

# 2015 | SOLAR PV STATUS REPORT FOR LEBANON





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**DREG**



LEBANESE CENTER FOR ENERGY CONSERVATION  
المركز اللبناني لحفظ الطاقة  
*efficient resources, sustainable achievements*

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DREG, [www.lb.undp.org/DREG](http://www.lb.undp.org/DREG)

Note: The information contained within this document has been developed within a specific scope, and might be updated in the future.

# ACKNOWLEDGMENTS

The United Nations Development Programme (UNDP) would like to thank both the Global Environment Facility (GEF) and the Lebanese Ministry of Energy and Water (MoEW) for their generous donation that enabled the Small Decentralized Renewable Energy Power Generation (DREG) Project to be realized. UNDP would also like to thank all its partners including the Lebanese Center for Energy Conservation (LCEC), the EU-funded UNDP CEDRO Project, Électricité du Liban (EDL), the UNDP Low Emission Capacity Building (LECB) Project at the Ministry of Environment (MoE), Banque du Liban (BDL), the Council for Development and Reconstruction (CDR), the Lebanese Solar PV companies which participated in the survey for this report, and all other institutions that work closely with this project.

## FOREWORD

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ARTHUR  
NAZARIAN

If one cannot measure something, one will definitely face difficulties managing it. Stemming from this notion, I am proud to announce Lebanon's first Solar Photovoltaic Status Report which will detail the status and the growth of the Solar PV market in Lebanon. Solar PV electricity generation has been on the rise in Lebanon since the 2000s but it only started seeing exponential growth in 2013 with the introduction of the NEEREA mechanism. NEEREA is a successful and ongoing financial mechanism initiated by the Central Bank of Lebanon with the support of the Ministry of Energy and Water, the United Nations Development Programme, and the Lebanese Center for Energy Conservation.

I encourage all the decision makers, stakeholders, and interested parties in the renewable energy sector in general, and the Solar PV sector in particular, to consult this report, get acquainted with its findings, and draw the lessons needed from it to continue supporting and growing this sector.

**Arthur Nazarian**  
Minister of Energy and Water

# ABSTRACT

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The 2015 Solar Photovoltaic (PV) Status Report for Lebanon, developed and published for the first time in 2016, highlights the status and the growth of the Solar PV market by presenting and analyzing all its available data.

Solar cells, also called photovoltaic (PV) cells, convert sunlight directly into electricity. PV gets its name from the process of converting light (photons) to electricity (voltage), which is called the PV effect.

This report serves as a baseline for the market and is based on data collected from all participating Lebanese Solar PV companies (44) with implemented projects all over Lebanon up until the end of 2015. The analyzed data enables the understanding of the Solar PV market growth in Lebanon over time through various indicators such as installed capacity, electricity generation, number and type of projects, amount of investments, monetary and environmental savings, and geographical location.

Starting in 2016, the Solar PV Status Report for Lebanon will become a yearly collaborative publication reporting on the market's growth for the previous year. This in turn will enable all the involved decision makers and stakeholders to align their efforts in order to continue supporting the market and sustaining its healthy growth.

# NOTE

\*DUE TO A NUMBER OF COMPANIES WHO CHOSE NOT TO PARTICIPATE IN THE DATA COLLECTION SURVEY, A CONSERVATIVE ESTIMATION WAS CONDUCTED TO QUANTIFY THEIR COMBINED INSTALLED CAPACITY AND IT LEAD TO AN ADDITIONAL 765 KWP. THIS VALUE WAS NOT ADDED TO THIS REPORT IN THE HOPES THAT THESE COMPANIES WILL COLLABORATE IN THE COMING YEARS BY PROVIDING THE DETAILED DATA REQUIRED.





## EXECUTIVE SUMMARY

- Lebanon's electricity generation capacity by EDL equaled **1,983 MW** by the end of 2015.
- Lebanon's electricity generation by EDL reached **12.4 TWh** in 2015.
- In 2010, Lebanon's Solar PV electricity installed capacity equaled 320 kWp.  
This number increased by:
  - > **41%** to equal **450 kWp** in 2011
  - > **73%** to equal **780 kWp** in 2012
  - > **124%** to equal **1.75 MWp** in 2013
  - > **117%** to equal **3.80 MWp** in 2014
  - > **149%** to equal **9.45 MWp** in 2015
- Total investment in the Solar PV sector up to the end of 2015 reached **\$30.5M**.
- Solar PV electricity capacity in 2015 was **0.47%** of EDL's total electricity capacity and **0.11%** of EDL's total annual electricity generation. With Solar PV added to Hydro, the renewables' share of the total annual electricity generation by EDL in 2015 is **4.1%**.
- From 2010 until the end of 2015, cumulative installed Solar PV electricity capacity has grown by an average rate of **101%** per year.
- The number of new Solar PV projects increased from **18** in 2011 to **94** in 2013 and to **259** in 2015.
- The year-over-year growth rate for the Solar PV electricity capacity increased from **41%** in 2011 to **149%** in 2015. The year-over-year growth rate for the number of new Solar PV projects increased from **27%** in 2011 to **72%** in 2015. This indicates that the average size of each project increased from **5 kWp** in 2010 to **21 kWp** in 2015.

- The turnkey price for Solar PV has been falling steadily year after year from **\$7,178** per kWp in 2010 to **\$2,675** per kWp in 2015.  
This constitutes a price drop of **63%** in a span of six years.
- The turnkey price for numerous types of Solar PV systems has decreased by more than **30%** and up to **66%** of the initial turnkey price since introduction in the Lebanese market.
- The total investment in the Solar PV sector increased from **\$2.3M** in 2010 to **\$30.52M** in 2015.  
The positive impact NEEREA has on the market is clearly seen with the exponential growth starting in 2012-2013 and carrying forward.
- The Top 4 sectors leading the Solar PV market in Lebanon are the Commercial sector with **2 MWp** at **22%**, the Residential sector with **1.7 MWp** at **18%**, the Agricultural sector with **1.7 MWp** at **18%**, and the Industrial sector with **1.6 MWp** at **17%**.
- The Top 3 project types prevailing in the Solar PV market in Lebanon are Hybrid/Multisource with **3.77 MWp** at **40%**, On-grid with batteries/grid interactive with **1.59 MWp** at **17%**, and Solar PV Pumping with **1.58 MWp** at **17%**.
- The Top 3 Governorates leading the Solar PV market in Lebanon are Mount Lebanon with **3 MWp** at **32%**, Beirut with **2.4 MWp** at **25%**, and Bekaa with **1.8 MWp** at **19%**.
- The estimated monetary savings from all the Solar PV projects in Lebanon grew from **\$191,000** per year in 2010 to **\$7,000,000** per year in 2015. These are the savings reaped by the operators of Solar PV systems in Lebanon by deferring a portion of their electricity consumption from the grid and diesel gensets to Solar PV electricity generation.
- The estimated emissions savings from all the Solar PV projects in Lebanon increased from **351 tCO<sub>2</sub>** per year in 2010 to **18,000 tCO<sub>2</sub>** per year in 2015.

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# TABLE OF ACRONYMS

<b>BDL</b>	Banque du Liban
<b>CDR</b>	Council for Development and Reconstruction
<b>EDL</b>	Electricité du Liban
<b>GEF</b>	Global Environment Facility
<b>kWp</b>	Kilo-watt-peak
<b>kWh</b>	Kilo-watt-hour
<b>LECB</b>	Low Emission Capacity Building Project
<b>MoE</b>	Ministry of Environment
<b>MoEW</b>	Ministry of Energy and Water
<b>MW</b>	Mega-watt
<b>MWh</b>	Mega-watt-hour
<b>MWp</b>	Mega-watt-peak
<b>NEEREA</b>	National Energy Efficiency and Renewable Energy Action
<b>PV</b>	Photovoltaic
<b>tCO<sub>2</sub></b>	Tonnes of CO <sub>2</sub>
<b>TWh</b>	Terra-watt-hour

# INTRODUCTION

The Small Decentralized Renewable Energy Power Generation Project, also known as DREG, is funded by the Global Environment Facility (GEF) and implemented by the United Nations Development Programme (UNDP). The project is nationally executed by the Ministry of Energy and Water (MoEW) in coordination with the Lebanese Center for Energy Conservation (LCEC).

The project's objective is to reduce greenhouse gas emissions by the removal of barriers to widespread application of decentralized renewable energy power generation.

This report serves as a baseline for the market and is based on data collected from all participating Lebanese Solar PV companies (44) with a total of 621 implemented projects all over Lebanon by the end of 2015. The analyzed data enables the understanding of the Solar PV market growth in Lebanon over time through various indicators such as installed capacity, electricity generation, number and type of projects, amount of investments, monetary and environmental savings, and geographical location.

Starting in 2016, the **Solar PV Status Report for Lebanon** will become a yearly publication reporting on the market's growth for the previous year. This in turn will enable all the involved decision makers and stakeholders to align their efforts in order to continue supporting the market and hence, sustaining its healthy growth.



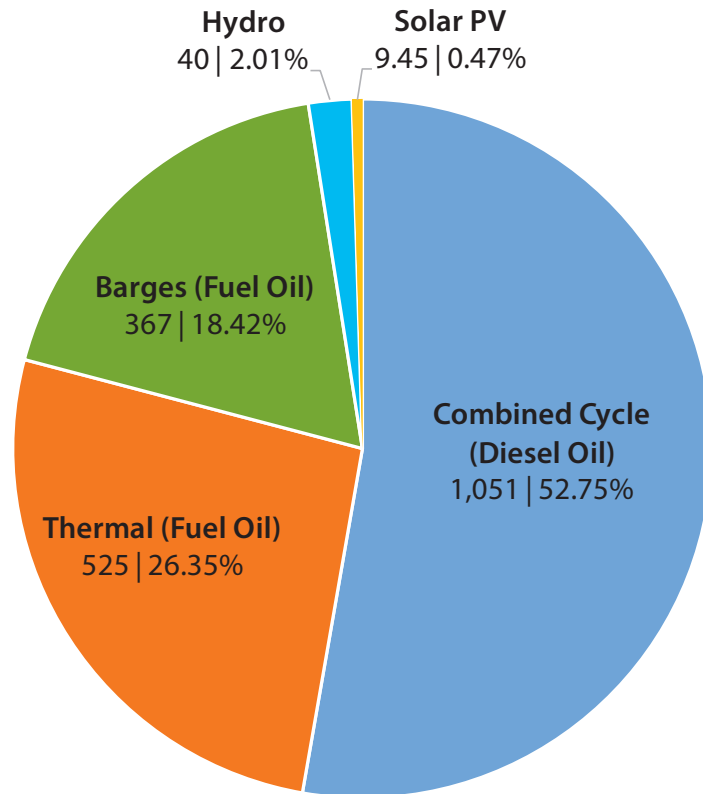


# LEBANON ELECTRICITY BACKGROUND INFORMATION



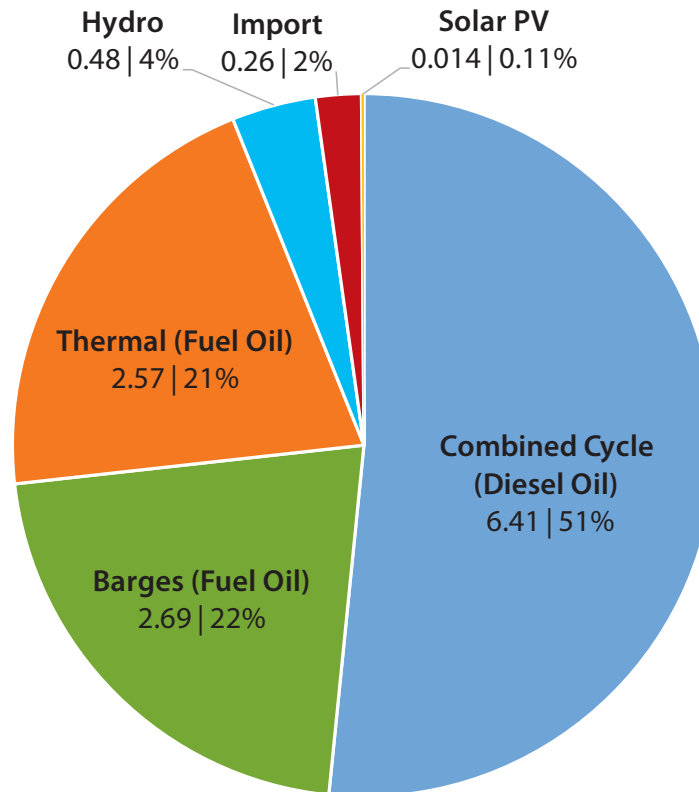


## Lebanon's 2015 Electricity Generation Capacity (MW | %)



*EDL's share of the total electricity generation capacity equaled 1,983 MW while the Solar PV's share equaled 9.45 MWp.*

## Lebanon's 2015 Electricity Generation (TWh | %)



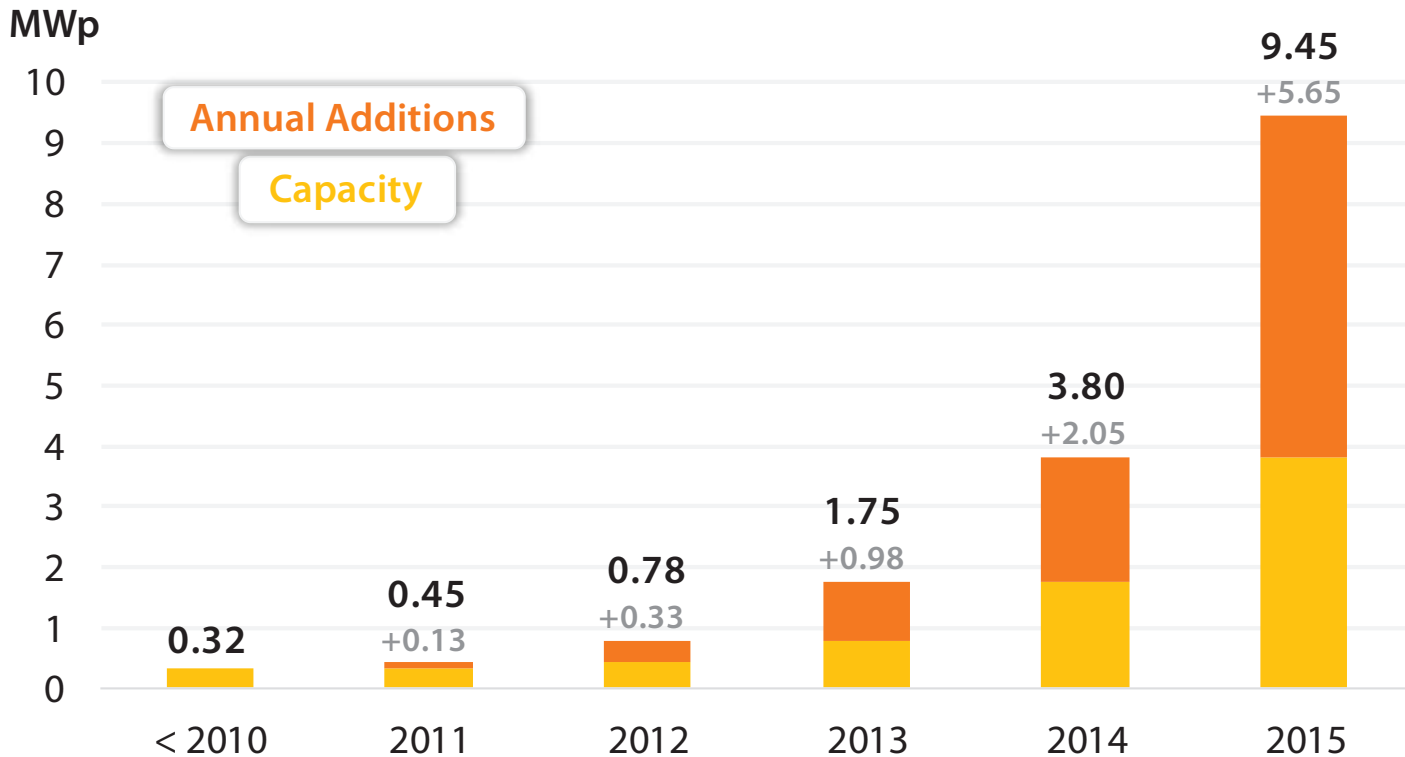
*EDL's share of the total electricity generation equaled 12.41 TWh while the Solar PV's share equaled 0.014 TWh or 0.11% of the total electricity generation.  
With Solar PV added to Hydro, the renewables' share of the total annual electricity generation by EDL in 2015 is 4.1%.*



# **SOLAR PV ELECTRICITY IN LEBANON**

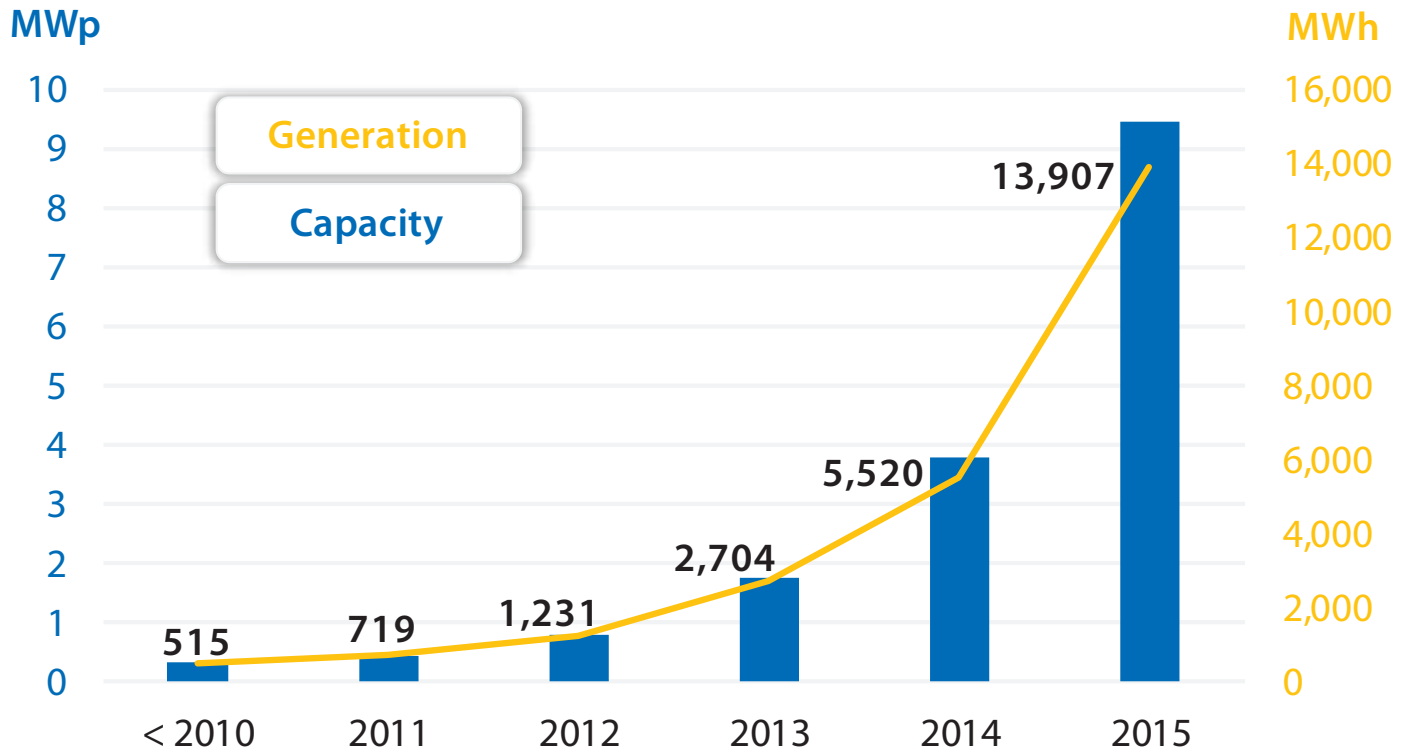


## Solar PV Electricity Capacity and Annual Additions



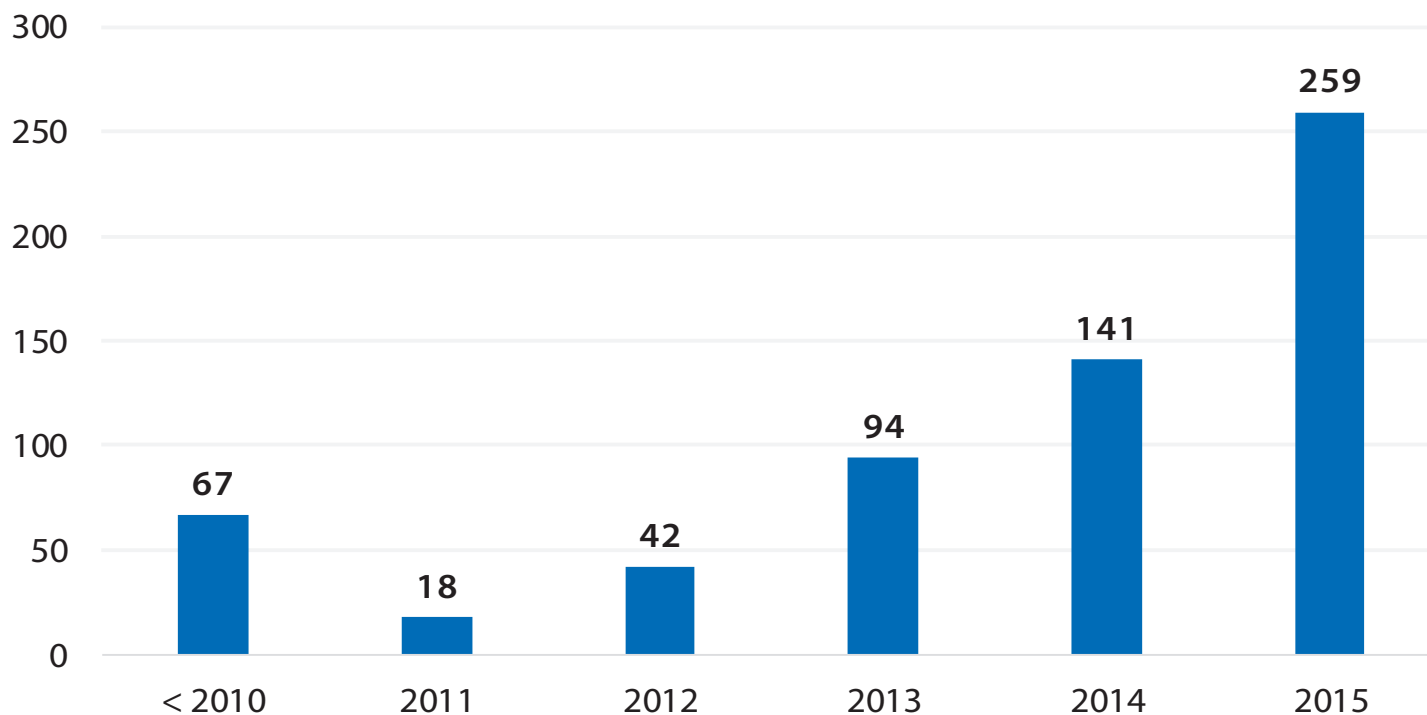
*The Solar PV electricity installed capacity was 320 kWp in 2010 and reached 9.45 MWp\* by 2015. The 9.45 MWp installed capacity include the Beirut River Solar Snake (BRSS) Project (1.08 MWp) whereas the remainder comes from decentralized systems (8.37 MWp).*

## Solar PV Electricity Capacity and Generation



*Around 14,000 MWh of Solar PV electricity was generated in 2015 which constitutes 0.11% of the total annual electricity generation by EDL.*

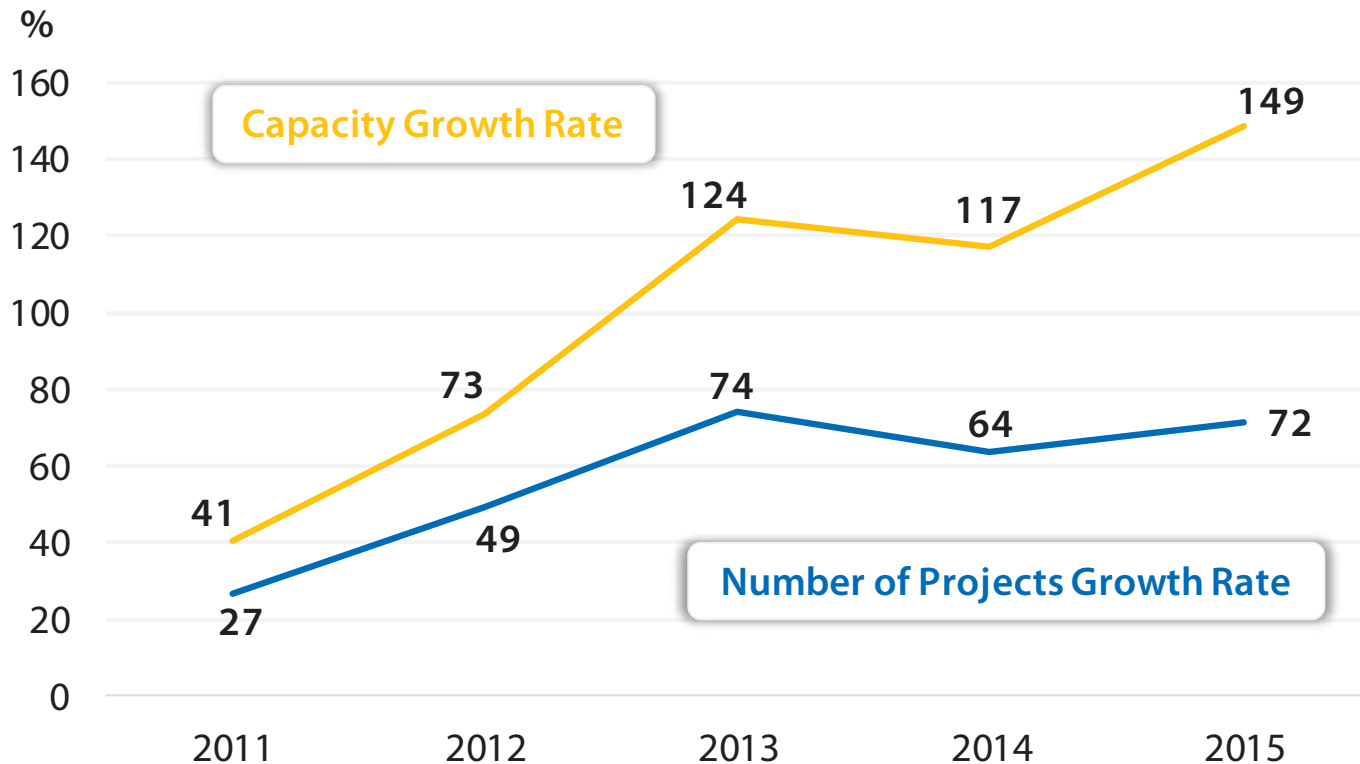
## Solar PV Annual New Projects Count



*The number of new Solar PV projects increased from 18 in 2011 to 94 in 2013 and to 259 in 2015.*

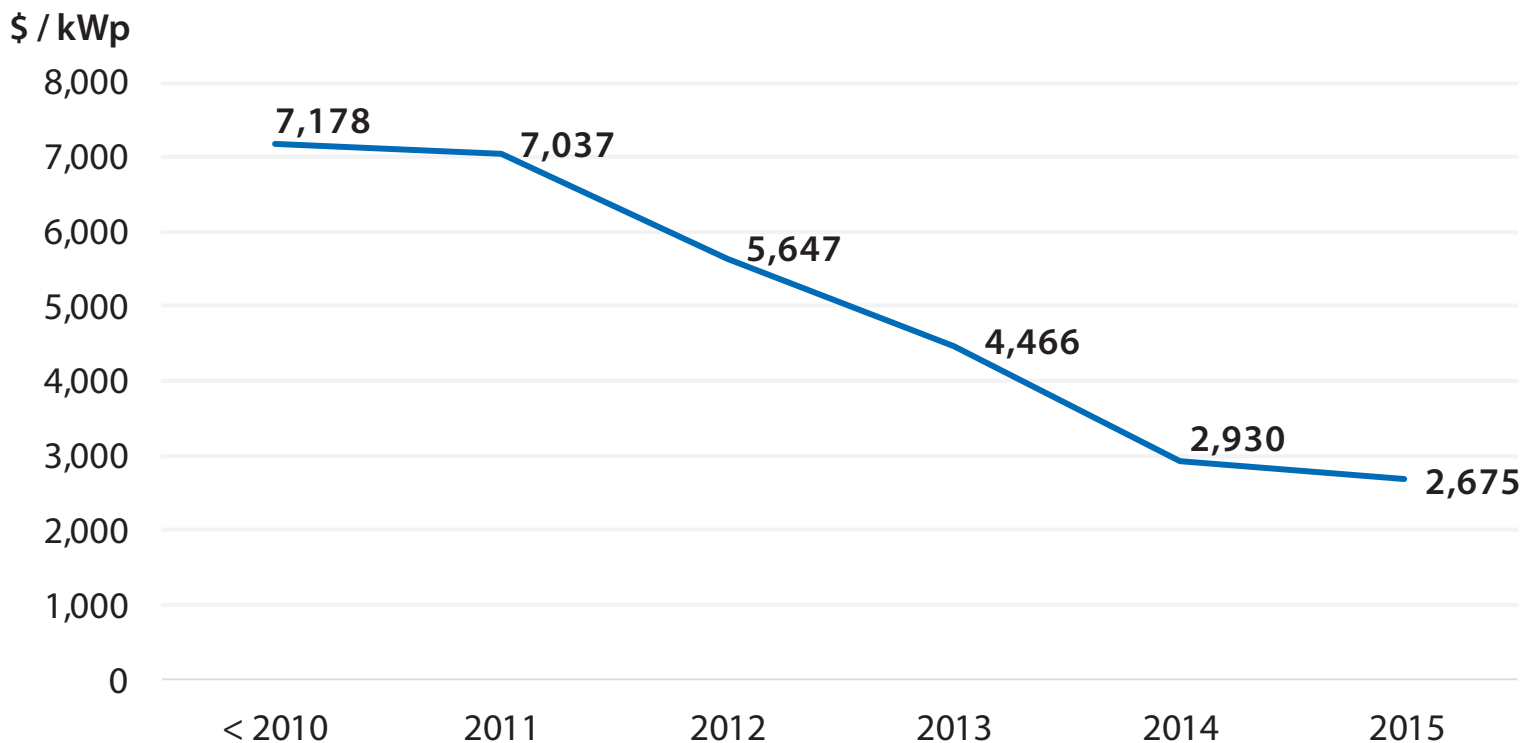


## Solar PV Electricity Capacity and Number of Projects Year-over-Year Growth Rate (%)



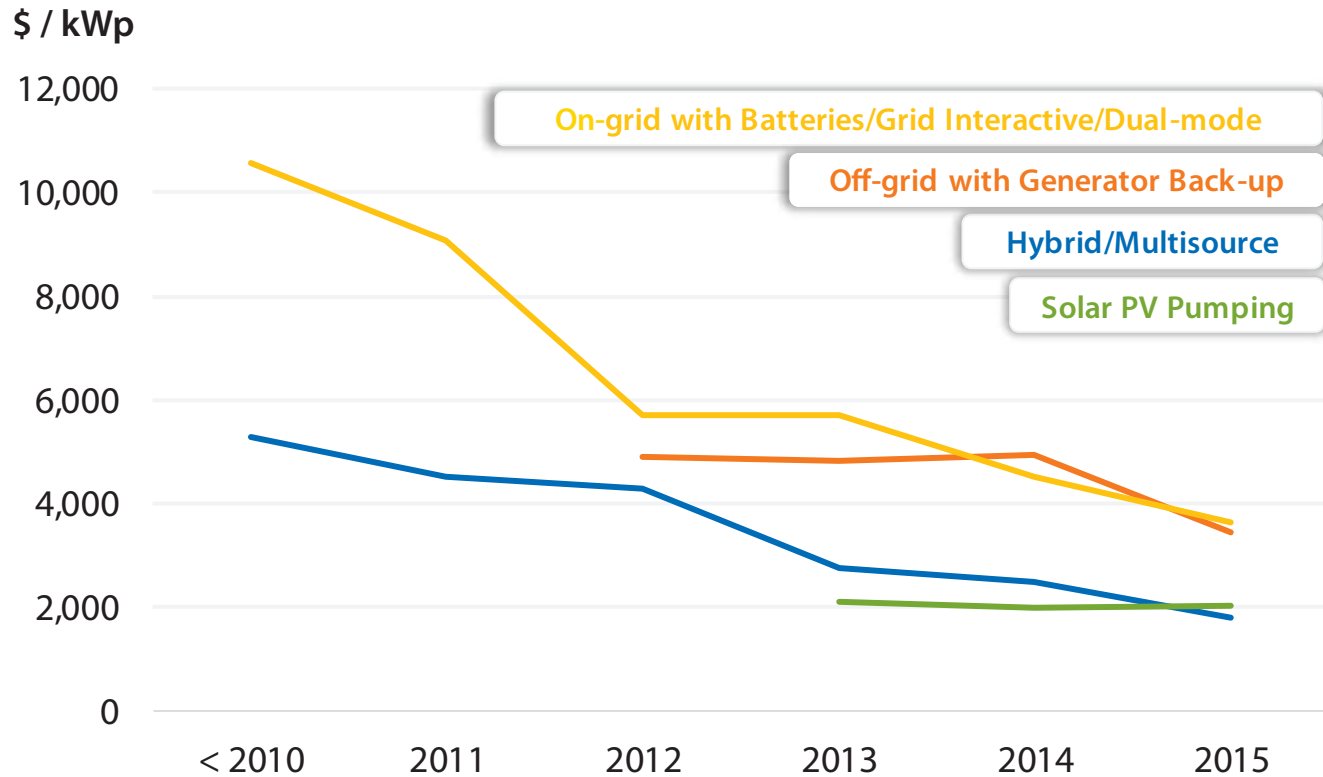
The year-over-year growth rate for the Solar PV electricity capacity increased from 41% in 2011 to 149% in 2015. The year-over-year growth rate for the number of new Solar PV projects increased from 27% in 2011 to 72% in 2015. This indicates that the average size of each project increased from 4.78 kWp in 2010 to 21.28 kWp in 2015.

## Yearly Average Solar PV Turnkey Price (\$ / kWp)



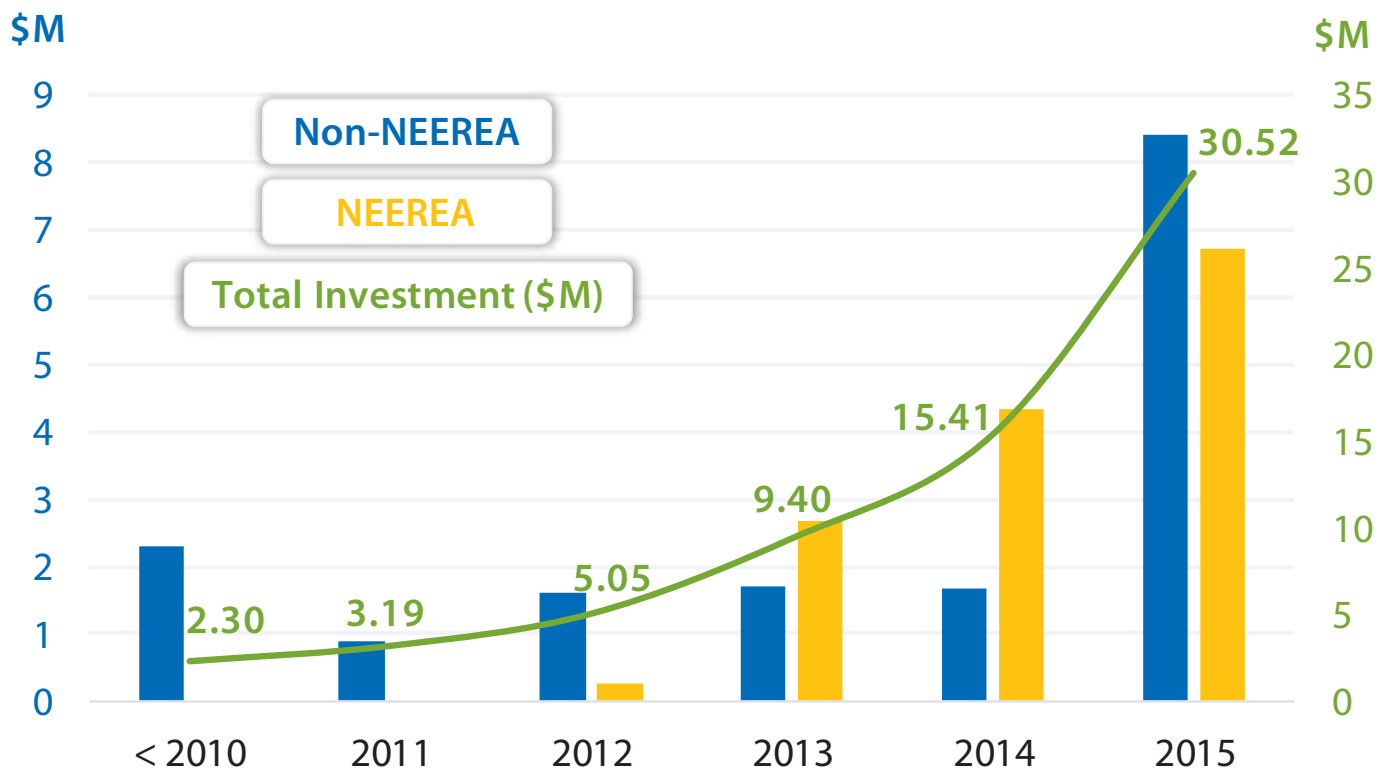
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## Yearly Average Solar PV Turnkey Price by Project Type (\$ / kWp)



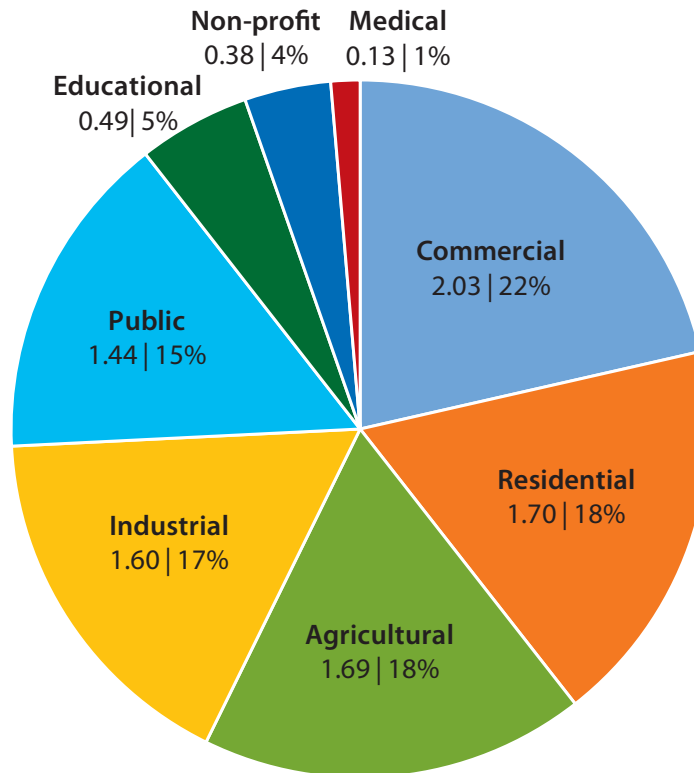
*The turnkey price for numerous types of Solar PV systems has decreased by more 30% and up to 66% of the initial turnkey price since introduction in the Lebanese market.*

## Solar PV Investment (\$M)



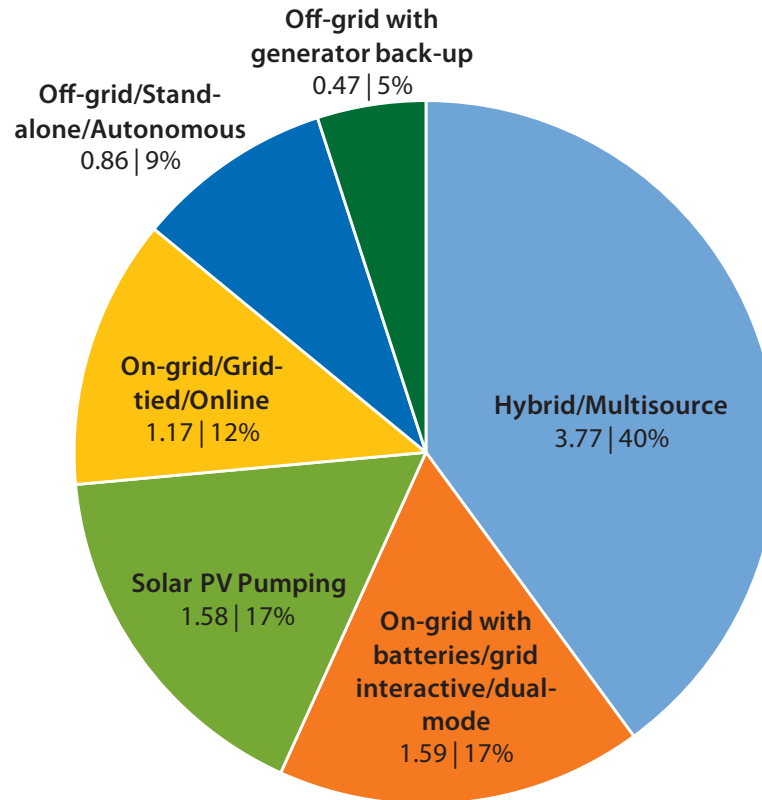
The total investment in the Solar PV sector increased from \$2.3M in 2010 to \$30.52M in 2015. The positive impact NEEREA has on the market is clearly seen with the exponential growth starting in 2012-2013 and carrying forward.

## Solar PV Capacity by Sector (MWp | %)



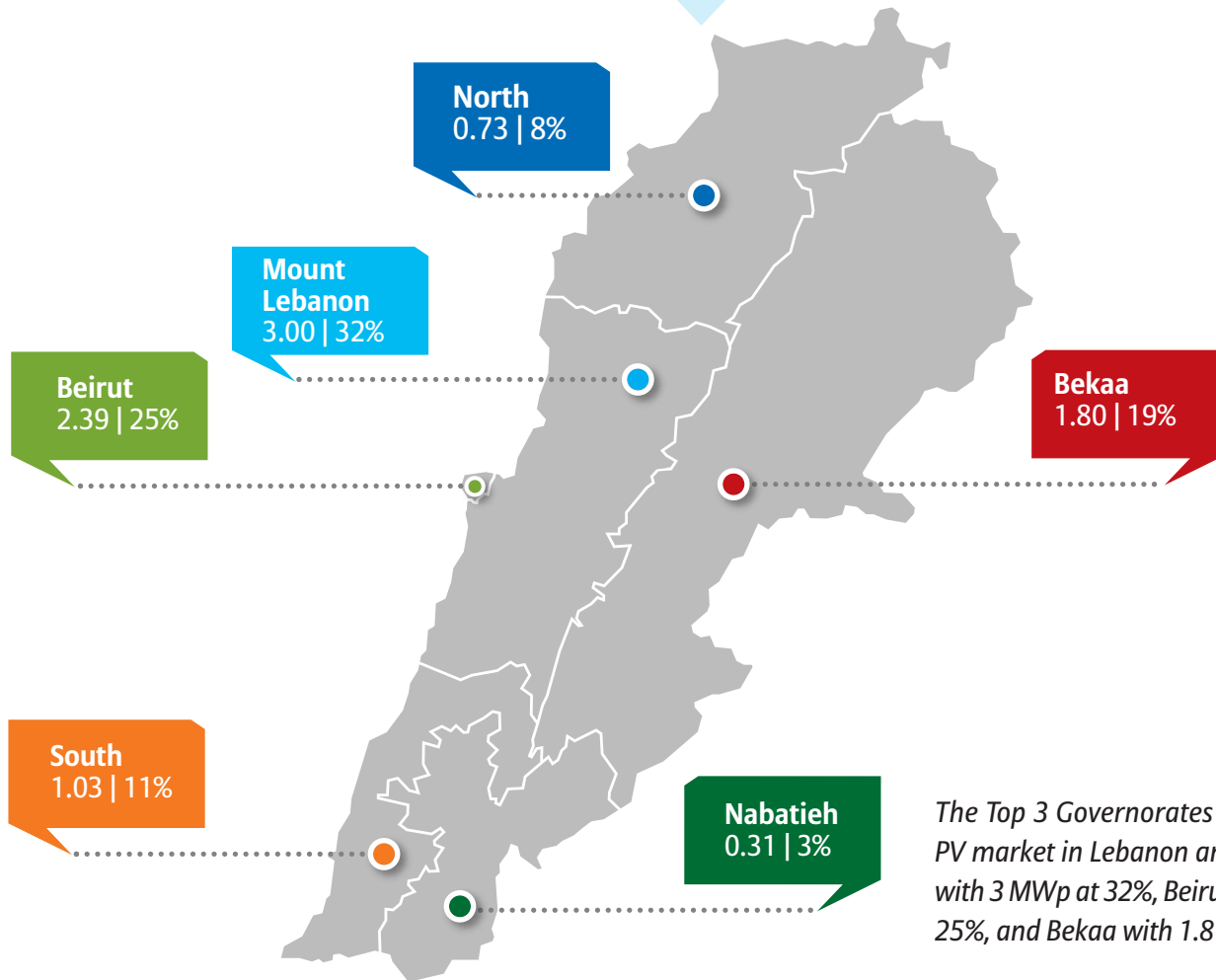
*The Top 4 sectors leading the Solar PV market in Lebanon are the Commercial sector with 2 MWp at 22%, the Residential sector with 1.7 MWp at 18%, the Agricultural sector with 1.7 MWp at 18%, and the Industrial sector with 1.6 MWp at 17%.*

## Solar PV Capacity by Project Type (MWp | %)



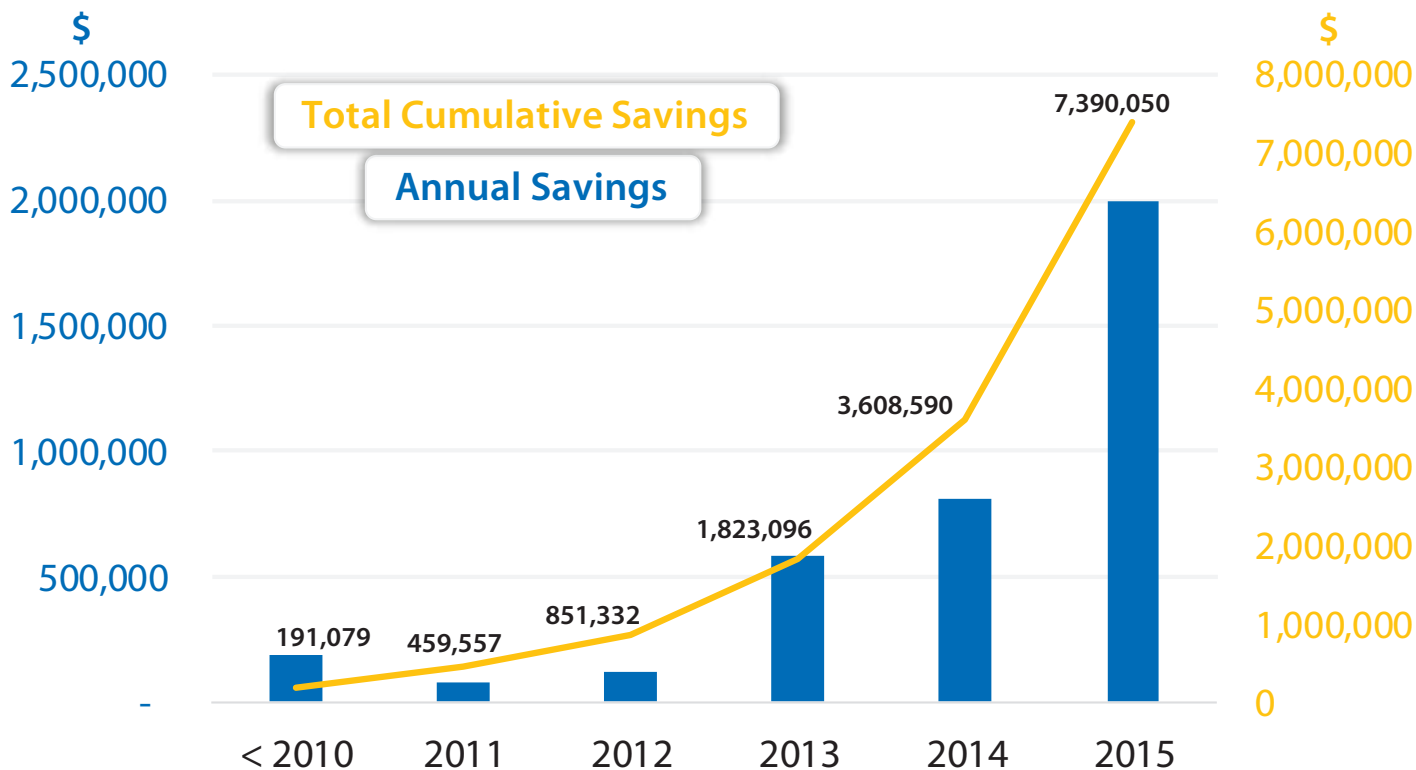
*The Top 3 project types prevailing in the Solar PV market in Lebanon are Hybrid/Multisource with 3.77 MWp at 40%, On-grid with batteries/grid interactive with 1.59 MWp at 17%, and Solar PV Pumping with 1.58 MWp at 17%.*

## Solar PV Capacity by Governorate (MWp | %)



The Top 3 Governorates leading the Solar PV market in Lebanon are Mount Lebanon with 3 MWp at 32%, Beirut with 2.4 MWp at 25%, and Bekaa with 1.8 MWp at 19%.

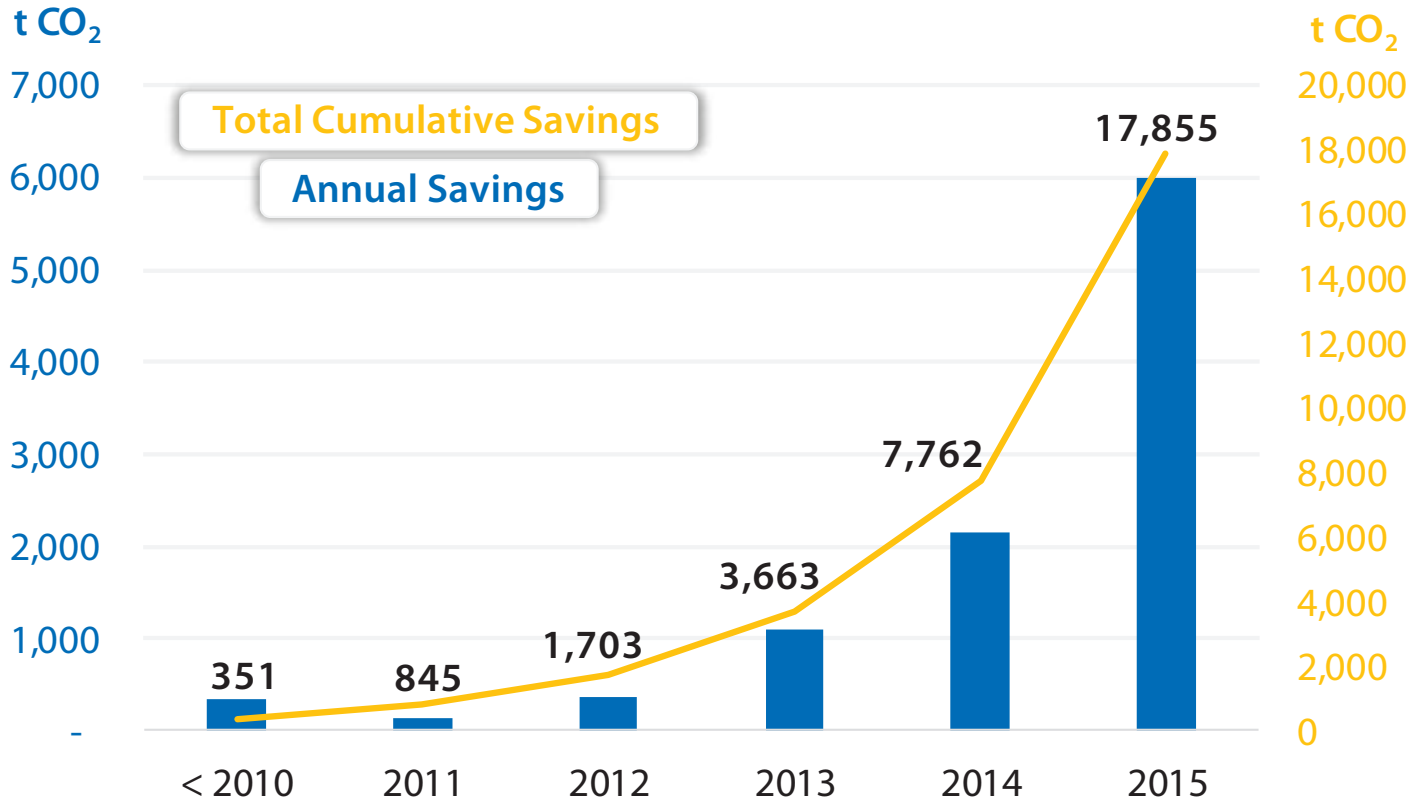
## Solar PV Estimated Monetary Savings (\$)



*The estimated total cumulative monetary savings from all the Solar PV projects in Lebanon grew from \$191,000 in 2010 to \$7,400,000 in 2015. These are the savings reaped by the operators of Solar PV systems in Lebanon by deferring a portion of their electricity consumption from the grid and diesel gensets to Solar PV electricity generation.*



## Solar PV Estimated Emissions Savings (tCO<sub>2</sub>)



*The estimated total cumulative emissions savings from all the Solar PV projects in Lebanon increased from 351 tCO<sub>2</sub> in 2010 to 18,000 tCO<sub>2</sub> in 2015.*

# LIST OF PARTICIPATING LEBANESE SOLAR PV COMPANIES

AEMS

Al Diyar for Engineering & Contracting & Trade

ALBINA

Alternative Energy DPC

Alternative Energy Inc.

ASACO

Black Box

Cenpro Energy

Consolidated Technology Industries

Contracom

Control Panel

DAWTEC

Durable Construction & Energy

Earth Technologies

ECOSYS

Elements Sun & Wind

Elie Abdlnour & Co.

Green Essence

EMCA

Free

Go Green

GP Stellar

Green Alternative Power Sources

Green Arms

Green Energy

Green Energy System

GREEN-MENA

Hawa Akkar

Ienergy

Ijazi Investment Company

Kypros

LIRASOLE

ME Green

Phoenix Energy

Power & Green

Renewable Med Energy

Salem International

Smart Age

SOLARNET

SOLAR WIND M.E

Solec Energy

UEC

Yazbek solar

Yellow eco energy





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