for the youth in the areas of innovation, entrepreneurship and networking. The program inaugurates trainings and activities dedicated for young entrepreneurs to evolve their ability to transform the economy (DiasporaID, Startup Scouts).

INVESTMENT OPPORTUNITIES

01. CLEAN TECHNOLOGIES IN WATER AND WASTEWATER MANAGEMENT

While water supply from rivers, springs, storage dams, and groundwater is estimated at 2,000-2,700 million m³ per year, higher than the expected projected water demand of about 1,800 million m³ in 2035¹⁹, widespread pollution and substandard water infrastructure are restricting the Government's ability to meet future water demands. The Ministry of Environment estimated that the total renewable resources (drinking, industrial and irrigation) would be 839m³ per

capita per year in 2015²⁰, lower than the international benchmark of 1,000 m³ per capita per year²¹.

Globally, the clean tech water sector was generating average profits of 12.9% in 2014²². Due to the MENA region's climate and with a growing population, it is clear that water and wastewater dominate the opportunities in clean tech in this region.

Lebanon possesses a few technologies for water and wastewater management:

► Rainwater harvesting from hill lakes or ground lakes

Several hill lakes were constructed in 2008 (mostly in North Lebanon and the Bekaa), with a total capacity of 98,139 m³²³. However, many factors, including the absence of a distribution system, hinder the wide use of this practice.

► Use of treated wastewater in irrigation (UTWWI)

Several treatment plants have been planned and a number of them are under construction. Municipalities have also taken measures to improve wastewater collection and disposal. However, the absence of specific laws pertaining to the use of treated wastewater, and the lack of a financial mechanism to sustain the treatment plants are some of the challenges that hinder the wide application of this method.

19-20 MOE/UNDP/ECODIT, 2011

21 World Bank, 2009

22 Lux Research, 2014

23 MoE/URC/GEF, 2012

INVESTMENT OPPORTUNITIES

Globally the clean tech water sector is focusing on a number of different areas (Figure 3), mainly:

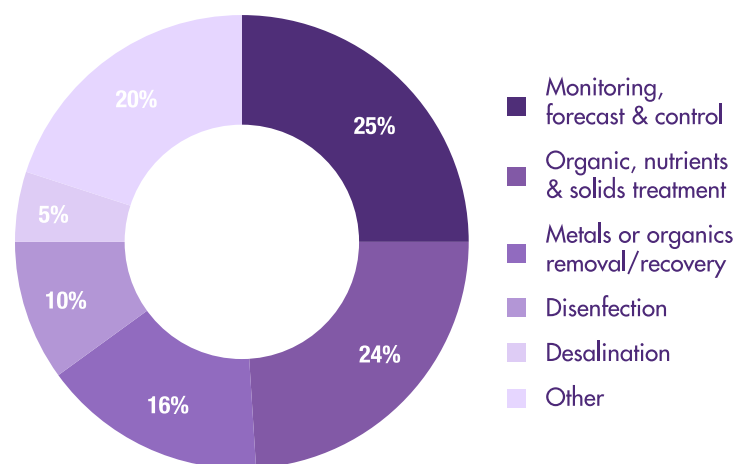
► Monitoring, forecasts and process controls

25% of startups working in the clean tech water sector are focusing on monitoring, forecasts and process controls (through sensors and Internet of Things applications).

► **Organic nutrients and solids treatment**
24% of startups globally are working on basic wastewater treatment.

► **Metals or organics removal/recovery**
16% of startups globally are working on these technologies.

Figure 3: Distribution of Startups in the Water and Wastewater Management Sector by Type of Activity % | 2014



Source: Lux Research, 2014

02. CLEAN TECHNOLOGIES IN THE AGRICULTURE SECTOR

The Agriculture sector generates around 5% of Lebanon's GDP²⁴, and employs roughly 10% of the Lebanese labor force²⁵, accounting for the fourth largest employer in the country. Lebanon's moderate climate, rich soil, and abundant water resources provide it with key enablers to stand out in the region as an ideal location for agricultural activity. The country is endowed with the highest proportion of agricultural land in the Middle East²⁶. Climate is overall moderate and allows the cultivation of a wide variety of crops that would normally grow in both cold and

tropical countries. Major regions for crops, meadows and pastures include the Bekaa plain (where more than 40% of the land is cultivated), and Northern Lebanon.

Due to increasing produce demand, agriculture is suffering from scarcity of land, climate change and environmental issues, and the changing needs of consumers that are demanding healthier and more nutritious products. Agriculture in Lebanon still relies on traditional methods, but a number of Lebanese companies are starting to innovate in this sector.

INVESTMENT OPPORTUNITIES

A number of investment opportunities exist in the Lebanese clean tech agriculture sector:

► The introduction of biotechnology to the agriculture sector

The genetic manipulation of crops to adapt them to certain climate conditions is gaining ground. Crops can be modified to adapt to drought conditions and therefore reducing the need for large amount of irrigation²⁷. Adapting to climate and selecting suitable varieties can have a 20% increase on yields²⁸.

► Precision agriculture via hardware innovations

Drones are increasingly used as a method of crop surveillance in order to minimize cost and maximize efficiency. The technology is driving the automation of traditionally manual agriculture practices.

► Precision agriculture via software applications

Agricultural software, i.e. smart irrigation allows the set up an automatic and much more efficient irrigation plan than traditional irrigation methods.

²⁴ National Accountss

²⁵ Central Administration of Statistics, 2009

²⁶ As defined by the FAO, agricultural areas include arable lands, as well as permanent crops and pastures

²⁷ Cleantech Group, 2015

²⁸ Ministry of Environment/URC/GEF, 2012)

03. CLEAN TECHNOLOGIES IN SOLID WASTE MANAGEMENT

Lebanon generates an average of 2.55 million tons of waste annually²⁹, 48% of this waste is landfilled, 29% is openly dumped, 15% is composted, only 8% is recycled³⁰. Charges for waste collecting and disposing them in sanitary landfills are higher in Lebanon than in other middle income countries: USD 147/ton compared to USD 100/ton³¹.

The absence of a proper waste management plan in Lebanon, in addition to the recent trash crisis that has been going on for more than two years, resulted in uncontrolled dumping all over

the country, causing in turn a number of environmental and health problems, including water and soil contamination, and increased GHG emissions. The fastest rate of growth of GHG emission in Lebanon occurred in the waste sector³².

Adopting a zero waste strategy in Lebanon can generate USD 135.7 million over a period of 20 years³³.

Today, more than 40 recycling centers and hubs are operating in Lebanon, contributing to the development of the industry³⁴.

INVESTMENT OPPORTUNITIES

Clean technology disruptions are urgently needed for waste management solutions. The main opportunities exist in:

► Web-based recycling platforms

These programs have created online recycling marketplaces where customers can conveniently recycle their waste, allowing consumers to change their behavior towards recycling more easily.

► Waste to energy technologies

This technology is particularly relevant in Lebanon as it deals with both waste management and energy production.

29-30-31 BlomInvest 2015
32 Ministry of Environment and UNDP
33 BlomInvest 2015
34 Lebtivity, 2016

04. CLEAN TECHNOLOGIES IN THE TRANSPORTATION SECTOR

GHG emissions from the transport system accounts for 21.41% of Lebanon's total GHG emissions in 2000, 94% of CO, 59% NOx and 66% NMVOC emissions³⁵. These emissions have increased from 1.84 MtCO2e in 1990 to 5.29 MtCO2e in 2012³⁶.

The transportation system relies mainly on private vehicles, which accounts for around 80% of private passenger cars. Public transport systems are inefficient, and cost-ineffective. In 2017, the number of passenger cars reached 31,324 vehicles up from 7% in 2012 while commercial cars vehicles have increased 19% over the same period³⁷.

The cost of environmental deterioration in Lebanon was estimated at up to USD 485 million yearly which accounts for 2.9%

of Lebanon's GDP. The most significant negative impacts on health are caused by urban air pollution with a mean estimate of USD 145 million per year or 0.87% of GDP³⁸.

Moreover, cars produce substantial noise pollution, due to traffic and old vehicle engines. Noise levels on average exceed 75dB, whereas the standard level is 72dB³⁹. Fuel efficient vehicles present considerable opportunities of consumption and CO2 emissions for all vehicle segments. Fuel efficient vehicles present considerable opportunities of consumption and CO2 emissions for all vehicle segments. When compared to the Lebanese consumption of the passenger car fleet in 2007, these vehicles present savings ranging from 30 to 60% (Table 1).

Table 1: Fuel Consumption and CO2 Savings by Type of Car | 2005

VEHICULE TYPE	FUEL CONSUMPTION ON COMBINED CYCLE (L/100KM)	FUEL AND CO2 SAVINGS RELATIVE TO THE WORLD AVERAGE 2005	FUEL AND CO2 SAVING RELATIVE TO THE LEBANESE FLEET 2007
Sub-compact cars	5.2	35.5%	53.4%
Compact cars	5.3	34.2%	52.4%
Midsize cars	6.7	17.2%	40.1%
Large cars	7.9	2.2%	29.3%
SUV	10.1	-24.6%	9.9%

Source: USDOE, 2011

35 MoE/UNDP/GEF, 2011
36 USAID, Greenhouse Gas Emissions, Lebanon (2016)
37 BlomInvest Bank, "Total Number of Registered New Cars Stagnated by October 2017"
38 "IPTEC, Ministry of Environment and UNDP, 2016
39 BlomInvest, 2015

INVESTMENT OPPORTUNITIES

Relative to fuel and energy consumption rates, emission savings and cost of different mitigation strategies (that include fuel efficient vehicles, hybrid electric vehicle, plug-in hybrid vehicles, battery electric vehicle, natural gas vehicle, and bus technologies with dedicated lanes), main investment opportunities in the clean transportation technology sector in Lebanon are⁴⁰ (Table 2):

- **Bus technologies** using diesel and natural gas for revitalizing the public transport.
- **Fuel efficient gasoline vehicles** for renewing the passenger car fleet.
- **Hybrid electric vehicles** for renewing the passenger car fleet.

Table 2: Energy Consumption and CO2 Savings by Type of Vehicle | 2012*

	FUEL EFFICIENT VEHICLES	HYBRID ELECTRIC VEHICLES	BUS TECHNOLOGIES (30 PASSENGER / VEHICLE)
Fuel consumption (l/100 Km.pass)	3.19	2.91	1.27
Total energy consumption (kWh/100km.pass)	29.34	26.81	11.66
PTW CO2 saving (%)	48.10	52.00	80.29
WTW CO2 savings (%)	26.5	28.6	N/A

*Latest available figures.
Source: MoE/URC/GEF, 2012

40 Ministry of Environment/URC/GEF, 2012

05. CLEAN TECHNOLOGIES IN THE ENERGY SECTOR

Renewable energy accounted for more than half of the new electricity-generating capacity added globally in 2012⁴¹, and created 9.8 million jobs in 2016⁴².

The power sector in Lebanon contributed to around 87% of GHG emissions in Lebanon during 2012⁴³ and has been increasing at a CAGR of 8% over the 1990-2012 period⁴⁴, due to increasing demand of electricity and the expansion of the national grid.

Lebanon is a net energy importing country. The electricity sector is dominated by Electricité du Liban (EDL) which controls around 90% of the sector⁴⁵. EDL operates mainly through 7 thermal power plants that function on heavy fuel oil-fired steam turbines, diesel-fired combined cycle gas turbine (CCGT); and diesel-fired open

cycle gas turbines (OCGT), depending on the plant. Lebanon's power sector is characterized by intermittences in power supply, as well as power shortages of up to 20 hours per day. Residents are increasingly relying on private generators for electricity supply. Self-generation accounted for 34% of total consumed power in 2009 (WB, 2011)⁴⁶. There are no official figures on the profits of the private generators in Lebanon but they are estimated at around USD 800 million each year⁴⁷.

Electricity power consumption in Lebanon reached 2,892 kWh per Capita, higher than the MENA region (2,875 kWh per Capita), and the Arab World (2,489 kWh per Capita) (Figure 3).

40 Ministry of Environment/URC/GEF, 2012

41 IPCC WGIII on Mitigation, 2014

42 IRENA, 2017

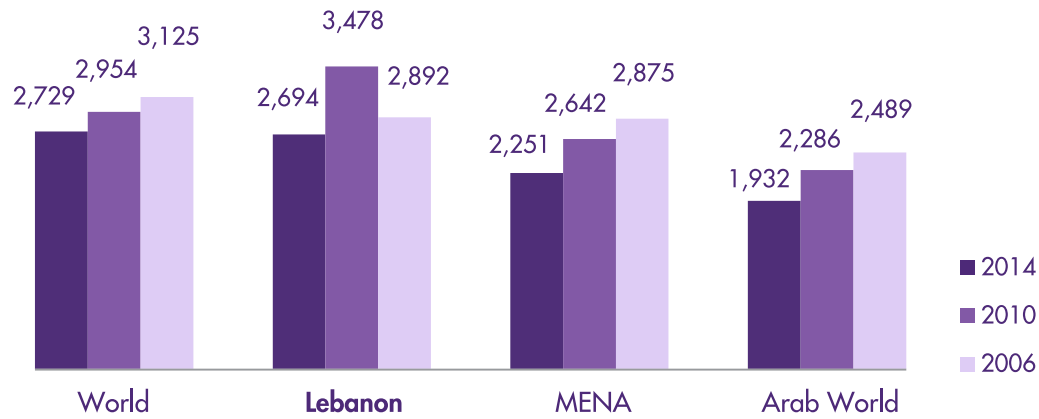
43 Ministry of Environment and UNDP

44 USAID, 2016

45-46 MoE/URC/GEF, 2012

47 Daily Star, 2017

Figure 4: Electric Power Consumption kWh Per Capita | 2006-2014



Source: Payscale 2018

In 2009, only 2.9% of total Primary Energy Supply in Lebanon was produced from renewables⁴⁸. In 2017, the maximum net generating capacity of power plants and other installations that use renewable energy sources to produce electricity was

of 312 MW⁴⁹. This number is higher than Kuwait, Qatar, KSA, and Bahrain⁵⁰ (Table 3). However, Lebanon has had one of the slowest growth in terms of total capacity from 2015 to 2017.

Table 3: Total Renewable Energy Produced in Selected Countries MW | 2015-2017

	TOTAL RENEWABLE ENERGY 2015 MW	TOTAL RENEWABLE ENERGY 2017 MW
Lebanon	221	228
Kuwait	NA	0
Qatar	25 (2011)	28
KSA	19 (2012)	25
Jordan	18	160
Iraq	2225	2513
Iran	6631	12024
UAE	10 (2009)	135

Note: The renewable power capacity data shown in these tables represents the maximum net generating capacity of power plants and other installations that use renewable energy sources to produce electricity.

Source: IRENA, 2018 statistics

48 IRENA, Renewable Energy Country Profiles Middle East, 2016

49-50 IRENA, Renewable Energy Capacity Statistics, 2018

The majority of this maximum capacity is due to hydropower, which had a 221 MW capacity in 2015. Wind, solar and bioenergy rank far behind with 1 MW, 4 MW, and 2 MW of capacity respectively⁵¹.

The presence of relatively high renewable energy sources is in line with Lebanon's target to reach 15% of electricity generation in renewable energy by 2030, the highest target in the Levant region⁵².

Contradicting the low presence of renewable energy technologies in the country, Lebanon possesses considerable high renewable energy sources, more than many other countries in the region (Table 4).

Table 4: Availability of Renewable Energy in the Middle East | 2016

RENEWABLE ENERGY RESOURCE	AVAILABILITY
Wind	High
Hydro	High
Solar	High
Biomass	Medium
Geothermal	Low
Ocean	Low

Source: IRENA, Renewable Energy Country Profiles Middle East 2016

51 IRENA, Renewable Energy Capacity Statistics, 2016

52 IRENA, 2016

INVESTMENT OPPORTUNITIES

Due to the high presence of renewable energy sources in Lebanon, main investment opportunities in the clean tech energy sector for Lebanon are⁵³:

► Energy optimization solutions

mainly in energy storage.

► Hydropower

In the MENA region renewable energy from water appears to be the leader in market potential for clean tech over the next 5 years⁵⁴. Lebanon currently possesses some hydropower plants along the Kadisha river, and it is one of the only clean energy technologies for which local expertise is already available.

► Solar power, in Photovoltaic cells and CSP

Solar technology is also a significant opportunity due to region's abundant solar resources. Solar technologies are in second place after water in market potential for clean tech over the next five years in the MENA region⁵⁵. The MENA makes it one of the only regions with large opportunities in CSP, which needs direct sunlight to work. Still in its early phase, the PV technology has been applied in a limited manner by private initiatives or through internationally funded projects (CEDRO) in Lebanon. "Penetration of PV cells in Lebanon is expected to be limited

to up to 1MW, with a capacity factor of around 0.2", and this number could lead to a 95% reduction of tons per year⁵⁶.

► Wind power

For the Levant, wind is ranked as the third cleantech sub-sector with the highest potential to grow⁵⁷. According to the Lebanese energy ministry, Lebanon is well suited for wind-generated power, especially in North Lebanon and on the Lebanese slope of Mount Hermon in the southeast, from Chebaa to Rashaya. However, there are only very few windmills in Lebanon operating at a micro level, and the concept of wind farming has never been applied. Wind farms could reduce GHG emissions by 75 times the actual amount, reaching an estimated 1,928 tons/year⁵⁸.

► Biomass

This presents an opportunity to deal with waste and energy problems at the same time. NEEAP (MOEW 2012) estimates that waste can generate 15-25 MW of electricity energy very year, and therefore lead to CO2 reductions of 102,492 Tons per year⁵⁹.

PRIVATE INVESTMENTS IN RENEWABLE ENERGY

The Ministry of Energy and Water (MoEW) has estimated the total upcoming investments in renewable energy between USD 1.1 and USD 1.6 billion in 2018:

- 1-** Launched an Expression of Interest for three solar farms generating 70-100 MW each.
- 2-** Launched an Expression of Interest for hydropower stations generating 4 MW each across all regions and a total combined generation of 300 MW.
- 3-** Launched a plan to build 24 solar farms (without storage) with a capacity of 10-15 MW each accessible to all the regions.
- 4-** Signed a Power Purchase Agreement with three private companies: Sustainable Akkar, Hawa Akkar SAL and Lebanon Wind Power SAL to build 200 MW wind turbines in Akkar region.
- 5-** Identified 32 potential sites for the generation of hydropower based on a masterplan put together by international firms.

53 MoE/URC/GEF, 2012

54-55 Ernest & Young, MENA Cleantech Survey, 2014

56 MoE/URC/GEF, (2012). Lebanon Technology Needs Assessment report for Climate Change

57 Ernest & Young, MENA Cleantech Survey, 2014

58-59 MoE/URC/GEF, (2012). Lebanon Technology Needs Assessment report for Climate Change

CLEANTECH SUCCESS STORIES

LEBANESE CASE STUDIES

ENERGY24

Energy24 is working on an energy storage solution that allows to store large amounts of electric energy into a specific type of battery in order to power residential, commercial and industrial loads during long power outages. ENERGY24 allows consumers to bypass power interruptions, all the while saving between 50% and 70% on their annual electricity bill.



WATER SYSTEM HHO

Water System HHO is a local solution to generator efficiency. The device saves the fuel that is usually wasted in generators. The technology is allows for generators to be 10% to 35% more efficient depending on the size of the generator.



GREEN TECH

Green Tech manufactures Solar Water Heater systems based on the evacuated tubes technology. Based in Lebanon, it is the largest manufacturing plant in the Middle East to have adopted this technology. Its technology provides an efficient hot water service that reduces carbon emission and considerably reducing the energy bill.



YELLOWBLUE

Yellowblue is a renewable energy and energy efficiency EPC company that designs, supplies, and installs clean tech energy solutions including Photovoltaic, and smart solar technologies.



NATIONAL INSTRUMENTS

National Instruments has developed integrated hardware and software platform to develop improved embedded systems for renewable energy applications such as online condition monitoring and grid integration control.



EARTH TECHNOLOGIES

Earth Technologies specialized in designing and installing top-quality products including LED lighting, solar thermal systems, solar photovoltaic systems, and solar street lighting.



ECO INDUSTRIES

ECO INDUSTRIES works on hydroponic farming. This technology allows growing crops without soil in a climate controlled environment, and addresses the need for heavier and more regular crops. This method also saves energy and water and land resources.



CARD SWITCH

Green studios created a technology that allows it to plant all types of plants including high shrubs, trees and vegetables in the hottest climates due to a fibrous skin layer that allows complete temperature insulation. It works in extreme climate, both indoors and outdoors, horizontally and vertically. The fibrous skin adapts to changing conditions via sensors linked to smart controllers, in order to keep the plants in good health.

GREEN STUDIOS

LIFELAB

LifeLab's is a custom hydroponic system with plans to create a 3,000 m2 hydroponic farm in southern Lebanon. Lifelab's hydroponic system can be operated through programmable logic controllers (PLCs), which provide a high degree of automation and the ability to manage the system remotely.



USEFUL ADDRESSES & CONTACTS

Association of Lebanese Industrialists
(ALI)
www.ali.org.lb

Ministry of Energy and Water
www.energyandwater.gov.lb

Ministry of Public Works and
Transport
www.transportation.gov.lb

Ministry of Environment
www.moe.gov.lb

Ministry of Agriculture
www.agriculture.gov.lb

Lebanese Agricultural Research
Institute
www.lari.gov.lb

Council for Development and
Reconstruction
www.cdr.gov.lb

Altcity
www.altcity.me

Bader
www.baderlebanon.com

Berytech
www.berytch.org

Beirut Creative Cluster
www.beirutcreativecluster.org

Beirut Digital District (BDD)
www.beirutdigitaldistrict.com

Business Incubation Association in
Tripoli (BIAT)
www.biatcenter.org

Endeavor
www.endeavor.org

Investment Development Authority of
Lebanon - IDAL
www.investinlebanon.gov.lb

Kafalat
www.kafalat.com.lb

Ministry of Economy and Trade
www.economy.gov.lb

Ministry of Telecommunications
www.mpt.gov.lb

MIT Enterprise Forum Pan Arab
Region
www.mitefarab.org

Office of the Minister of State for
Administrative Reform
www.omsar.gov.lb

OGERO
www.ogero.gov.lb

South Business Innovation Center
(SOUTH BIC)
www.southbic.org



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