



Lebanon Municipal Service Emergency Project (LMSEP)

The Baalbeck Solar Pumping Systems Project Bekaa PVSL Project



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Lebanese Center for Energy Conservation (LCEC)

September 28th, 2018

Current Status of PV in Lebanon |



The National Renewable Energy Action
Plan for the Republic of Lebanon
2016-2020

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Chapter 6 - Solar photovoltaic distributed generation

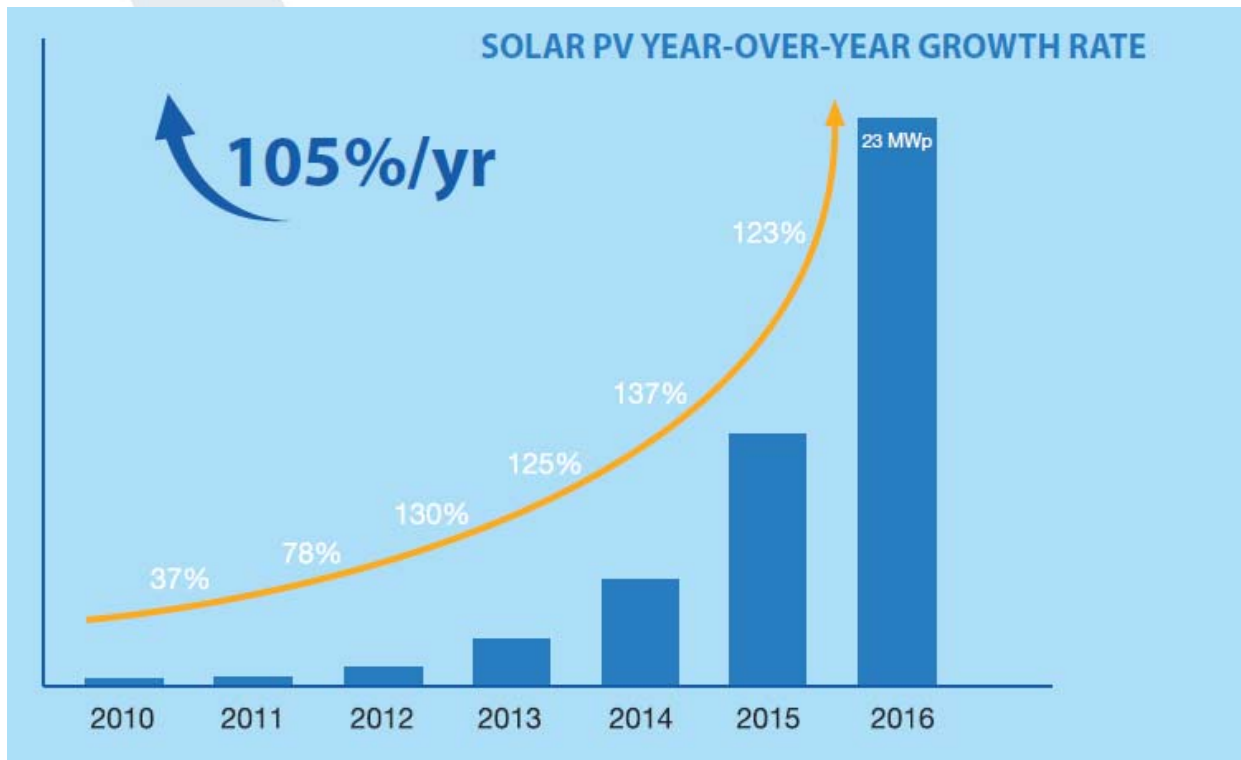
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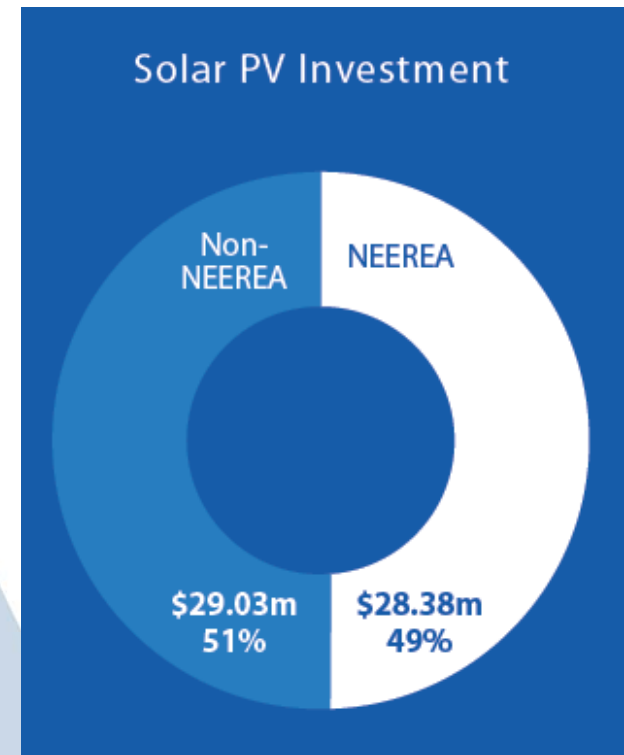
Current Status of PV in Lebanon |

Solar photovoltaic distributed generation	Pessimistic			Realistic			Optimistic		
	MW	MWh	ktoe	MW	MWh	ktoe	MW	MWh	ktoe
Industrial sector	10	16,500	3.6	30	49,500	10.7	40	66,000	14.3
Commercial sector	25	41,250	8.9	40	66,000	14.3	60	99,000	21.4
Agriculture sector	5	8,250	1.8	10	16,500	3.6	20	33,000	7.1
Residential sector	5	8,250	1.8	10	16,500	3.6	20	33,000	7.1
Others (public, municipalities)	2	3,300	0.7	5	8,250	1.8	20	33,000	7.1
Public street lighting	3	4,950	1.1	5	8,250	1.8	10	16,500	3.6
TOTAL	50	82,500	17.8	100	165,000	35.6	170	280,500	60.6

Current Status of PV in Lebanon |



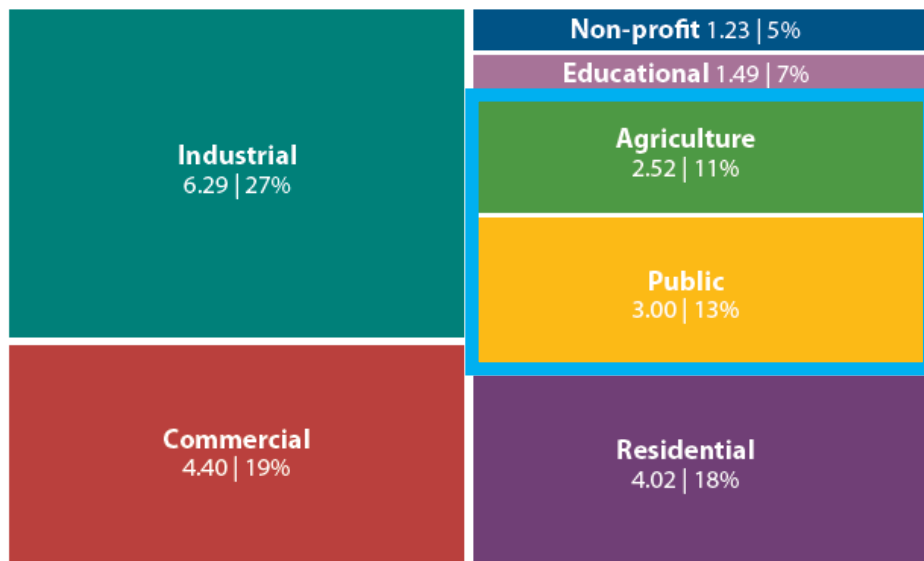
Source: DREG 2016



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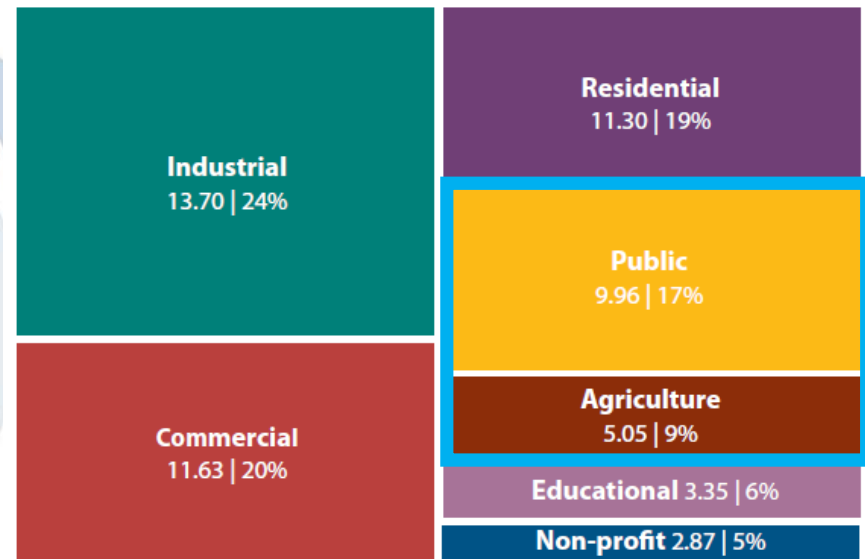
Current Status of PV in Lebanon |

SOLAR PV CAPACITY BY SECTOR (MWp | %)



Source: DREG 2016

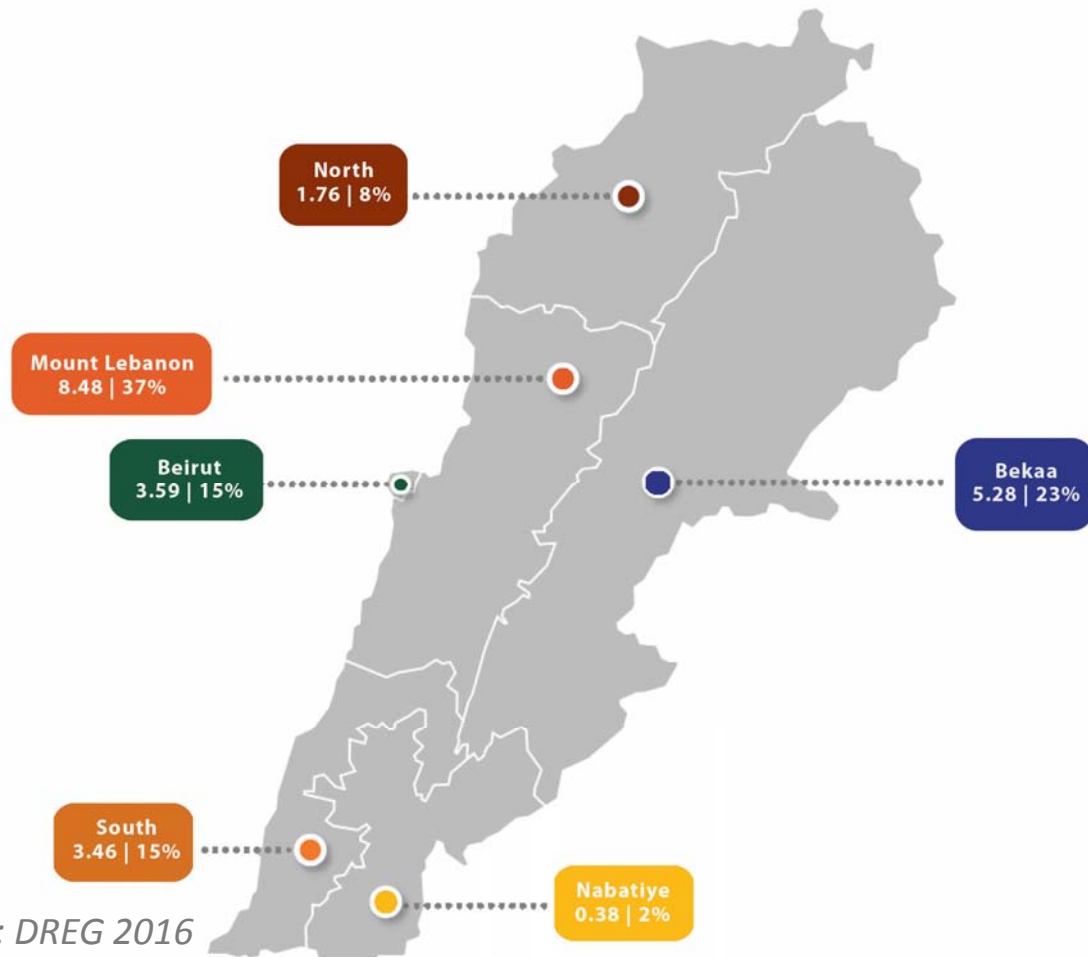
SOLAR PV CAPACITY BY INVESTMENT (\$m | %)



Source: DREG 2016

Current Status of PV in Lebanon |

SOLAR PV CAPACITY BY GOVERNORATE (MWp | %)



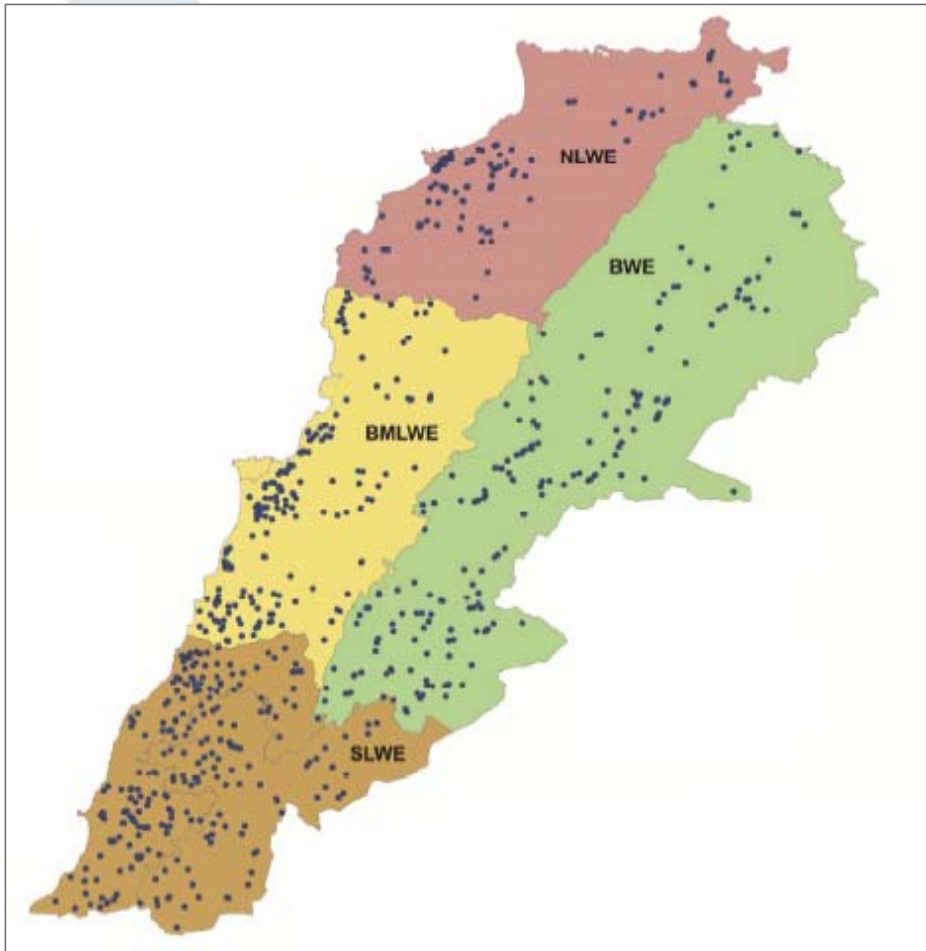
Source: DREG 2016

Background of the Project |



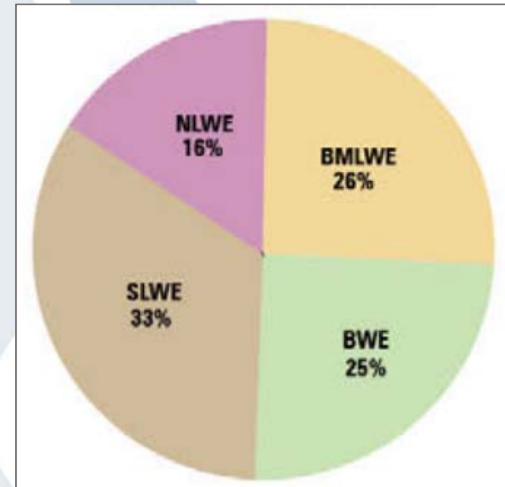
- **Water supply** has always been a **challenge** in the Northern Bekaa area
- **Increase in water demand** do to **Syrian refugee influx** (drinkable, domestic, and irrigation)
- Bekaa area is prone to electricity **blackouts** **safety** and **security** require street lighting.
- The use of **generators** by municipalities for water pumping during **outages** motivates local authorities to shift to **green energy production** via solar PV systems
- The **Lebanon Municipal Service Emergency Project (LMSEP)** is an initiative launched and funded by the **World Bank (WB)** and managed by **CDR**.
- The main objective is to **ease the load** on the municipal services, areas, and communities **hosting Syrian refugees**.
- **LCEC** is acting as the technical consultant for this project.

Background of the Project |



Distribution of Wells and Total Extraction per Establishment

ESTABLISHMENT	TOTAL NO. OF WELLS SURVEYED IN THE FIELD	TOTAL EXTRACTION (rate m ³ /day)	TOTAL EXTRACTION RATE (million m ³ /year)
BMLWE	218	193,642	71
BWE	209	90,422	33
SLWE	277	309,128	113
NLWE	137	88,383	32
Total	841	681,576	249



Percentage Distribution of Wells per Establishment

Source: Assessment of groundwater resources in Lebanon publication 2014



The Baalbeck Solar Pumping Systems Project

Lebanon Municipal Service Emergency Project (LMSEP)



What is Solar Pumping?



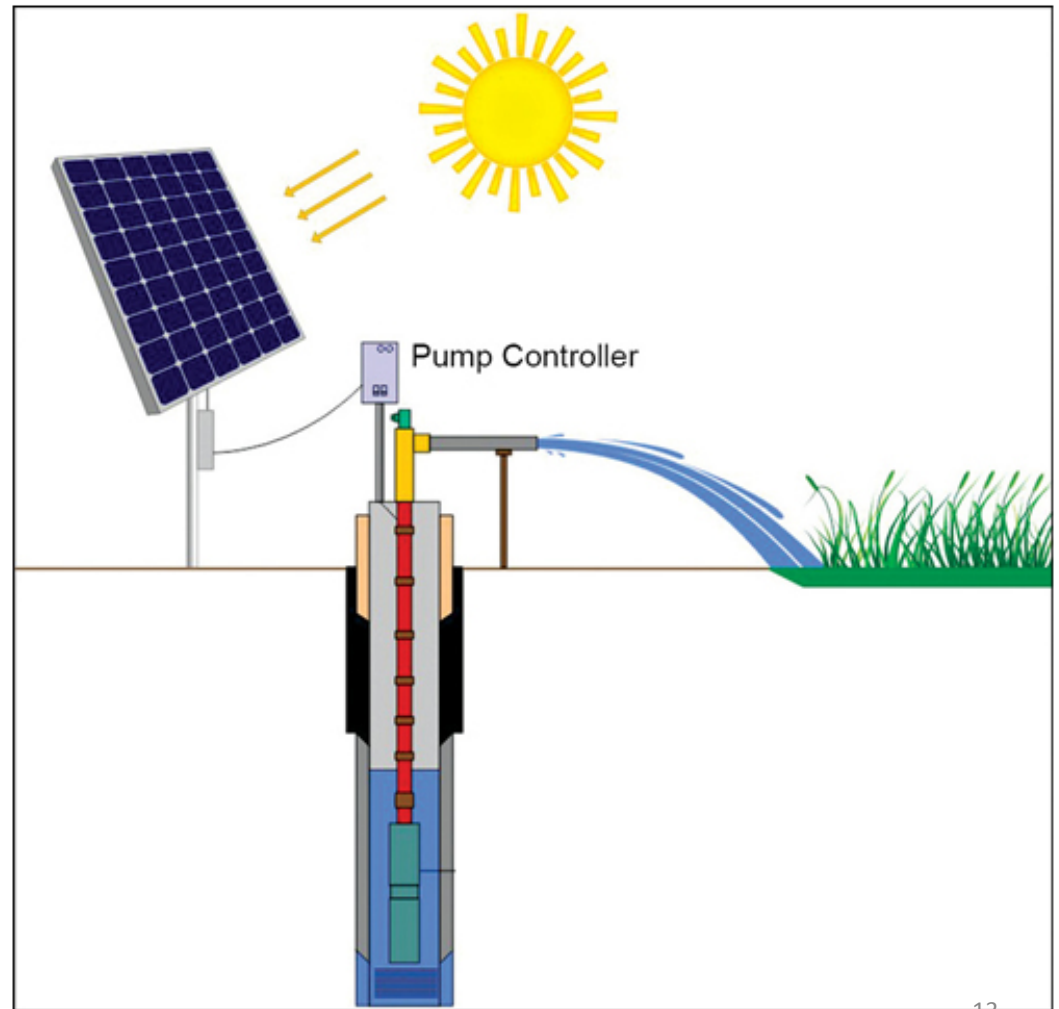
What is Solar Pumping?



What is Solar Pumping?

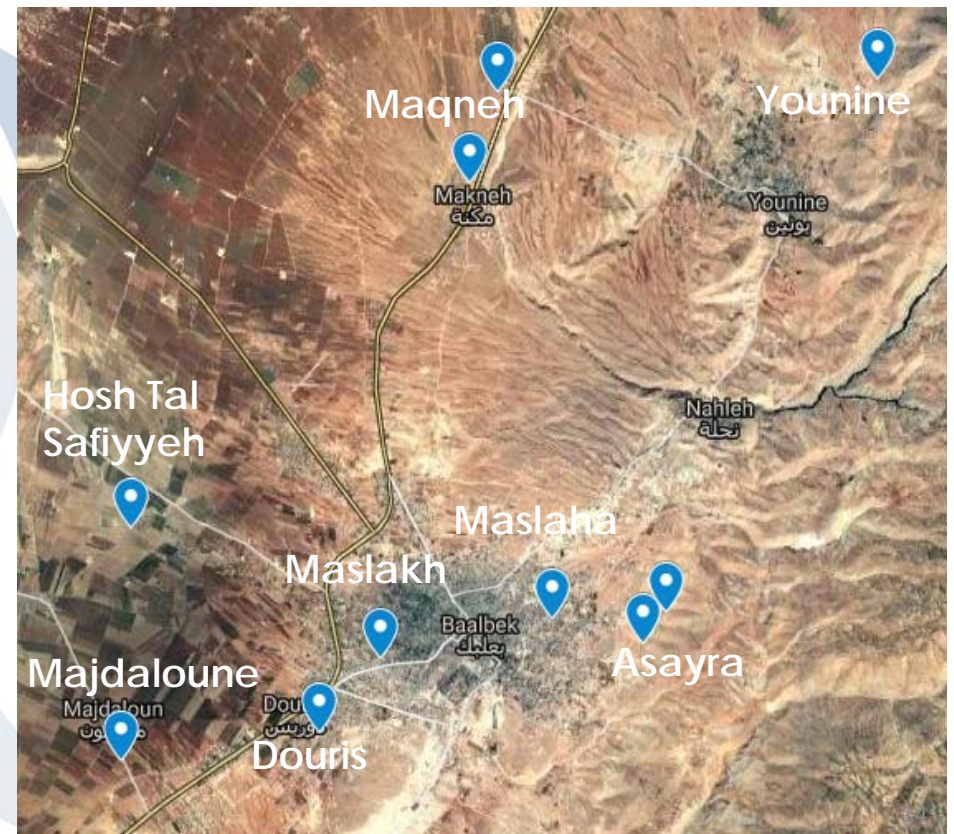
Components:

- PV Array (Inclination/Orientation)
- Steel Structure (galvanized steel)
- VFD Inverters
- DC/AC Interconnections
- Protection Devices
- Earthing
- Lightning
- Remote Monitoring
- Weather Station
- Sensors: Water Level Sensor, Flow Meter
- Fence
- Security Cameras
- Safety Signs



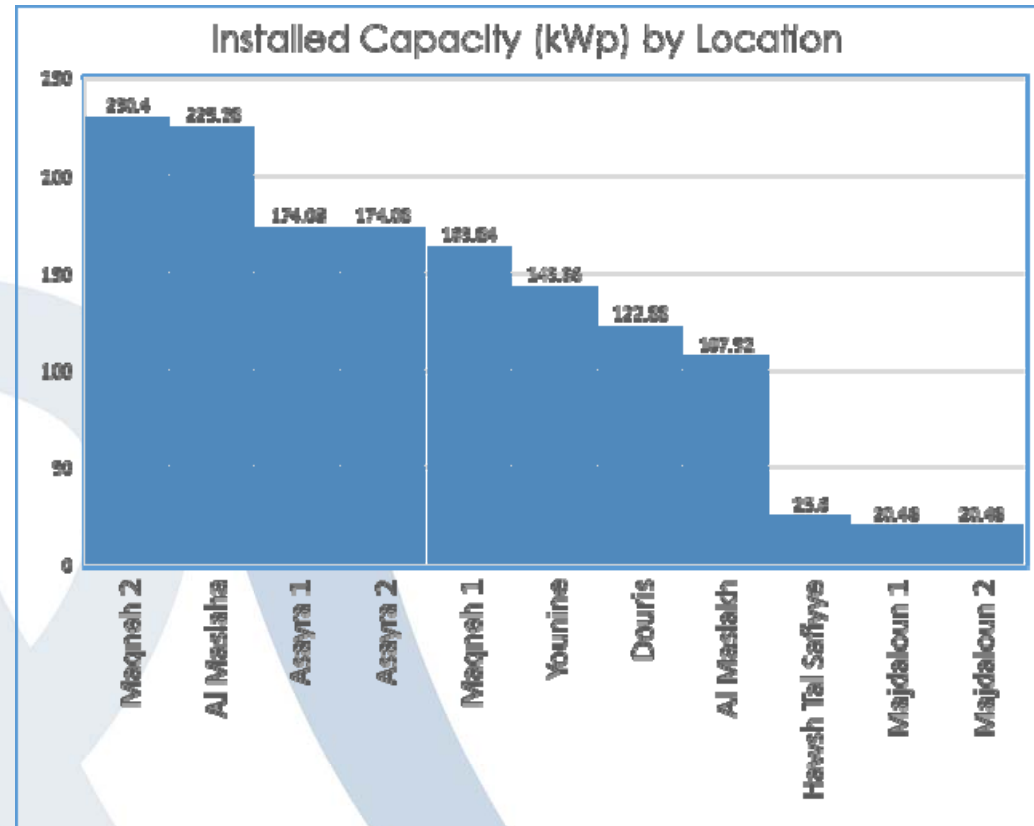
Baalbeck PV Pumping Project |

Solar PV System to drive the **submersible water pumps** in **11 wells** within the Union of Municipalities of Baalbeck and Surrounding Communities



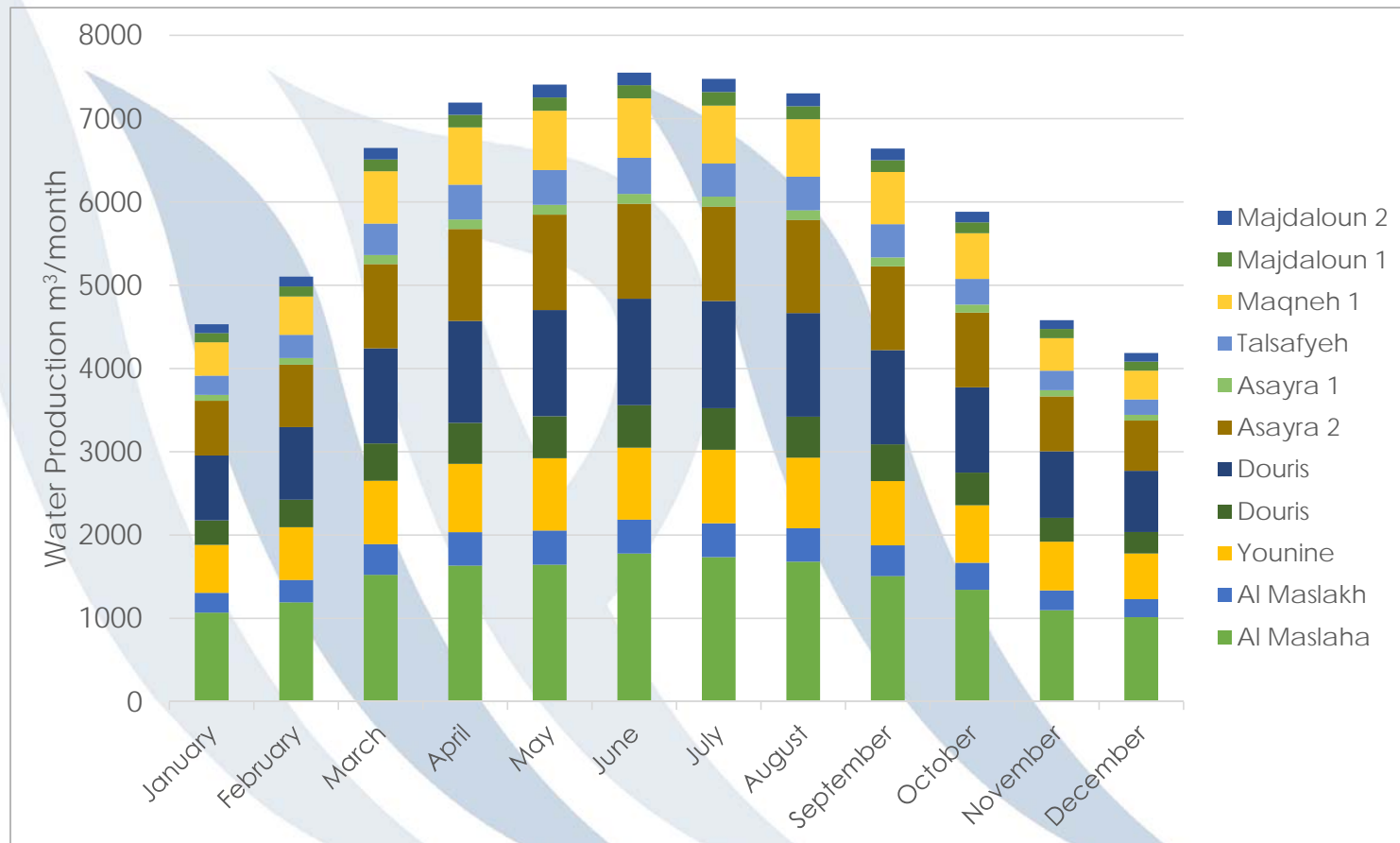
Baalbeck PV Pumping Project |

Ref. Location	Pump Size (Hp)	Total (kWp)
1 Maqneh North	125	163.84
2 Maqneh South	125	230.4
3 Douris	75	122.88
4 Younine	68	143.36
5 Al Maslaha	150	225.28
6 Al Maslakh	120	107.52
7 Asayra North	125	174.08
8 Asayra South	125	174.08
9 Majdaloun 1	7.5	20.48
10 Majdaloun 2	7.5	20.48
11 Hawsh Tal Safiyye	15	25.6
Total		1,408.00



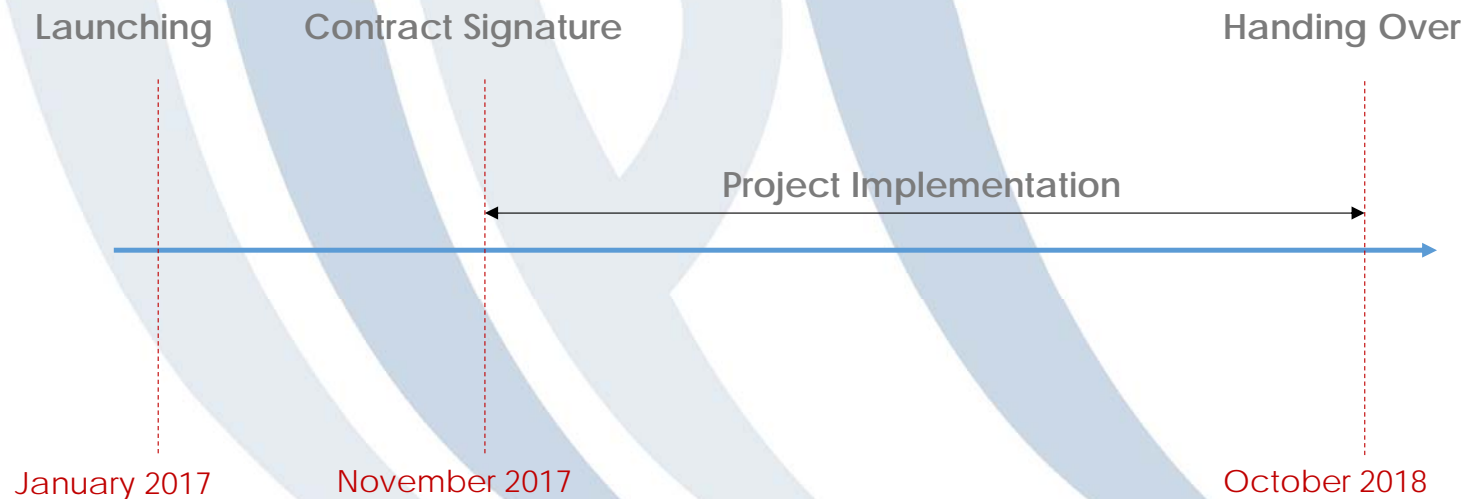
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Monthly Water Production from Solar Pumping per Site (m³/month)



Baalbeck PV Pumping Project |

Installed Capacity	1.4 MWp
Technology	Solar PV Pumping
Number of Wells	11
Number of Sites	9
Expected Daily Water Production from Solar	6,214 m ³ /day
Expected Yearly Savings	375,000 USD/year



Baalbeck PV Pumping Project |



Baalbeck PV Pumping Project |



Baalbeck PV Pumping Project |



Baalbeck PV Pumping Project |

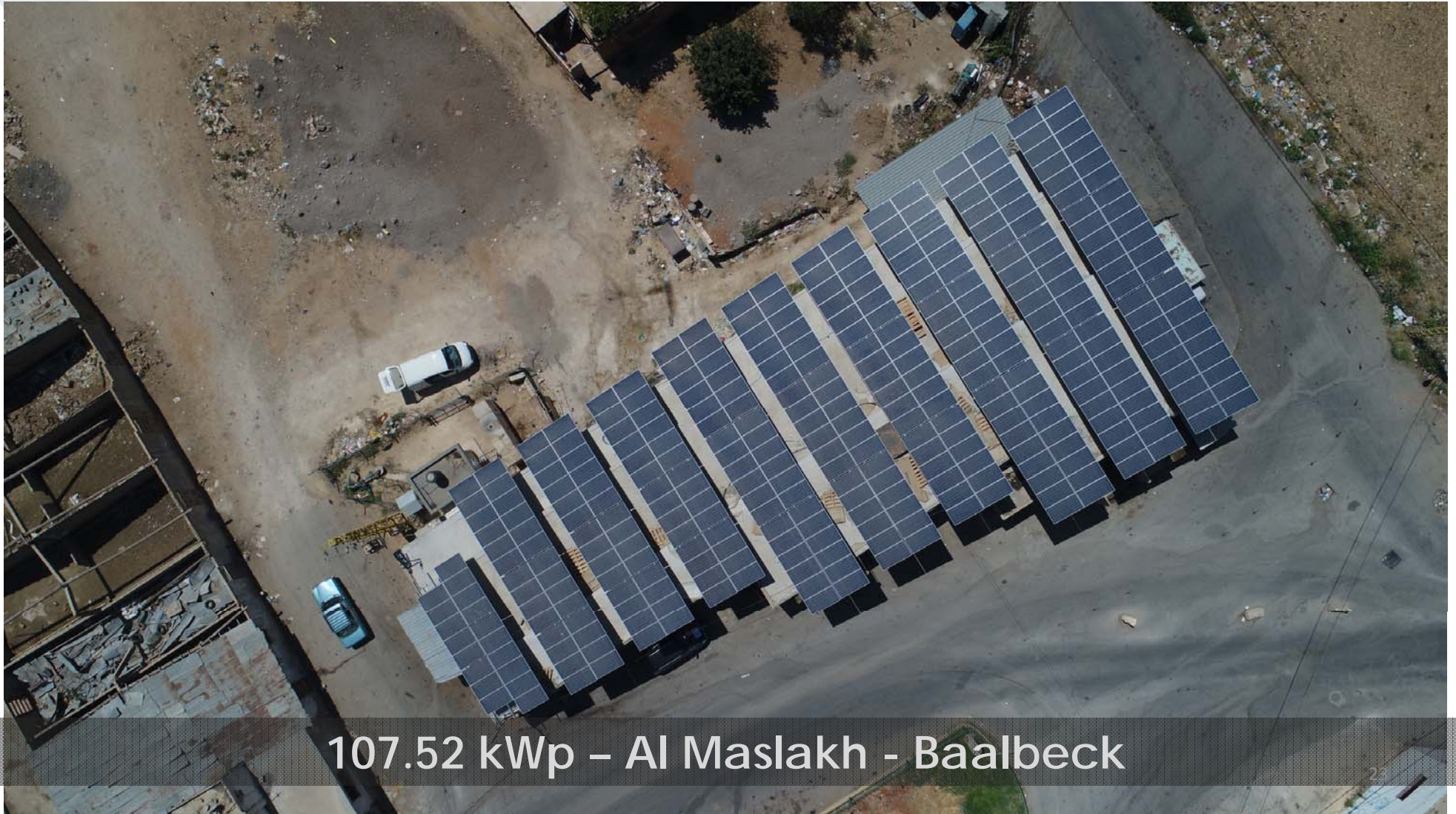


Baalbeck PV Pumping Project |



225.28 kWp Al Maslaha - Baalbeck

Baalbeck PV Pumping Project |



107.52 kWp – Al Maslakh - Baalbeck

Baalbeck PV Pumping Project |



174.08 kWp - Asayra

Baalbeck PV Pumping Project |



174.08 kWp – Asayra

Baalbeck PV Pumping Project |



143.36 kWp – Younine

An aerial night photograph of a city street. In the foreground, a row of cars is parked along the side of the road. A group of people is walking on the sidewalk. The street is illuminated by streetlights. In the background, a river or canal is visible, reflecting the city lights. The overall scene is a nighttime urban landscape.

Bekaa Solar Street Lighting Project

Lebanon Municipal Service Emergency Project (LMSEP)

Solar Street Lighting Project |

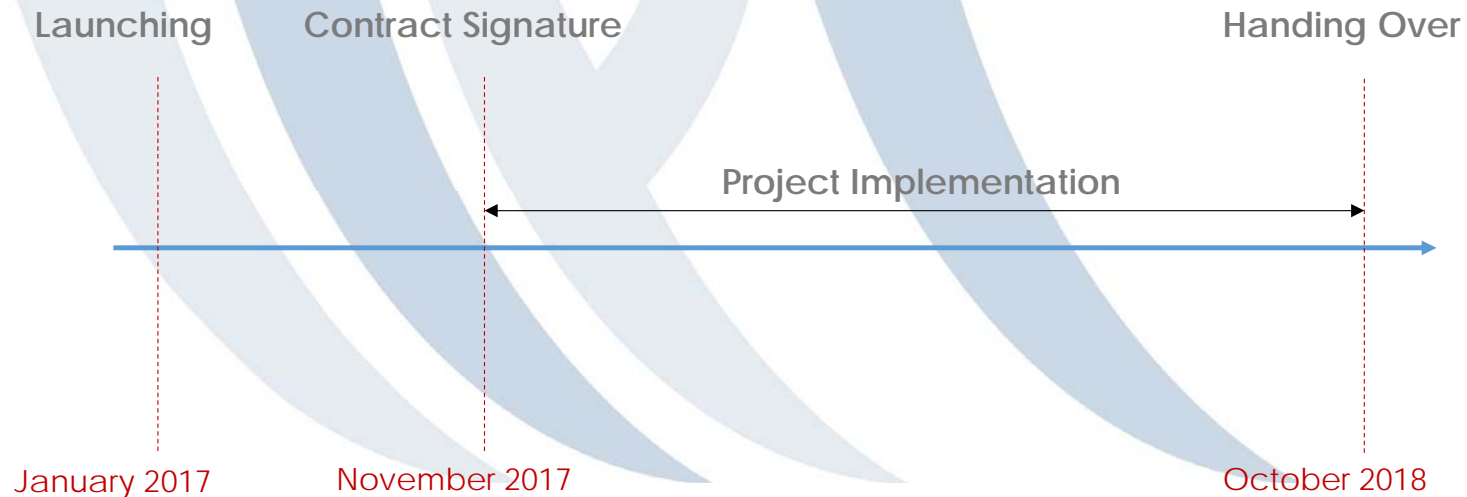
Components:

- **Concrete base**
- **1xPV Panel** (265 Wp) + accessories
- **1xPole** (7m) – Steel 4mm
- **1xCharge Controller + LED Driver**
- **1xLED Lamp** 60W at 6m or double headed
- **2xBatteries** (12V 150Ah at C20) + accessories

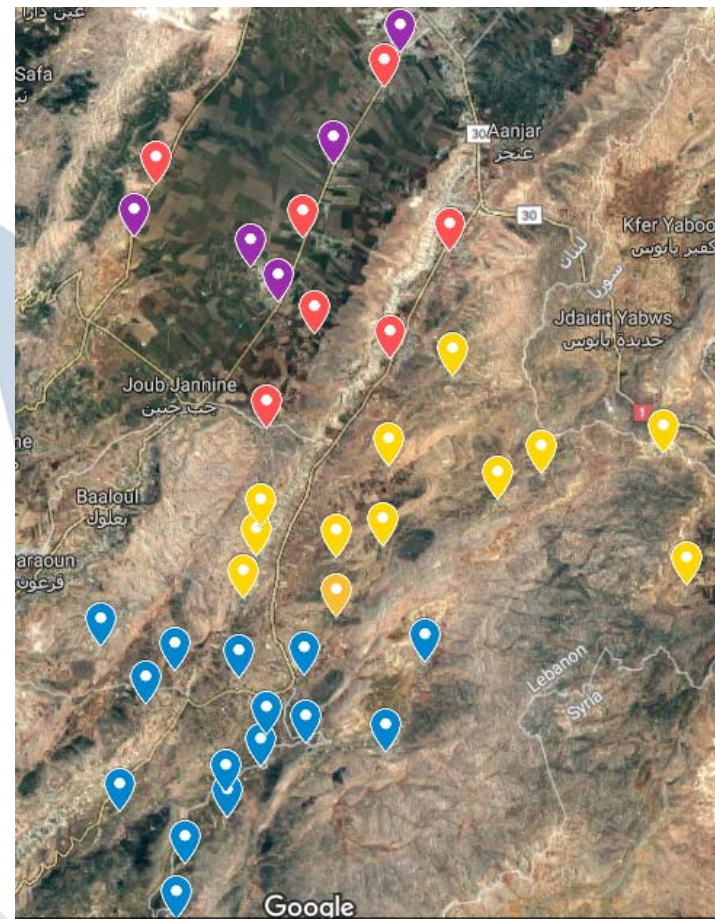


Solar Street Lighting Project |

Installed Capacity	213 kWp 804 PVSL Systems
Yearly Savings with Baseline 250W Sodium	50,000 USD/year
Location	Al Sahel Union of Municipalities (11 municipalities) Al Istiklal Union of Municipalities (12 municipalities) Jabal Al Cheikh Union of Municipalities (14 municipalities)



Solar Street Lighting Project |







Solar Street Lighting Project |





Conclusion |

Solar photovoltaic distributed generation	Pessimistic			Realistic			Optimistic		
	MW	MWh	ktoe	MW	MWh	ktoe	MW	MWh	ktoe
Industrial sector	10	16,500	3.6	30	49,500	10.7	40	66,000	14.3
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TOTAL	50	82,500	17.8	100	165,000	35.6	170	280,500	60.6

1.4 MW Solar **Pumping** Project is equivalent to:

Pessimistic Target: 70%
 Realistic Target: 28%
 Optimistic Target: 7%

PV Street **Lighting** Project 213 kW is equivalent to:

Pessimistic Target: 7%
 Realistic Target: 4%
 Optimistic Target: 2%

Thank you

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01-389589