# Lebanon Municipal Service Emergency Project (LMSEP)

## The Baalbeck Solar Pumping Systems Project
## Bekaa PVSL Project

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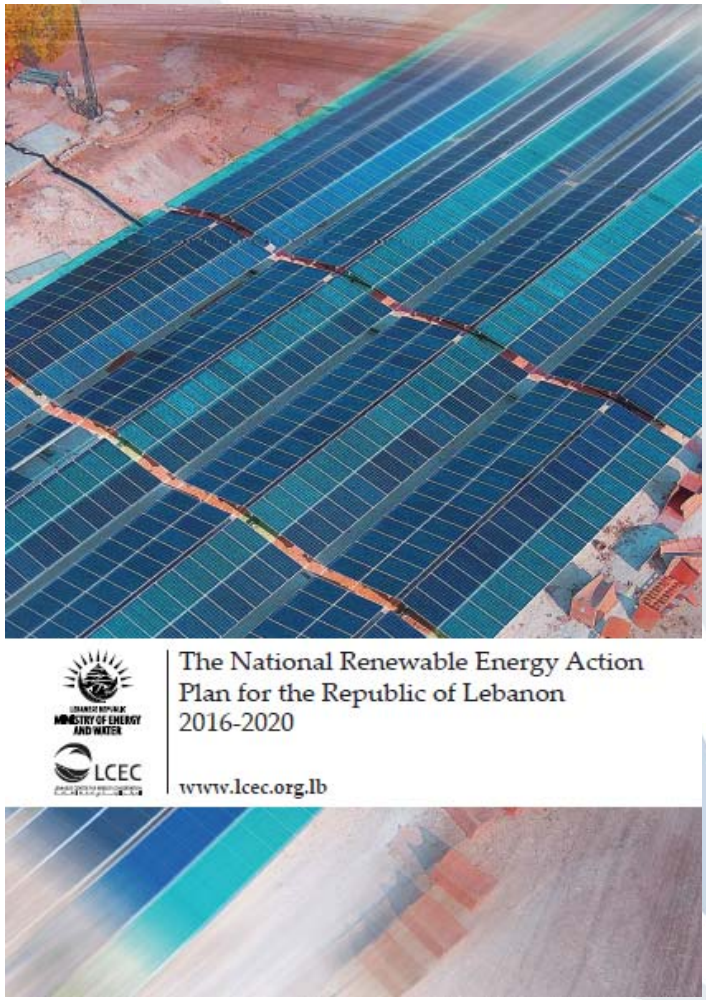
Lebanese Center for Energy Conservation (LCEC)

September 28th, 2018

# Current Status of PV in Lebanon|

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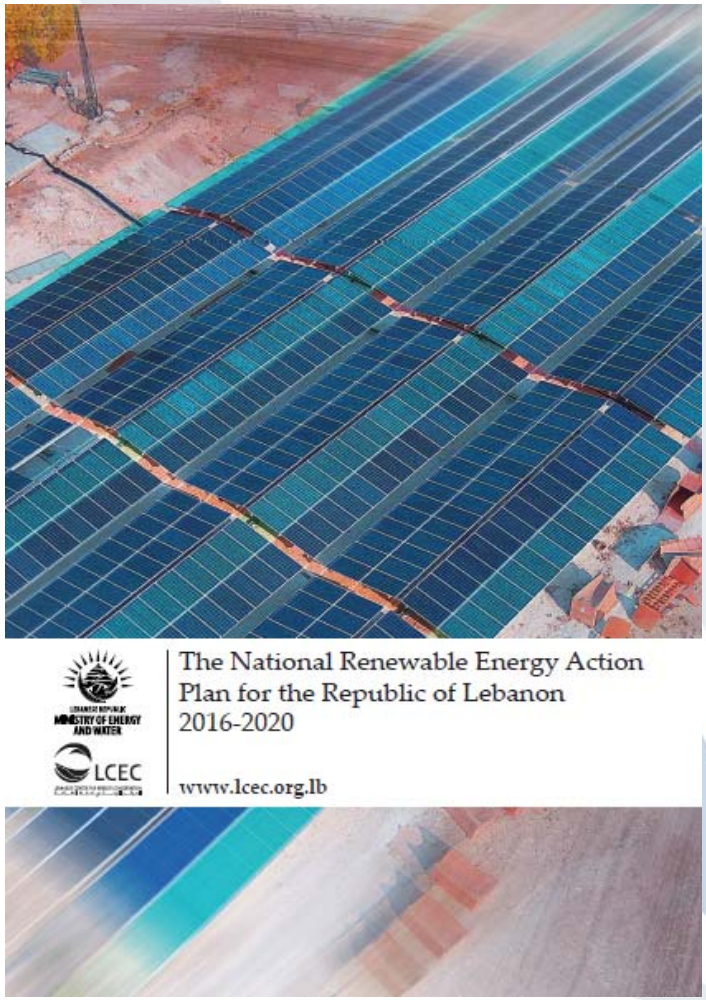
**Chapter 5 - Solar photovoltaic farms**

5.1 Global, regional, and national technology outlook

5.2 Potential for photovoltaic farms in Lebanon

# Current Status of PV in Lebanon|

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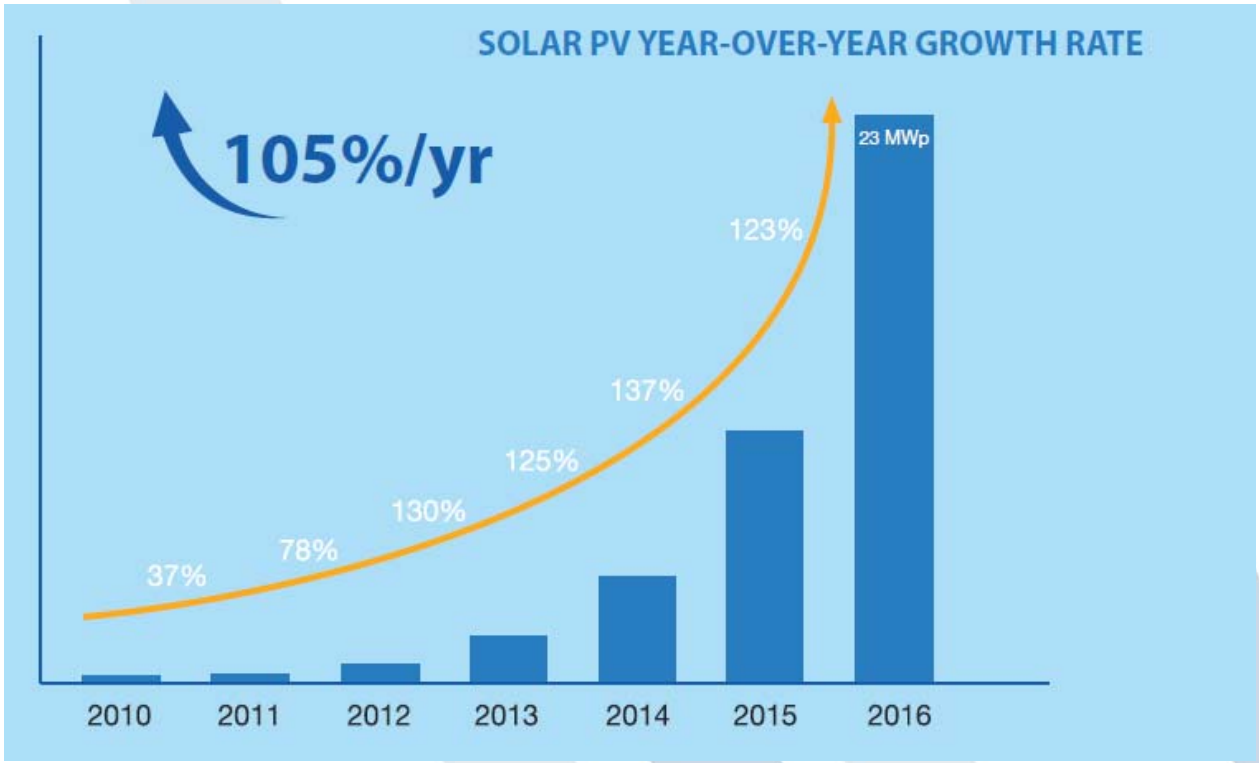
## Chapter 6 - Solar photovoltaic distributed generation

## 6.1 Solar photovoltaic distributed energy resources

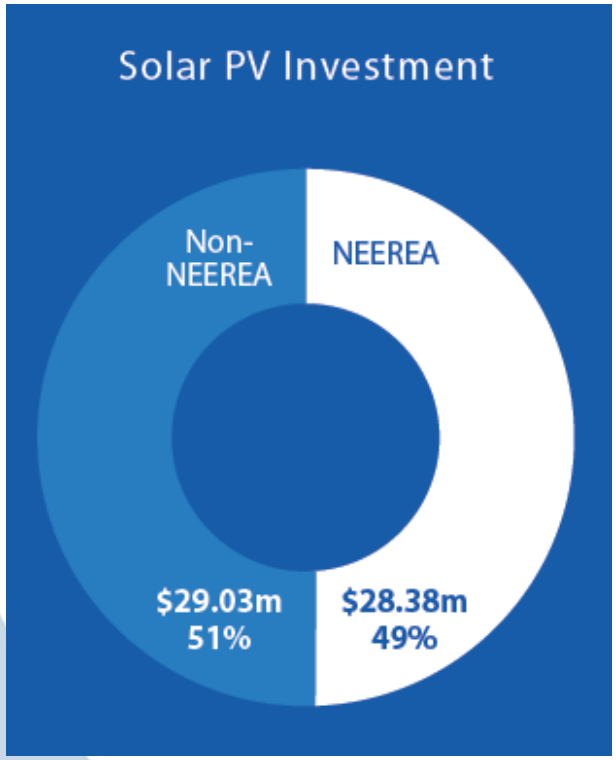
# Current Status of PV in Lebanon|

| 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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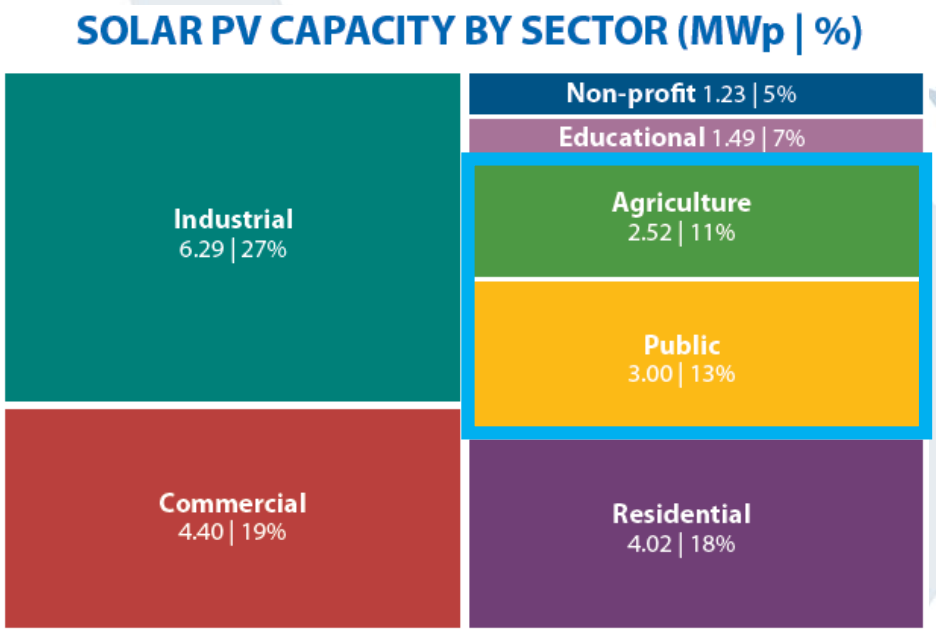


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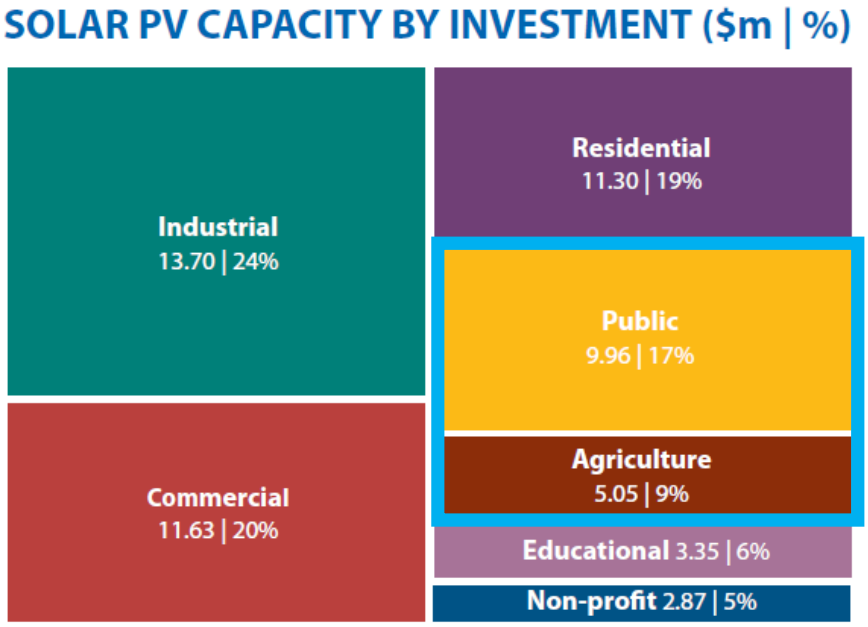
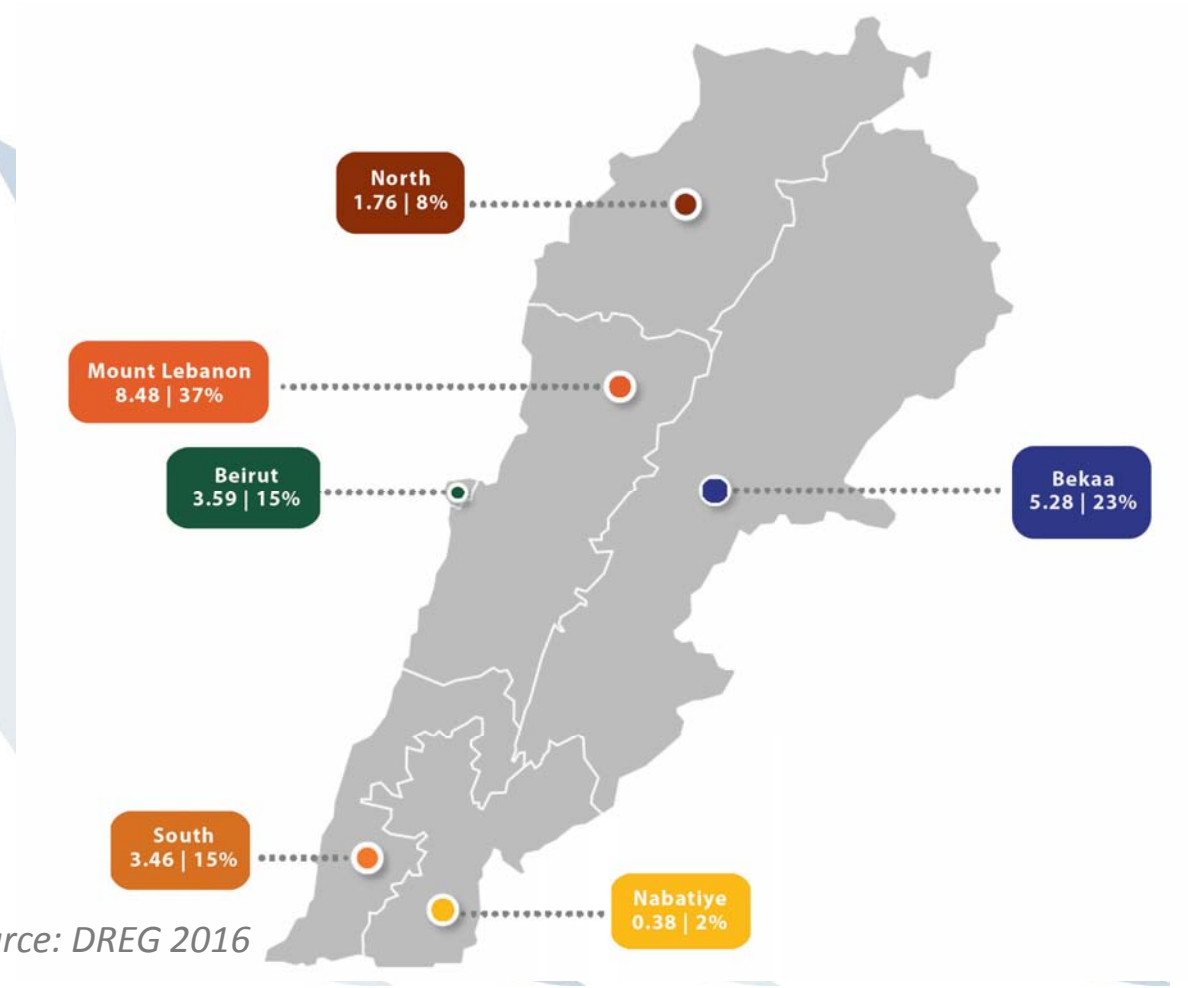



*Source: DREG 2016*

# Current Status of PV in Lebanon|

## SOLAR PV CAPACITY BY GOVERNORATE (MWp | %)

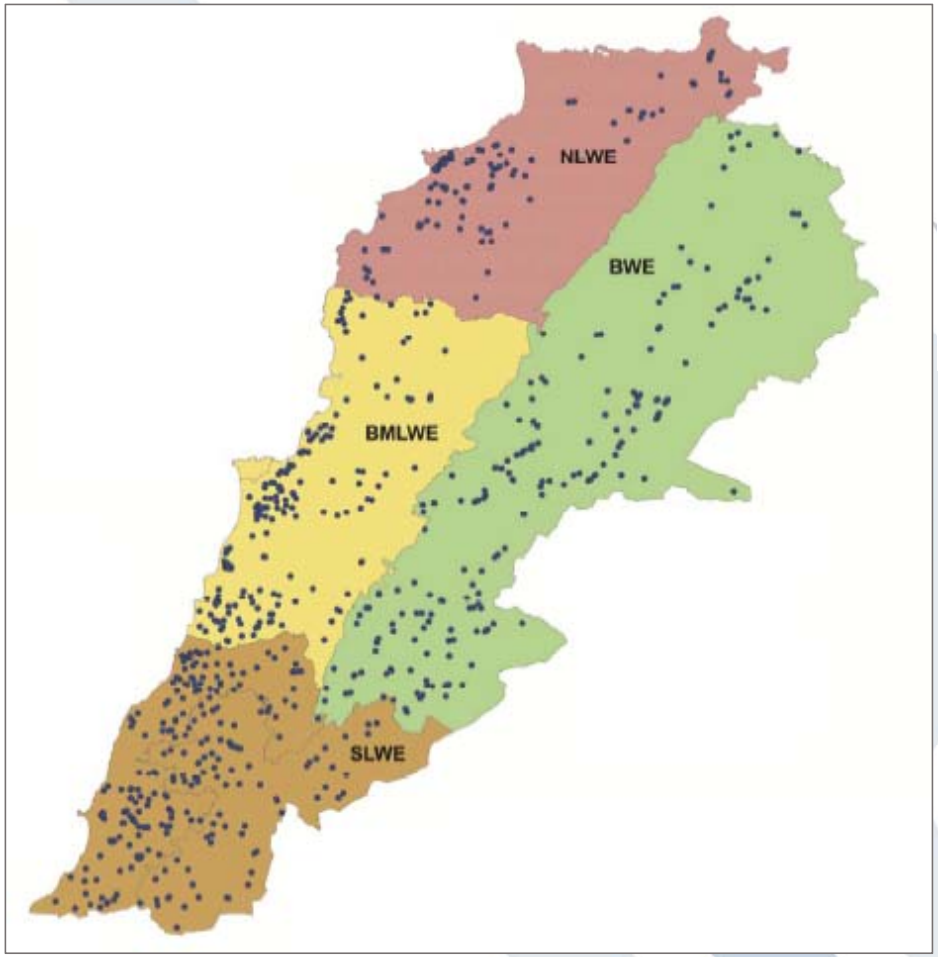



*Source: DREG 2016*

# Background of the Project|

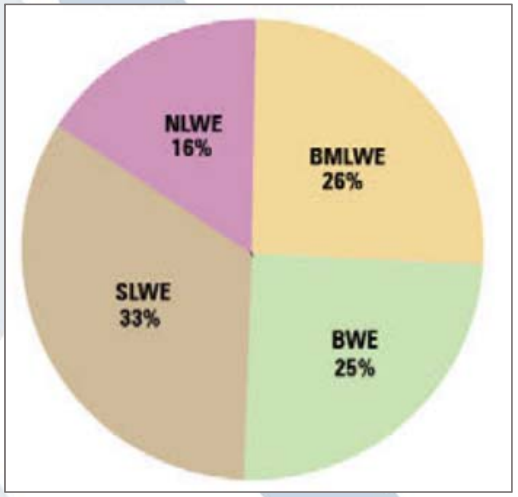
- **Water supply** has always been a **challenge** in the Northern Bekaa area
- **Increase in water demand** do to **Syrian refugee influx** (drinkable, domestic, and irrigation)
- Bekaa area is prone to electricity **blackouts safety** and **security** require street lighting.
- The use of **generators** 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)

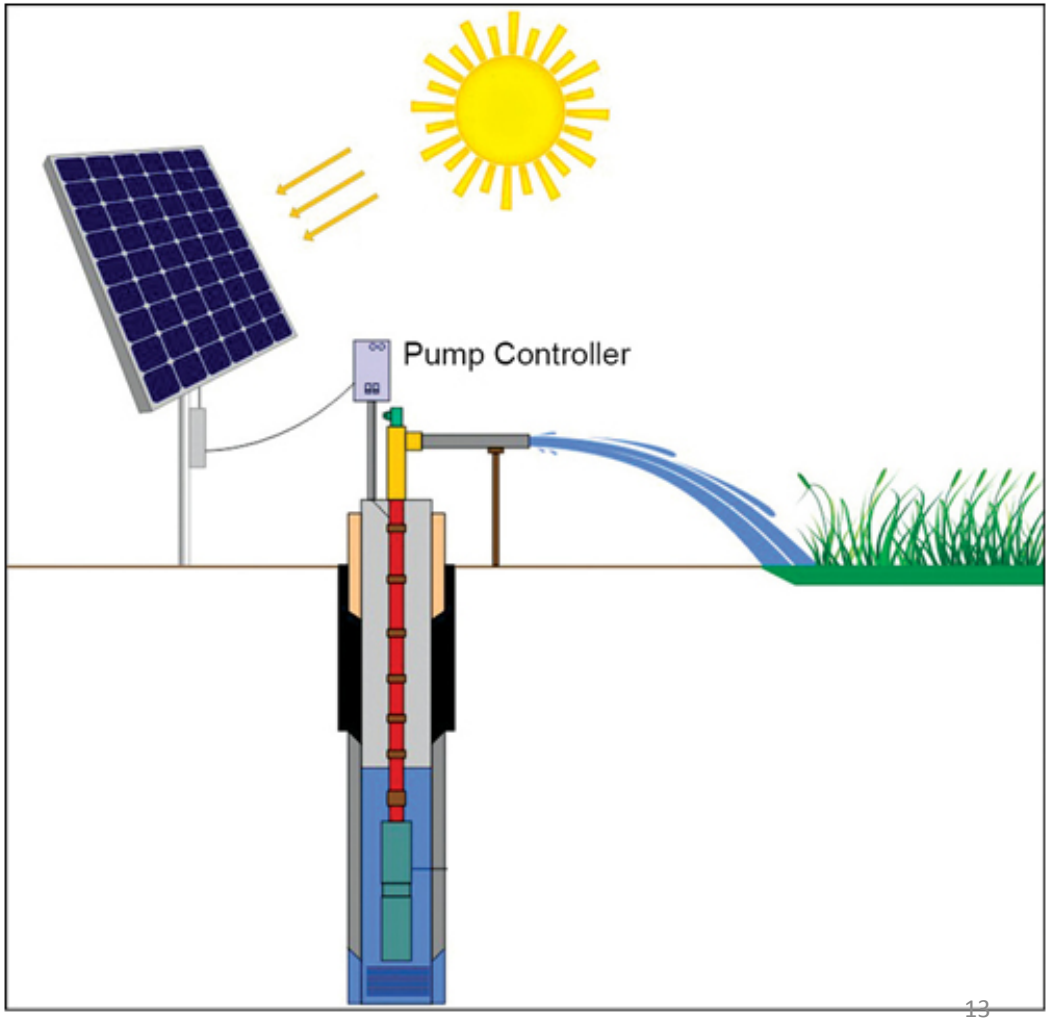
# What is Solar Pumping?

# What is Solar Pumping?

# What is Solar Pumping?

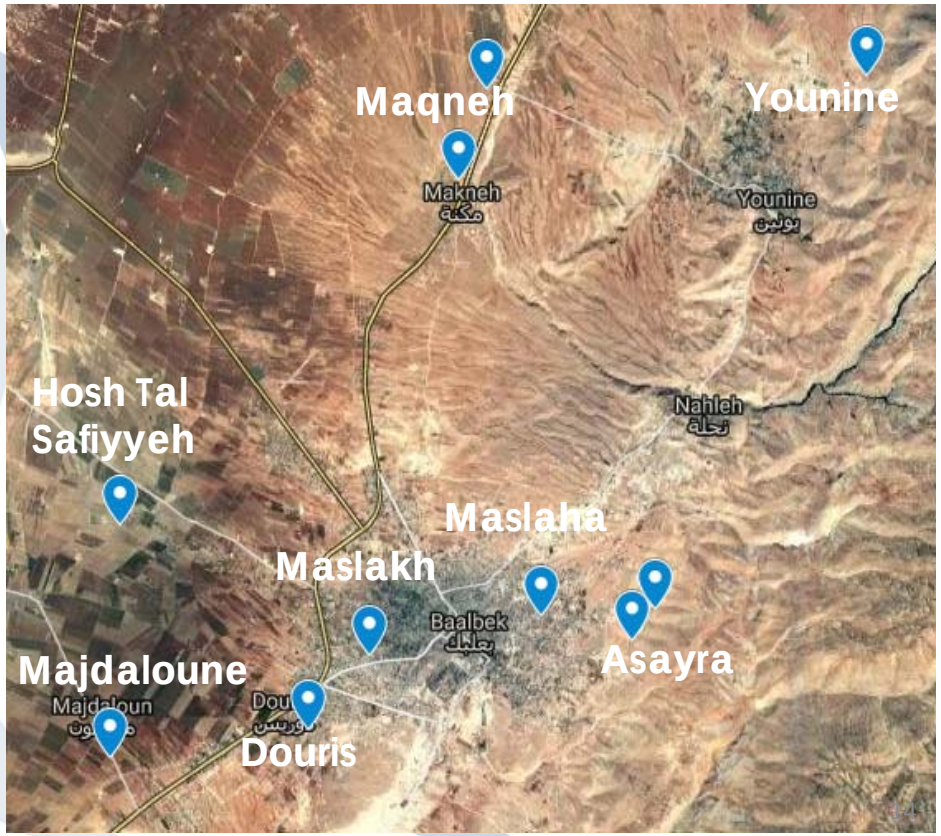
## Components:

- **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**

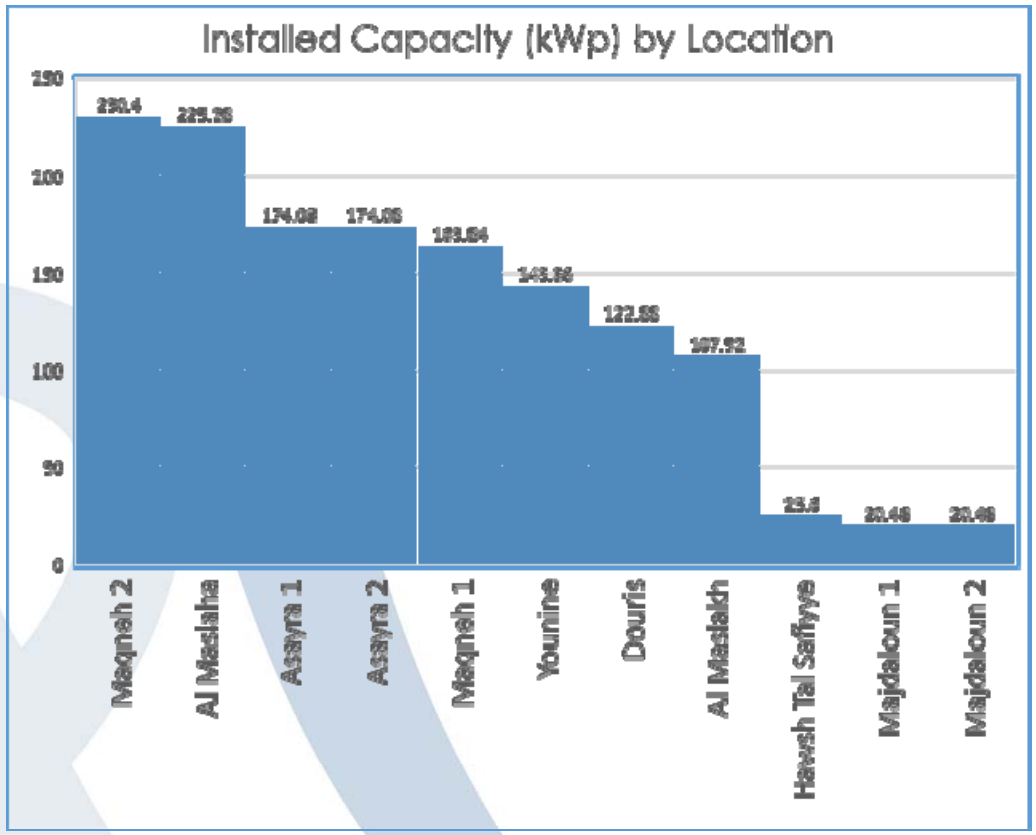
# Baalbeck PV Pumping Project|

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

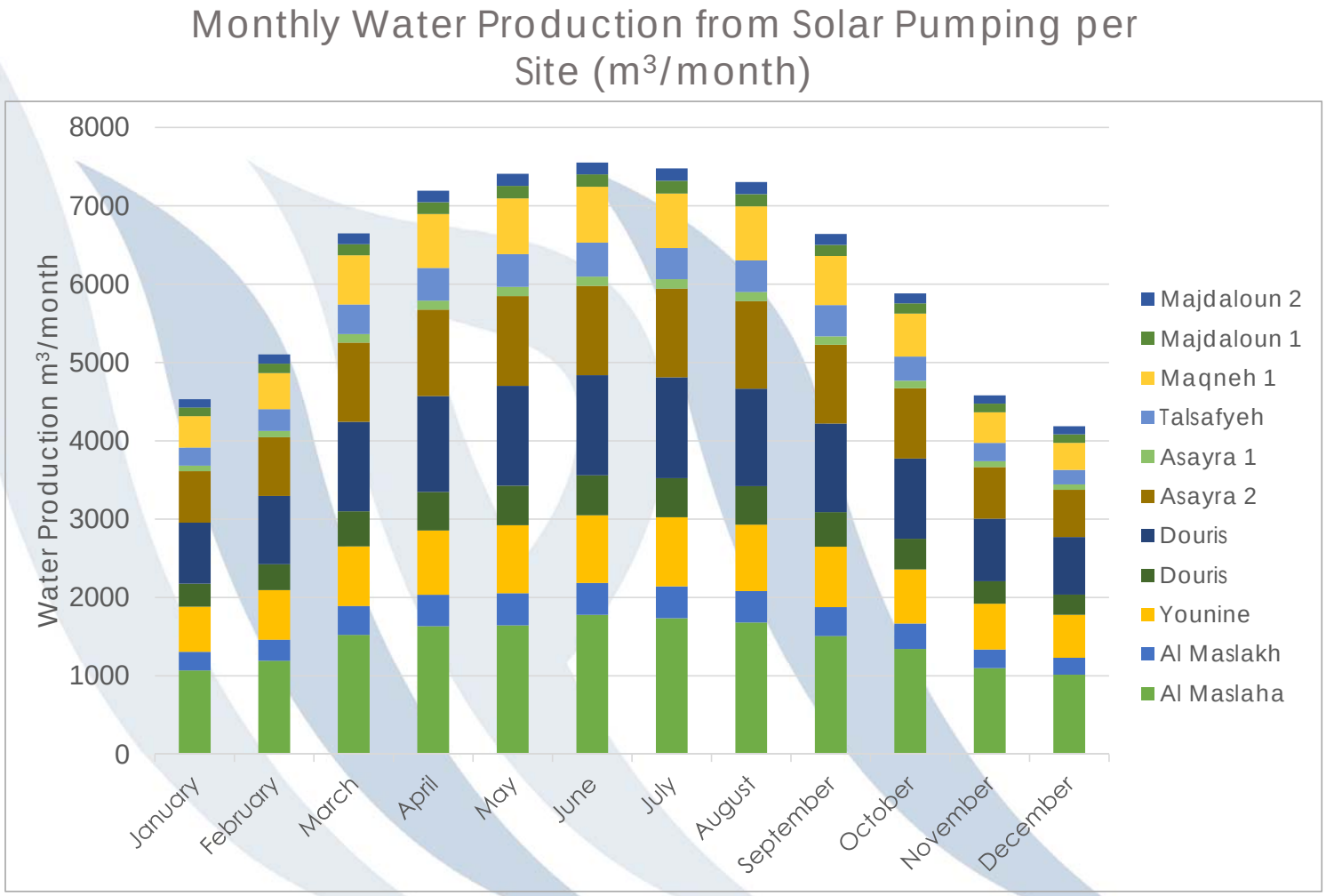



# Baalbeck PV Pumping Project|

| 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** |

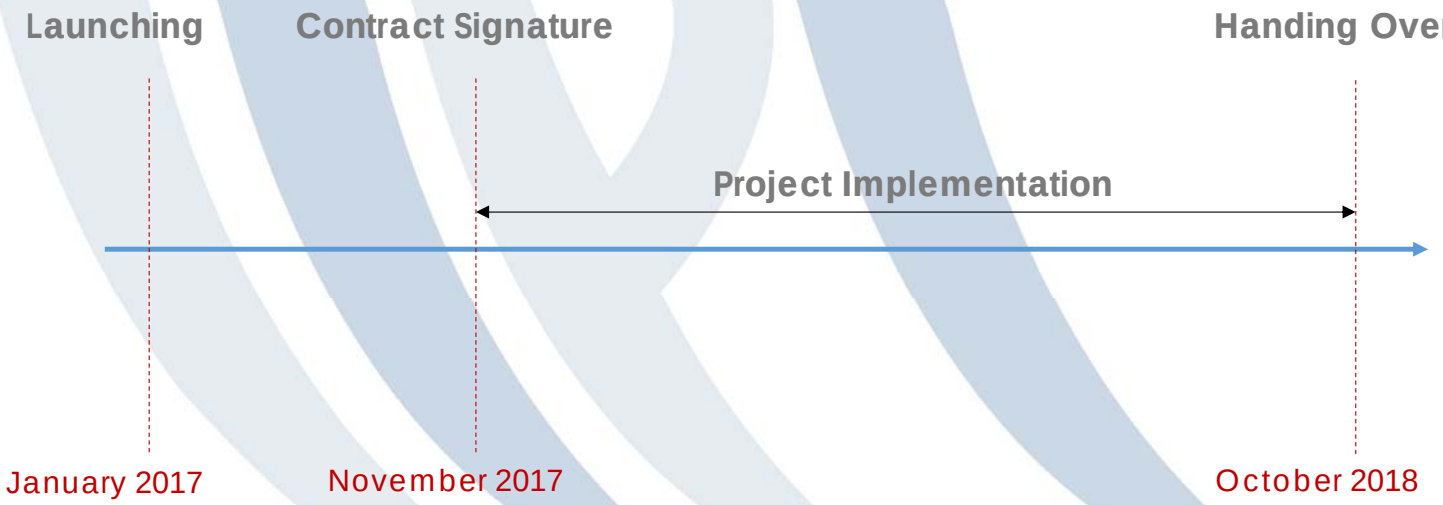


# Baalbeck PV Pumping Project|



# 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|

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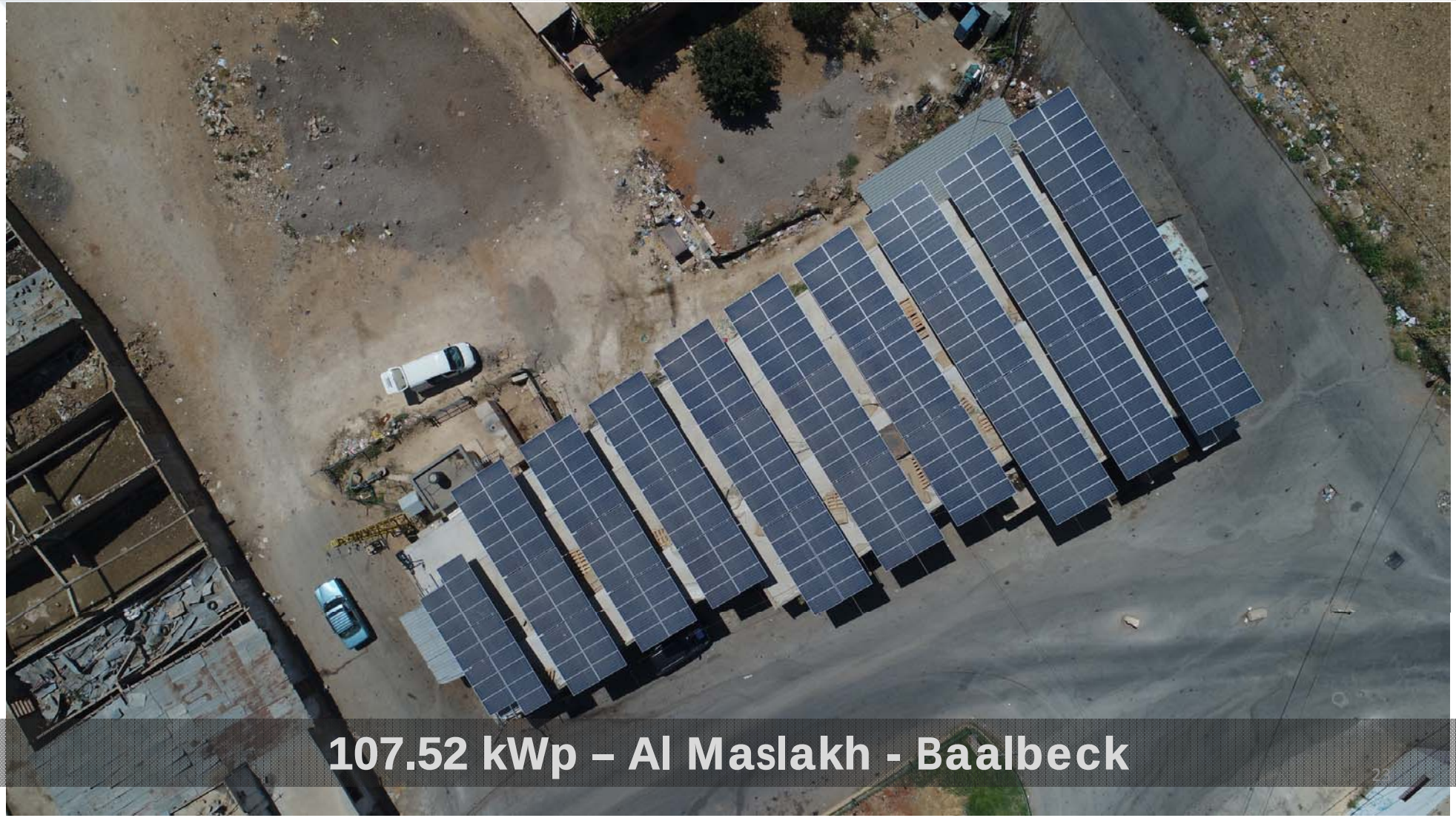
225.28 kWp Al Maslaha - Baalbeck

# Baalbeck PV Pumping Project|



107.52 kWp – Al Maslakh - Baalbeck

# Baalbeck PV Pumping Project|

174.08 kWp - Asayra

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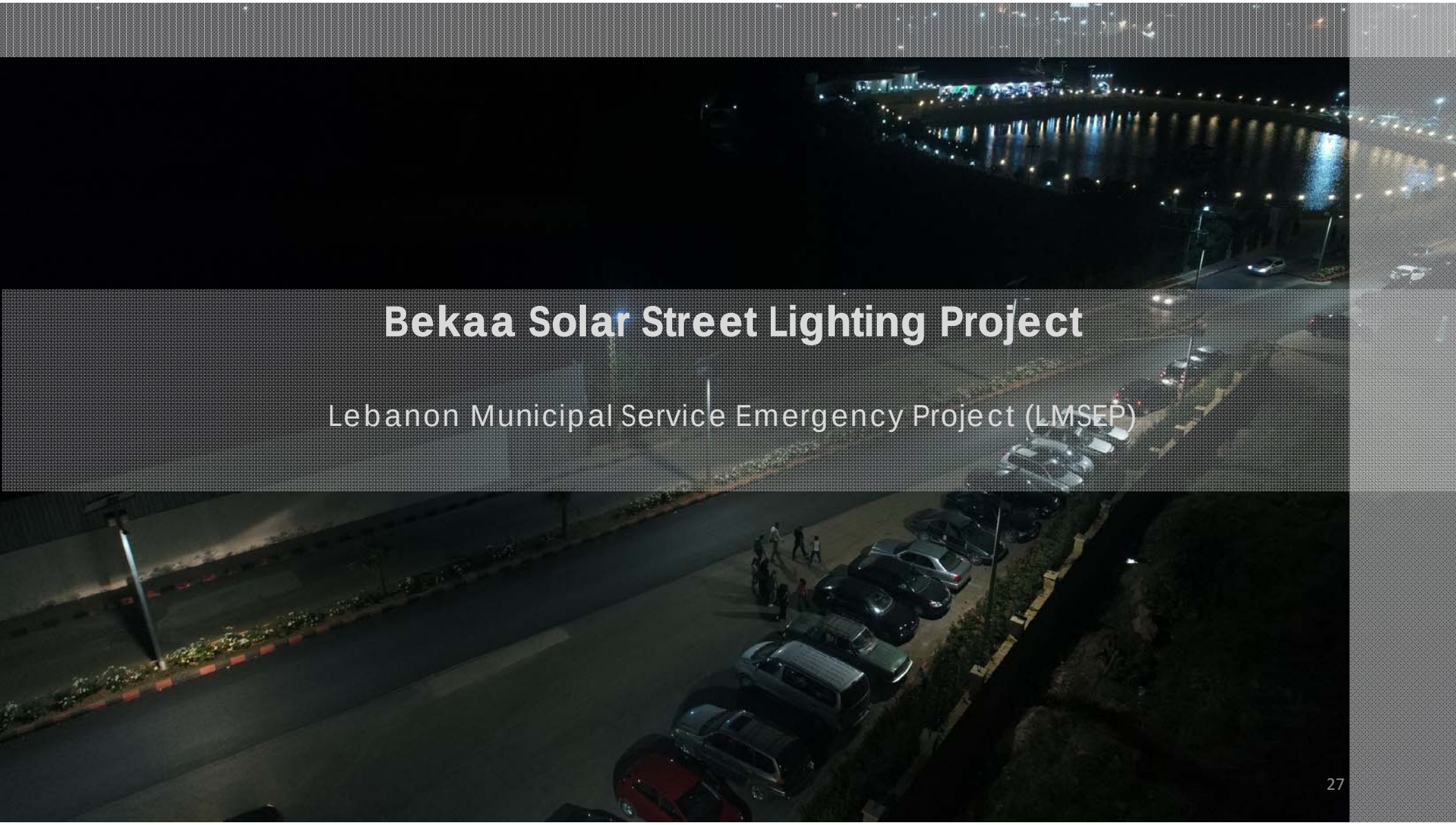
174.08 kWp – Asayra

# Baalbeck PV Pumping Project|

143.36 kWp – Younine



# Bekaa Solar Street Lighting Project

Lebanon Municipal Service Emergency Project (LMSEP)

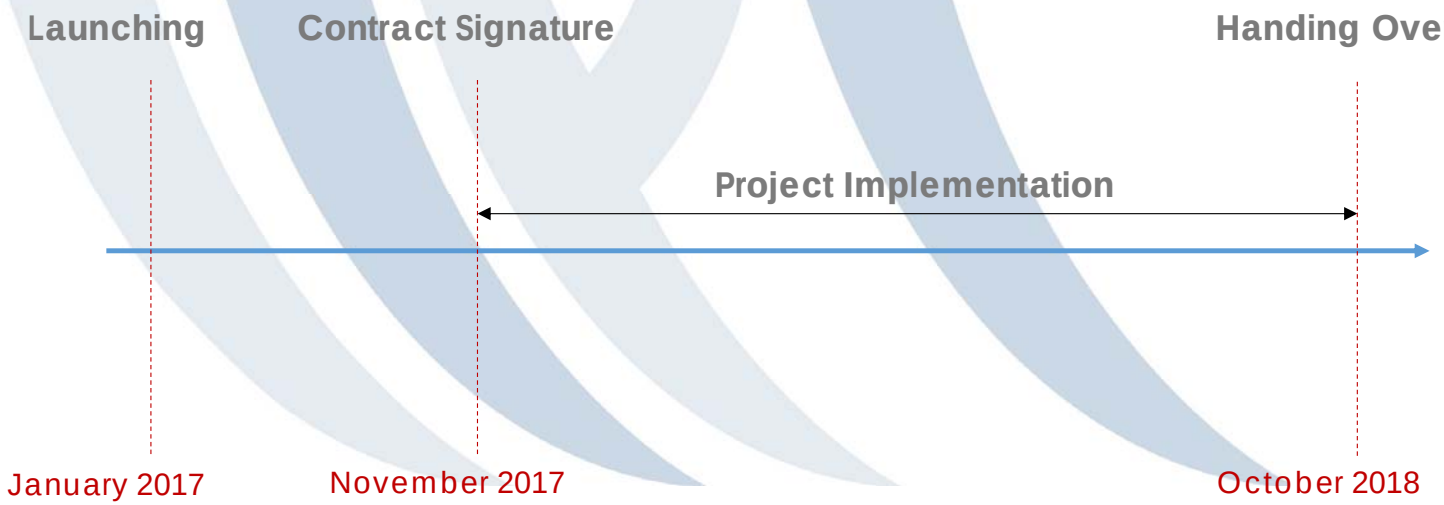
# Solar Street Lighting Project |

## Components:

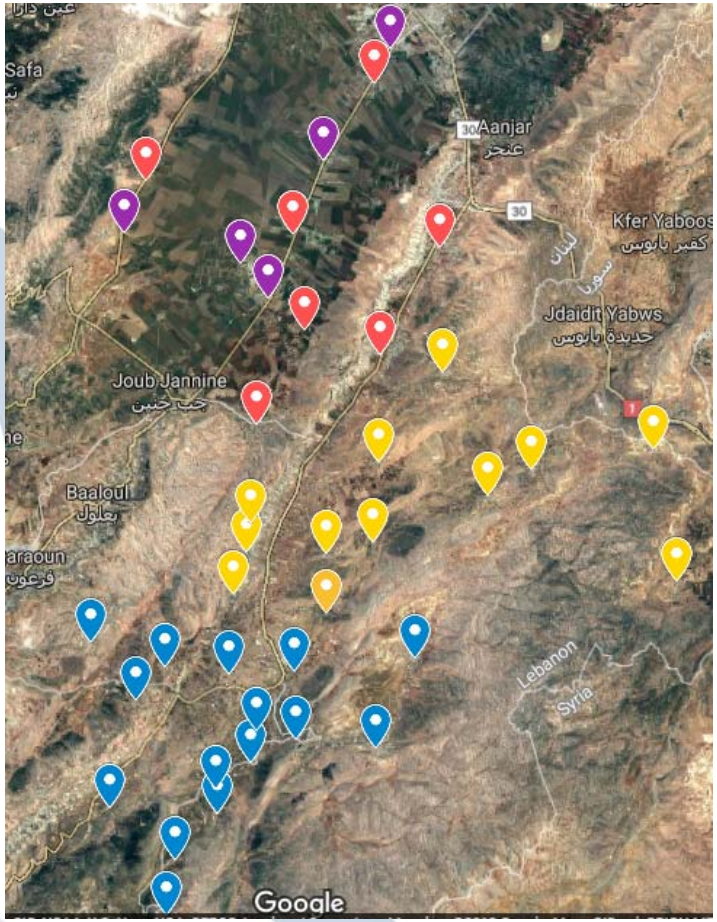
- **Concrete base**
- **1xPV Panel** (265 Wp) + accessories
- **1xPole** (7m) – Steel 4mm
- **1xCharge Controller** + **LED Driver**
- 1xLED **Lamp** 60W at 6m or double headed
- **2xBatteries** (12V 150Ah at C20) + accessories

# Solar Street Lighting Project |

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



# Solar Street Lighting Project |

# Solar Street Lighting Project |

# Conclusion |

| Solar photovoltaic distributed generation | Pessimistic | | | Realistic | | | Optimistic | | |
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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%

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# Thank you

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