



The 2020 Solar PV Status Report for Lebanon

June 2022

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The Lebanese Center for Energy Conservation (LCEC) is the national energy agency for Lebanon. LCEC is an association within the Lebanese Ministry of Energy and Water (MEW) with a financially & administratively independent statute. LCEC acts as the technical arm of the Lebanese Government, specifically the Ministry of Energy and Water in all issues related to energy efficiency, renewable energy, and green buildings.

For more information:

The Lebanese Center for Energy Conservation, www.lcec.org.lb

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





Acknowledgments

The Lebanese Center for Energy Conservation (LCEC) would like to thank all its partners specifically Électricité du Liban (EDL), Banque du Liban (BDL), and all renewable energy companies for contributing to the data presented herein and for their support in the preparation of this report.

LCEC would also like to thank the UNDP - DREG Project for the development of the first three versions of the Solar PV Status Report and for enabling the continuation of the fourth, fifth, and the present sixth edition.





FOREWORD

2020 was an exceptional year worldwide in general, and for Lebanon in particular. The pandemic's outbreak, the severe economic crisis, and the catastrophic explosion of the 4th of August, were all huge set backs for every sector of the Lebanese economy. Despite all that, the solar PV market kept growing impressively, and with more than 13 MWp additional installed capacity, the total cumulative installed systems reached around 90 MWp, equivalent to 90% of the distributed solar PV capacity's target set for 2020 in the National Renewable Energy Action Plan for the Republic of Lebanon (NREAP 2016-2020).

The Ministry of Energy and Water strongly believes in the importance of pushing forward the renewable energy sectors in general, and especially the solar PV applications, as the latter can help households in securing their basic needs of energy on the short term, & is essential as well for the long term target of

having 30% of electricity generation from renewables in 2030, as set in the Lebanon Energy Outlook for Lebanon 2030 prepared in partnership and with the full support of the International Renewable Energy Agency (IRENA).

While a lot of effort has been invested during the last decade to promote such projects, in terms of raising awareness, developing legal frameworks and financial mechanisms, standardization, implementing pilot projects, and many capacity building activities, the Ministry is aware that more effort needs to be done especially in the current situation to tackle the new challenges. In this regard, the Ministry set a facilitation scheme for rooftop solar applications in close collaboration with the Ministry of Interior and Municipalities. The Ministry also prepared and submitted to the Council of Ministers the Distributed Renewable Energy Law prepared with the support of the European Bank for Reconstruction and Development (EBRD). The Ministry is also well aware of

the need to move ahead with large scale solar projects all over the country, based on Power Purchase Agreements to be signed with the private sector.

I am pleased to share the "2020 Solar PV Status Report for Lebanon," and I look forward to help realize the promising potential and bright future the solar PV market holds in Lebanon. We hope that 2020 will be remembered as a turning point in the energy transition of Lebanon when the country's deepest energy crisis was transformed into a successful opportunity promising a more sustainable future.

Dr. Walid Fayad
Minister of Energy and Water

ABSTRACT

This report is prepared annually by the Lebanese Center for Energy Conservation (LCEC) to report on the development of rooftop solar PV applications at the national level. The LCEC intends to develop the “Annual Solar PV Status Report for Lebanon” by establishing and producing annual market monitoring reports on the installed capacity & electricity produced from decentralized renewable energy across Lebanon.

The objective of the report is to present comprehensive data relevant to the implemented decentralized solar photovoltaic projects in Lebanon, mainly privately owned systems installed with the aim to increase the energy security and to reduce the environmental impact of fossil fuels.

The 2020 Solar Photovoltaic (PV) Status Report for Lebanon, developed and published in its sixth edition in 2022, highlights the status and the trends of the solar PV market by presenting and analyzing all its available data.

This report is based on data collected from local participating solar PV companies, with

installed & operational systems across different regions in Lebanon until the end of 2020. The reported data covers the systems installed in both public and private facilities, and includes the PV projects implemented under the NEEREA national financing mechanism. The analyzed data enables a clear understanding of the solar PV market growth in Lebanon over time through various indicators such as installed capacity, energy generation, number and types of projects, value of investments, monetary and environmental savings, financial incentives, and geographical distribution.

The Solar PV Status Report for Lebanon has become a yearly collaborative publication reporting on the market's growth for the previous year. This in turn enables decision-makers and stakeholders to align their efforts to continue supporting the market and sustaining its healthy growth.

EXECUTIVE SUMMARY

01 Lebanon's energy generation by EDL reached **12.50 TWh** in 2020¹.



02 In 2010, Lebanon's solar PV installed capacity equaled **330 kWp**.

The installed capacity increased by:

43% to equal **470 kWp** in 2011

68% to equal **790 kWp** in 2012

137% to equal **1.86 MWp** in 2013

140% to equal **4.76 MWp** in 2014

147% to equal **10.98 MWp** in 2015

118% to equal **23.98 MWp** in 2016

53% to equal **36.71 MWp** in 2017

50% to equal **54.92 MWp** in 2018

39% to equal **76.08 MWp** in 2019

18% to equal **89.84 MWp** in 2020

03 From 2010 until the end of 2020, the cumulative installed solar PV capacity grew by an average rate of **81%** per year.

04 The solar PV electricity generation in 2020 represented **1.03%** of the total annual electricity generation by EDL (compared to **0.73%** in 2019).

05 The total investment in the solar PV sector up till the end of 2020 reached **\$135.19 Million**.

06 The number of new solar PV projects per year increased from **25** in 2011 to **313** in 2020.

¹ Source: EDL

EXECUTIVE SUMMARY

- 07** The year-over-year growth rate for the solar PV capacity has decreased from **39%** in 2019 to **18%** in 2020. The number of new solar PV projects decreased from 360 in 2019 to 313 in 2020. Lebanon's growth rate of **18%** in 2020 is equal to the global growth rate of PV in residential and commercial applications for the same year².
- 08** The turnkey price for solar PV has been falling steadily year after year from **\$7,186** per kWp in 2011 to **\$807** in 2020. This constitutes a price drop of **89%** in a span of ten years.
- 09** The total cumulative investment in the solar PV sector increased from **\$2.29 Million** in 2010 to **\$135.19 Million** in 2020.
- 10** **44%** of the installed solar PV capacity to date is funded by NEEREA financing mechanism for a total investment of **\$63.48 Million** whereas the remaining **56%** of installed capacity was funded by non-NEEREA investments totaling **\$71.71 Million**.
- 11** Investments coming through NEEREA totaled **\$0.14 Million** in 2020 whereas non-NEEREA investments reached **\$10.97 Million** with a total investment of **\$11.11 Million**.

² Source: IEA, Renewables 2020.



EXECUTIVE SUMMARY

12 The Top 4 sectors leading the solar PV Market in Lebanon are:

The Industrial sector with **28.43 MWp** at **32%** (compared to **24.35 MWp** in 2019)

The Commercial sector with **16.63 MWp** at **19%** (compared to **15.71 MWp** in 2019)

The Agricultural sector with **15.57 MWp** at **17%** (compared to **10.33 MWp** in 2019)

The Residential sector with **10.81 MWp** at **12%** (compared to **9.26 MWp** in 2019)

13 The Top 3 Governorates leading the solar PV Market in Lebanon are Mount Lebanon with **29.97 MWp** at **33%**, Beqaa with **23.84 MWp** at **27%**, and Baalbek-Hermel with **10.4 MWp** at **12%**.

14 The estimated monetary savings from all solar PV projects in Lebanon grew from L.L. 300 Million per year in 2010 to **L.L. 59.86 Billion** in 2020. The cumulative savings by the end of 2020 amount to around **L.L. 160 Billion**. These are the savings achieved by the owners/operators of solar PV systems in Lebanon by deferring a portion of their electricity consumption from the grid and diesel generators to solar PV generation.

Note that the value of the Lebanese Pound (L.L.) remained relatively stable between 2010 and 2019 at around L.L. **1,500/USD** and started deteriorating afterwards.

15 The estimated emissions savings from all solar PV projects in Lebanon grew from **377 tCO₂e** per year in 2010 to **20,458 tCO₂e** per year in 2019, and then decreased to **15,866 tCO₂e** in 2020. The cumulative savings by the end of 2020 amount to **316,787 tCO₂e**.

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TABLE OF ACRONYMS

BDL	Banque du Liban
EDL	Électricité du Liban
kW	Kilo-watt
kWh	Kilo-watt-hour
kWp	Kilo-watt-peak
LCEC	Lebanese Center for Energy Conservation
LAF	Lebanese Armed Forces
MoE	Ministry of Environment
MoEW	Ministry of Energy and Water
MW	Mega-watt
MWh	Mega-watt-hour
MWp	Mega-watt-peak
NEEREA	National Energy Efficiency and Renewable Energy Action
PV	Photovoltaic
TWh	Terra-watt-hour
UNDP-DREG PROJECT	United Nations Development Program-Decentralized Renewable Energy Generation Project

TABLE OF TERMS

Decentralised Energy

Decentralised energy is produced close to where it will be used rather than being generated in a large plant and transmitted through the national electrical grid.

Generation Capacity

Generation capacity is the maximum electric output an electricity generator can produce under specific conditions.

Electricity Generation

Electricity generation is the amount of electricity a generator produces over a specific period.

PV projects for Power Generation

Category of solar PV projects serving the purpose of generating and consuming (or storing) electrical power, in order to reduce the consumption from the national grid and/or diesel generators.

PV projects for Solar Pumping

Category of solar PV projects serving the purpose of generating (or storing) electrical power in order to operate DC or AC pumps used for water pumping.

On-grid /Grid-tied /Online

PV systems operating with the national grid only.

On-grid with storage

PV systems operating with the national grid only, and having a storage component (batteries) for backup.

TABLE OF TERMS

**Hybrid/ Multisource
(EDL/EDZ+DGs) with storage**

PV systems operating with the national grid and with diesel generator(s), and having a storage component for backup.

**Hybrid/ Multisource
(EDL/EDZ+DGs) without storage**

PV systems operating with the national grid and with diesel generator(s), without having a storage component for backup.

**Off-grid/ Stand-alone
/Autonomous with storage**

PV systems not connected to the national grid, feeding the local loads and charging the batteries thereby ensuring a fully autonomous operation.

**Off-grid /Stand-alone
/Autonomous without storage**

PV systems not connected to the national grid, feeding the local loads only thereby ensuring a fully autonomous operation.

**Off-grid with generator
backup with storage**

PV systems not connected to the national grid but operating with backup diesel generator(s), feeding the local loads and the batteries, but relying also on backup generator(s) for the same purposes when needed.

**Off-grid with generator
backup without storage**

PV systems not connected to the national grid but operating with backup diesel generator(s), feeding the local loads only, but relying also on backup generator(s) for the same purpose when needed.

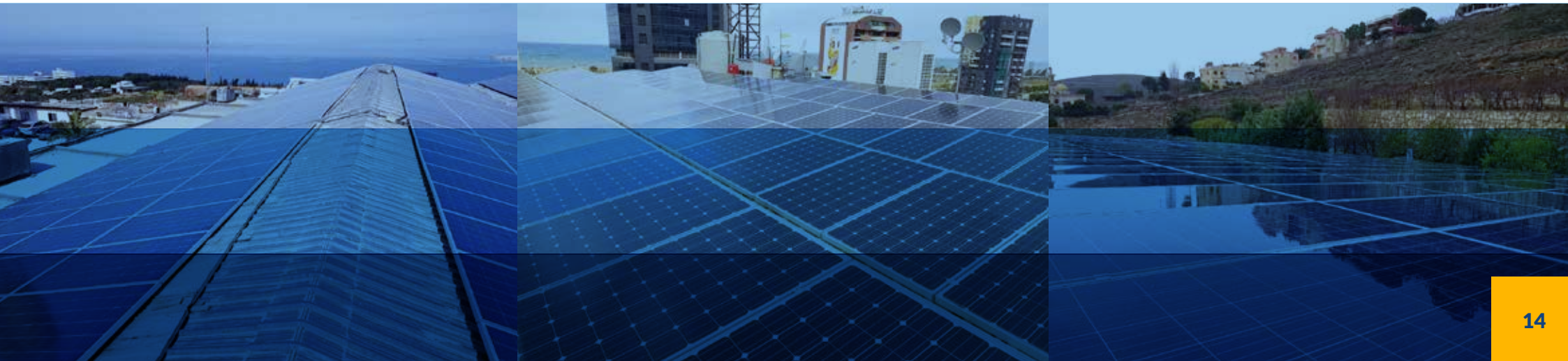
2020 HIGHLIGHTS

13.76 MWp of solar PV capacity were installed in 2020, compared to **21.16 MWp** in 2019. This would bring the total installed capacity to **89.84 MWp** and help achieve around **90%** of Lebanon's national target of reaching 100 MWp decentralized solar PV by 2020, as per the National Renewable Energy Action Plan (NREAP 2016-2020).

The decentralized solar PV electricity generation has increased from accounting for **0.73%** of the total annual electricity generation by EDL in 2019 to **1.03%**

in 2020, equivalent to **129.02 GWh** production in 2020. With Lebanon's decentralized solar PV generation target set at **160 GWh** per year by 2020 as per NREAP, the market succeeded in achieving around **80%** of this target.

Compared to 2019, the agricultural and residential sector witnessed respectively **138%** and **93%** growth in installed capacities of PV systems, where the reduction of subsidies has enabled a faster adoption of better sustainable and economic solutions.



2020 HIGHLIGHTS

Similar to 2019, the industrial sector achieved the highest solar PV capacity addition totaling **4.08 MWp** during 2020 and a cumulative installed capacity of **28.43 MWp**. This is partially due to the increase in the cost of fossil fuel in Lebanon witnessed in 2020, which created an incentive for industrialists to reduce their diesel consumption by investing in on-grid solar PV systems. The savings achieved by offsetting diesel with PV is creating net positive cashflows all year round, and resulting in payback periods of six years or less. The higher the cost of fossil fuel, the greater the savings.

The average turnkey price for solar PV continued its decline from **\$937 per kWp** in 2019 to **\$807** in 2020, a drop of **13.8%**. The major contributor to this decrease remains the fall in the cost of equipment. Moreover, local competition during 2020 due to the economic situation significantly increased thanks to the launch of numerous tenders by various national and international stakeholders, which also helped reduce prices. To better grasp the positive impact these price reductions have had on the market, a **\$100,000** investment in 2011 would have financed a **14 kWp** system whereas it financed a **124 kWp** system in 2020 .



2020 HIGHLIGHTS

In 2020, the total cumulative investment in the solar PV sector grew by **9%** from the previous year; totaling over **\$135.19 Million**. Accordingly, 2020 has witnessed additional **\$11.11 Million** in new PV investments.

7 Lebanese solar PV companies were working in the sector up until 2008. This number started growing steadily from 14 companies in 2010 to **66** companies by the end of 2018, but since 2019, the number started decreasing to reach 50 companies by 2020³.

At least **499** jobs were active in the PV sector at the end of 2020 in comparison to **653** active jobs at the end of 2019, witnessing a **23%** decrease, due to the economic crisis.

³ There may be other active companies in the market that may have been unreachable or may have chosen not to reply to the LCEC's survey. Companies interested in contributing to this report can contact the LCEC at pvstatusreport@lcec.org.lb



1.

LEBANON ELECTRICITY BACKGROUND INFORMATION

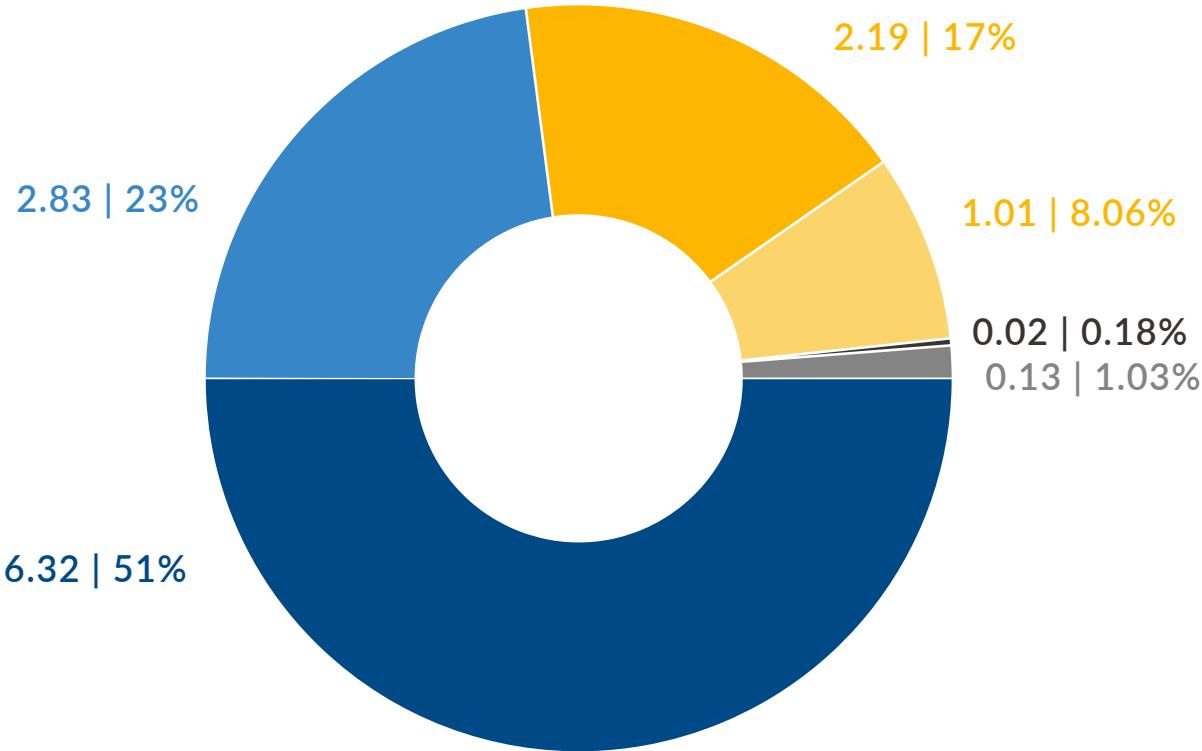


LEBANON'S 2020 ELECTRICITY GENERATION (TWh)

EDL's share of total electricity generation equaled 12.50 TWh while the solar PV share equaled 0.13 TWh or 1.03% of total electricity generation (up from 0.73% in 2019).

With solar PV added to Hydro and Biogas, the share of renewables of the total annual electricity generation in 2020 reached 9.27%.

- Hydro
- Barges
- Solar PV
- Thermal (Steam)
- Thermal (CCGT & OCGT)
- Landfill Biogas



2.

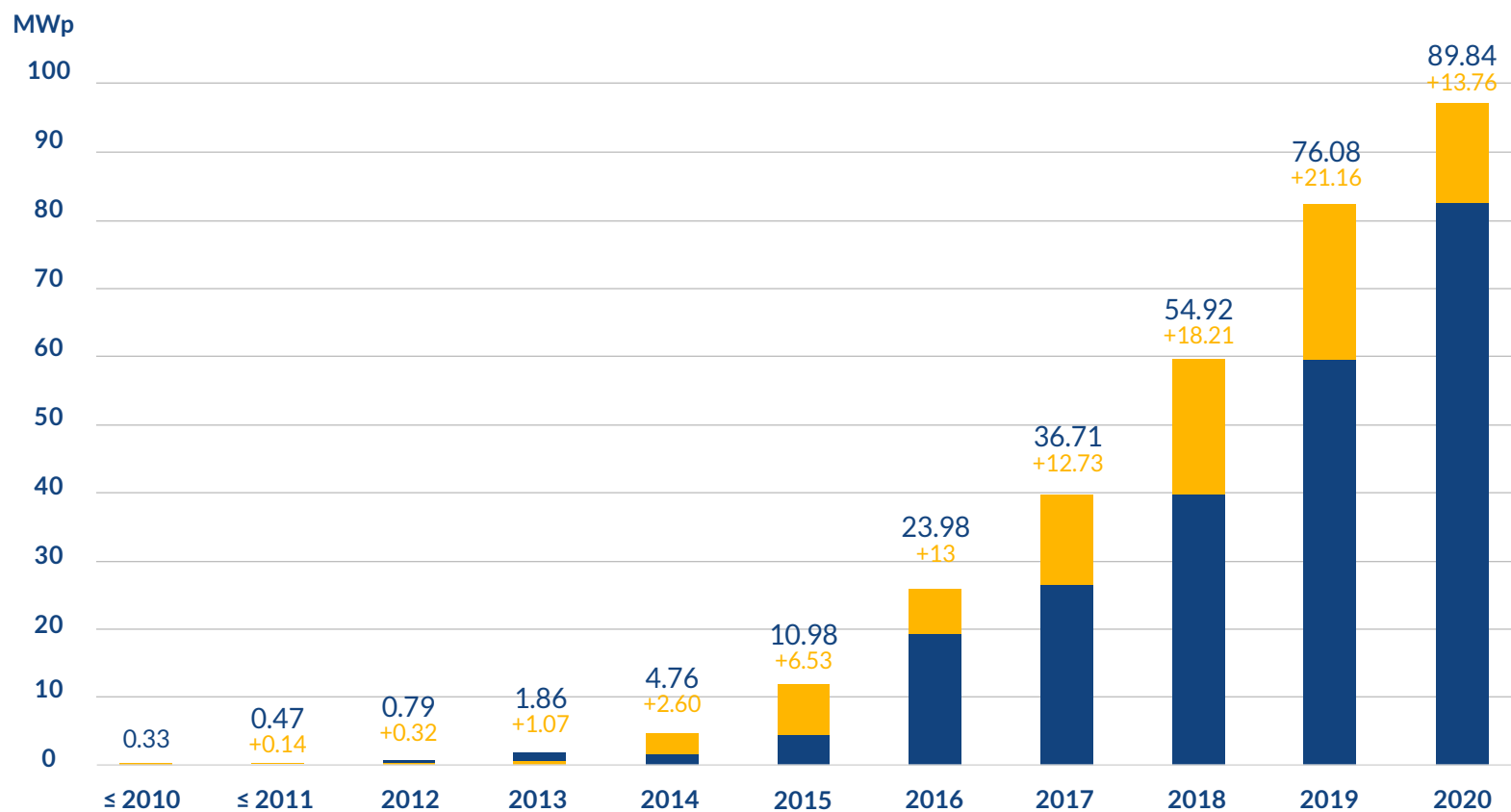
SOLAR PV ELECTRICITY IN LEBANON



SOLAR PV CAPACITY AND ANNUAL ADDITIONS

Installed capacity of solar PV increased from 0.33 MWp in 2010 to 89.84 MWp in 2020, which constitutes around 90% of the NREAP target for decentralized solar PV installations by 2020.

- Annual Additions
- Capacity



SOLAR PV CAPACITY AND ANNUAL ADDITIONS

Around 13.76 MWp of solar PV installed capacity was added in 2020 to reach a total of 89.84 MWp.

This figure includes all public projects implemented by MEW:

- Casino du Liban – Jounieh (316 kWp)
- The Beirut River Solar Snake Project (1.08 MWp)
- The Zahrani Oil Installations Project (1.09 MWp)
- The Ministry of Energy and Water (135.30 kWp)
- Directorate of Engineering and Planning - Lebanese Armed Forces (155.70 kWp)
- El Helou Barrack (32.30 kWp)
- Lebanese Army Health Dispensary of Qobbeh (54.40 kWp)
- Lebanese Army Health Dispensary of Ablah (54.40 kWp)

In addition, two projects were implemented through the Council for Development and Reconstruction (CDR):

- 11 Solar Water Pumping Sites in the Baalbek Union of Municipalities- Total of 1.4 MWp
- Solar Street Lighting in 3 Unions of Municipalities in the Beqaa – 800 PV Street lighting poles

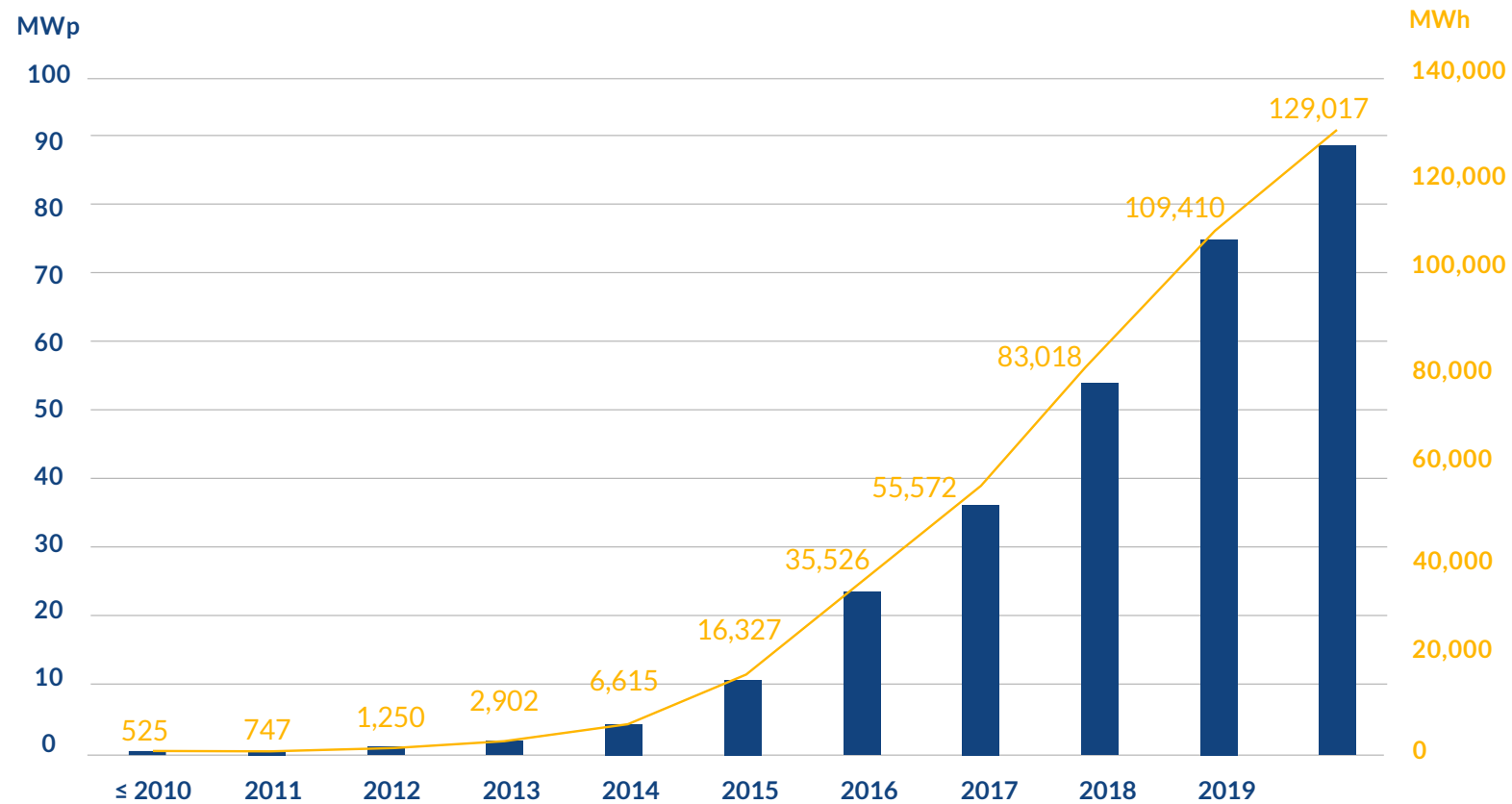


These are added to small scale projects and around 2 MWp of PV street lighting implemented in several municipalities, as well as 1.136 MWp installed in 122 schools under the Japanese Grant by the Ministry of Education and Higher Education, among others.

SOLAR PV CAPACITY AND GENERATION

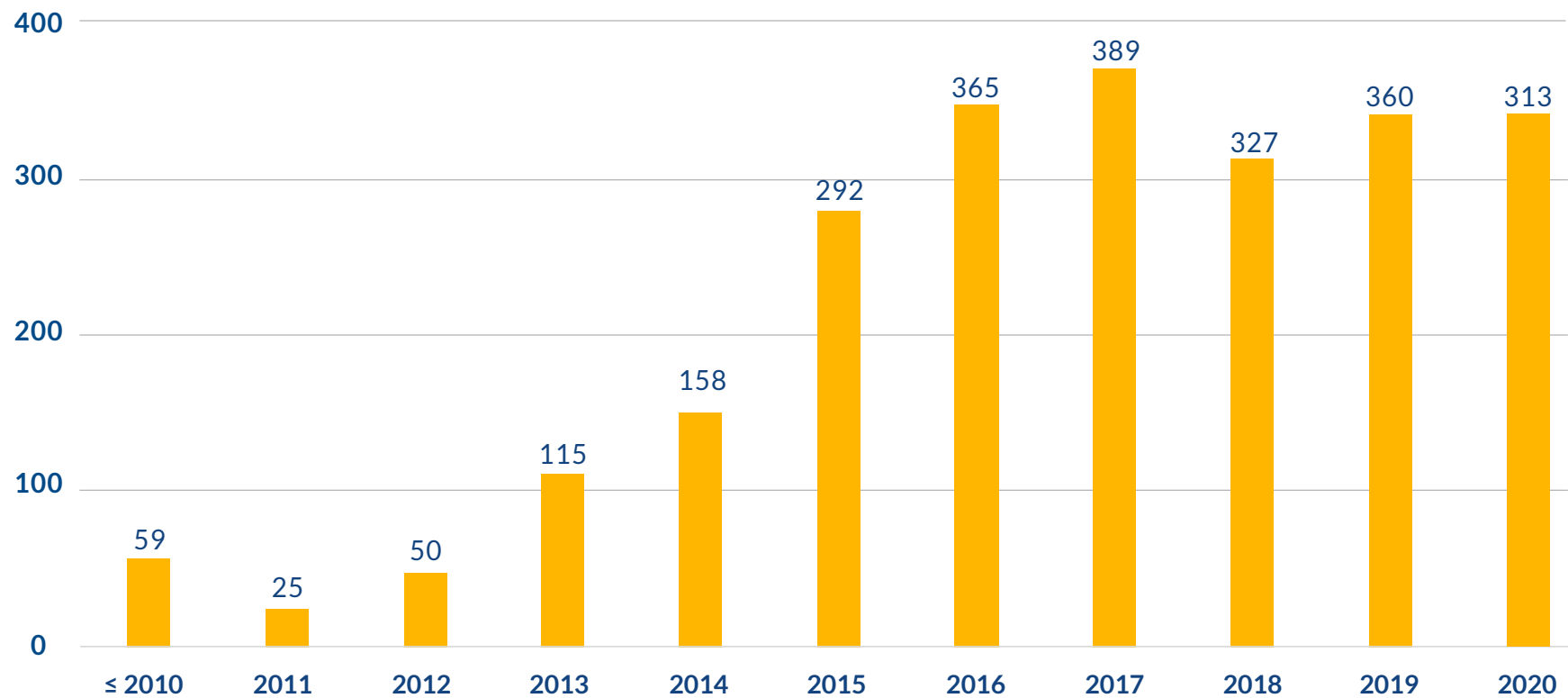
Solar PV electricity generation increased from 109,410 MWh in 2019 to 129,017 MWh in 2020 which constitutes 1.11% of the total annual electricity generation by EDL.

■ Generation
■ Capacity



SOLAR PV ANNUAL NEW PROJECTS COUNT

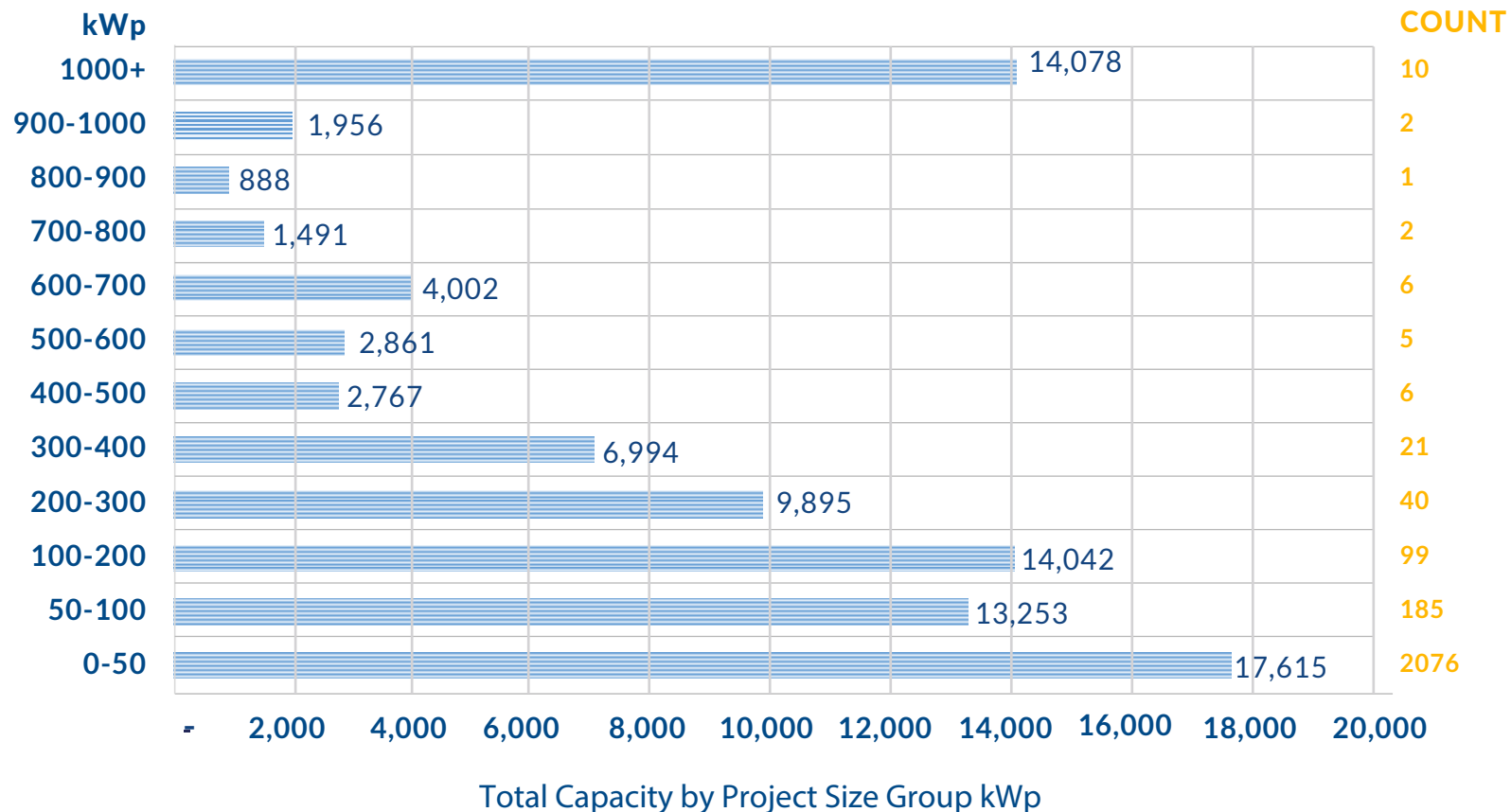
The number of new solar PV projects decreased from 360 in 2019 to 313 in 2020.



SOLAR PV CAPACITY AND COUNT BY PROJECT SIZE GROUP

The total number of solar PV projects reached 2,453 by the end of 2020.

Small-sized projects, under 50 kWp, dominate the market in terms of capacity (19%) and count (84%) with a total of 17.61 MWp of installed capacity.

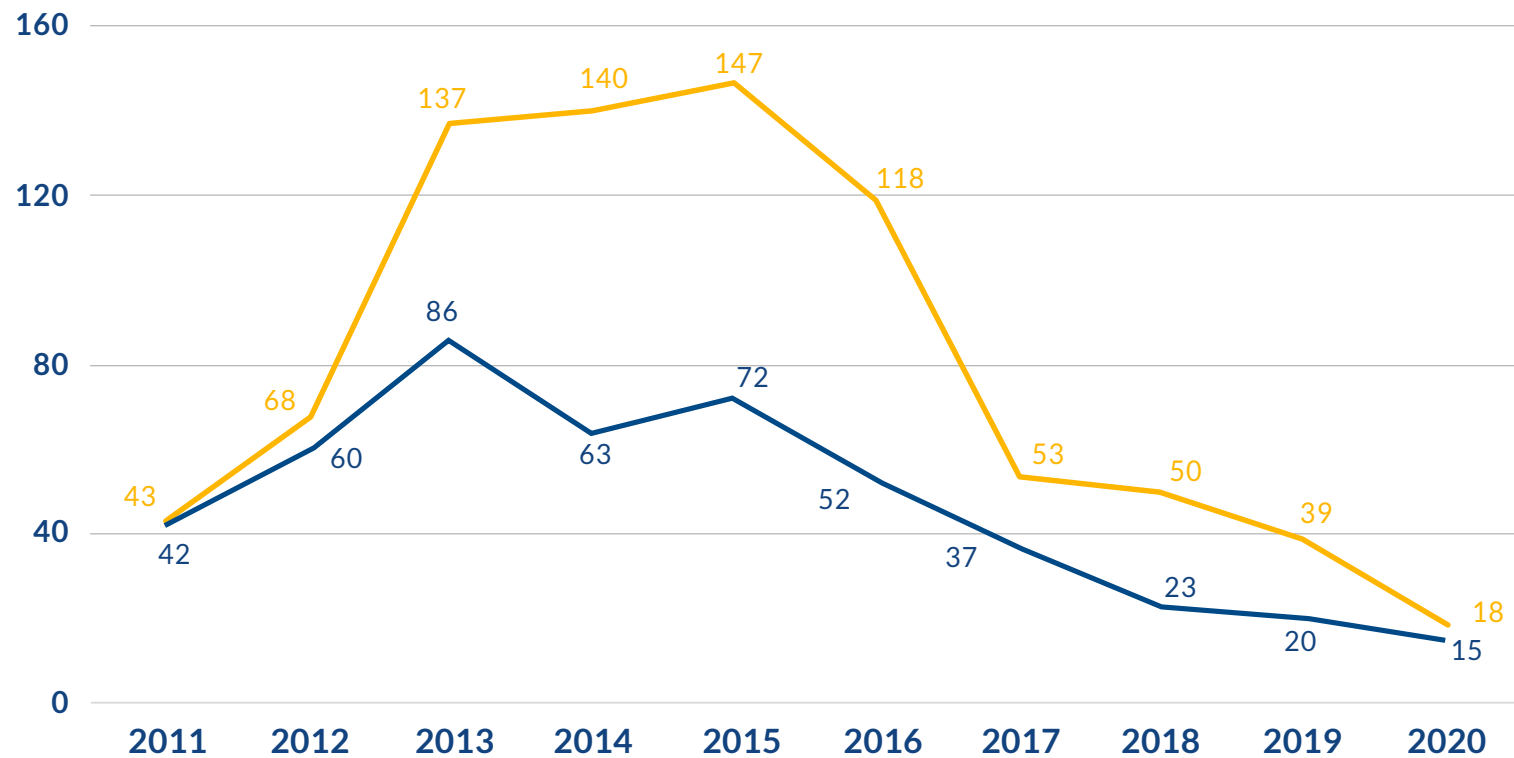


SOLAR PV CAPACITY AND NUMBER OF PROJECTS YEAR-ON-YEAR GROWTH RATE (%)

The solar PV capacity growth rate fell from 39% in 2019 to 18% in 2020.

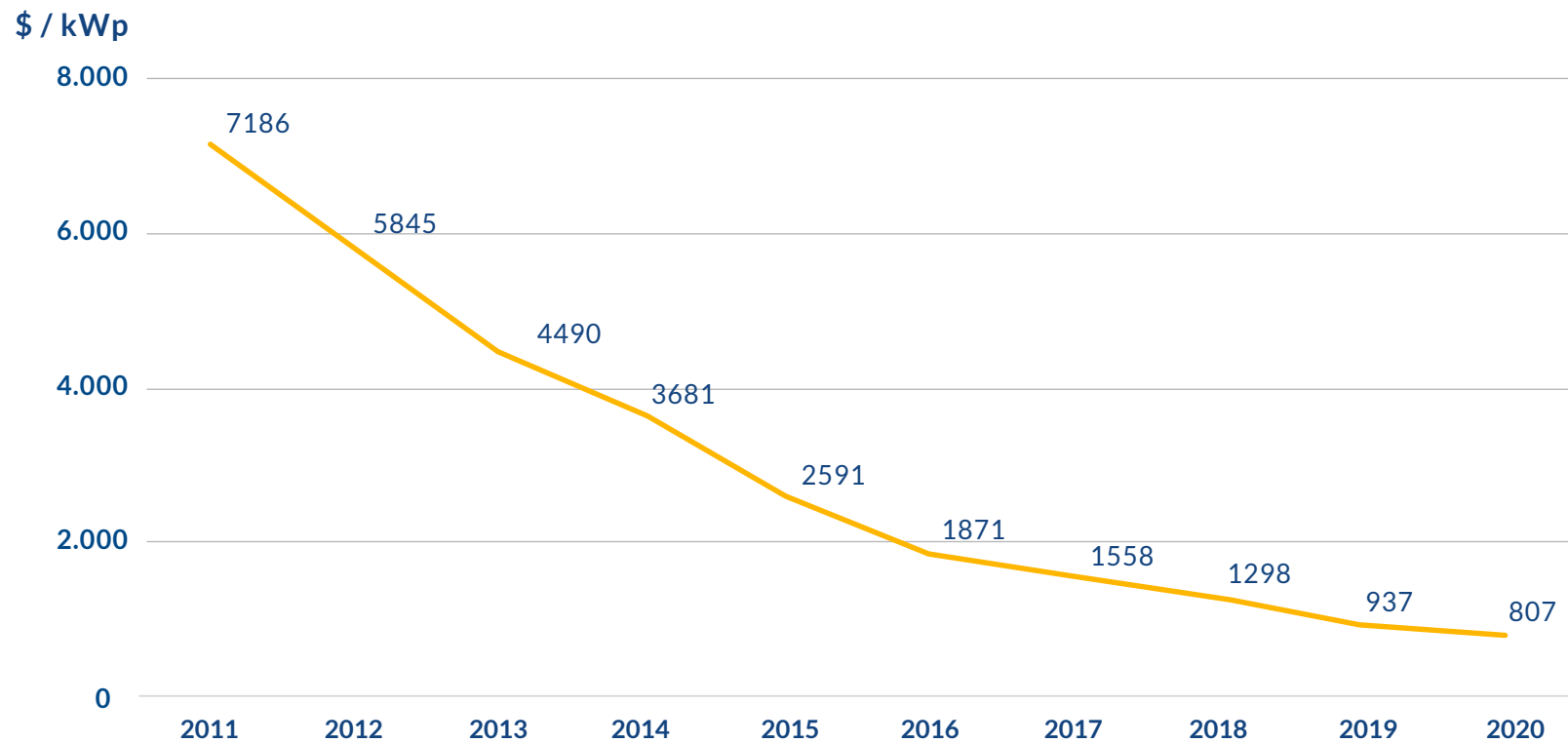
The year-on-year growth rate for the number of new solar PV projects also fell from 20% in 2019 to 15% in 2020.

— Capacity growth rate
— Number of projects growth rate



YEARLY AVERAGE SOLAR PV TURNKEY PRICE (\$/kWp)

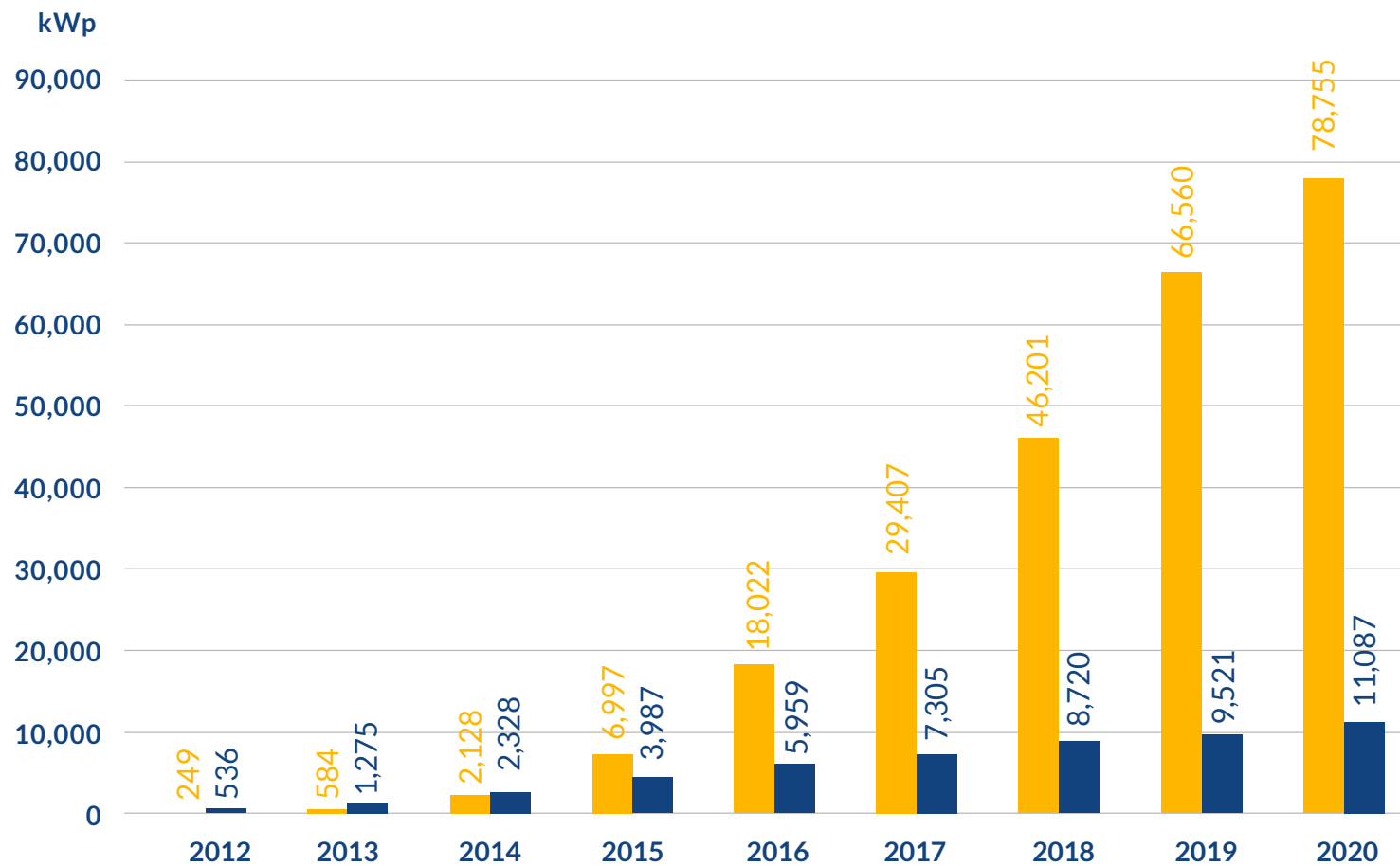
The turnkey price of solar PV systems continued its steady decrease from \$7,186 per kWp in 2011 to \$807 in 2020. This constitutes a remarkable price drop of 89% in a span of ten years.



PV INSTALLED CAPACITY WITH AND WITHOUT STORAGE (kWp)

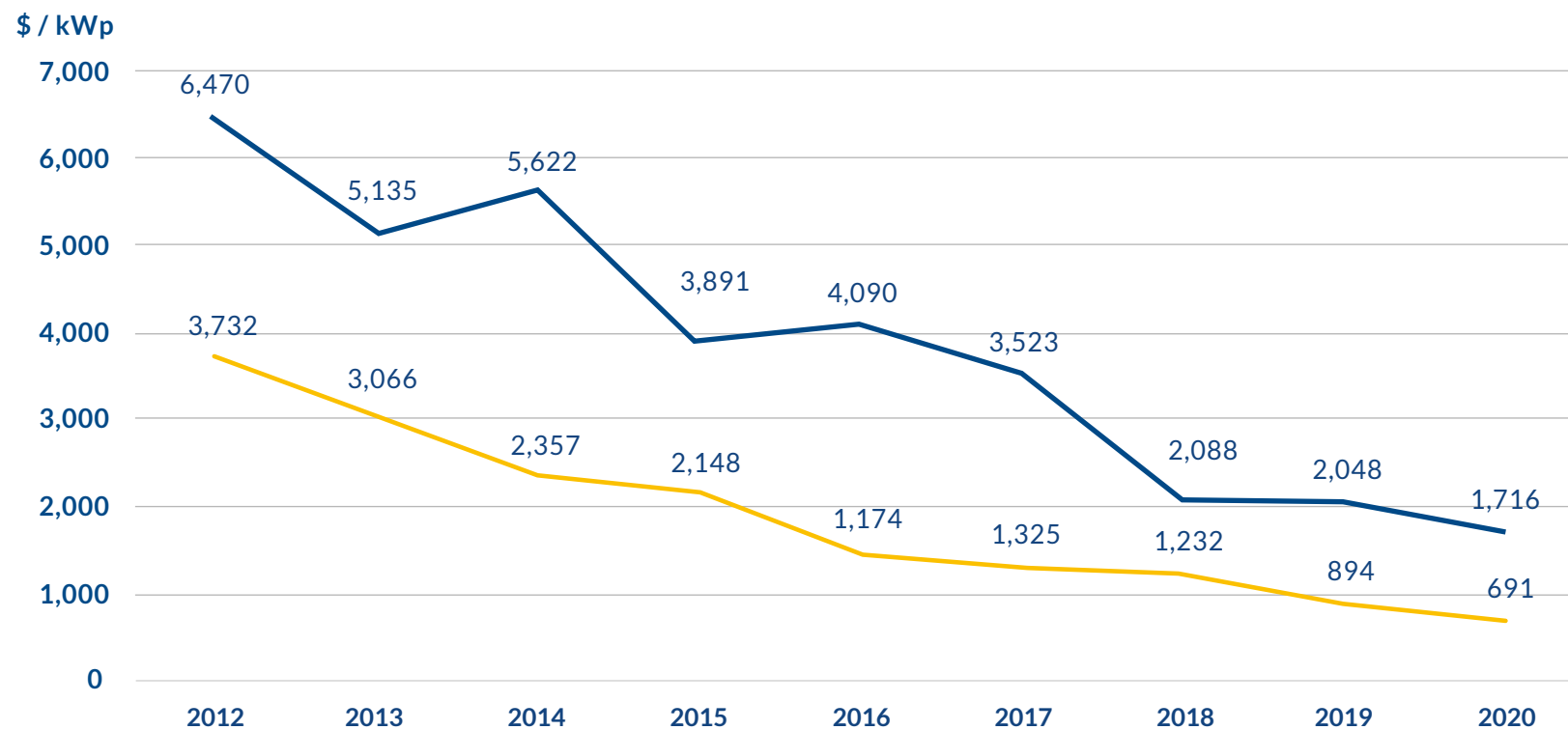
The share of Solar PV systems with battery storage is around 12% of the total installed capacity by end of 2020.

- PV systems without storage
- PV systems with storage



PV UNIT PRICE WITH AND WITHOUT STORAGE (\$/kWp)

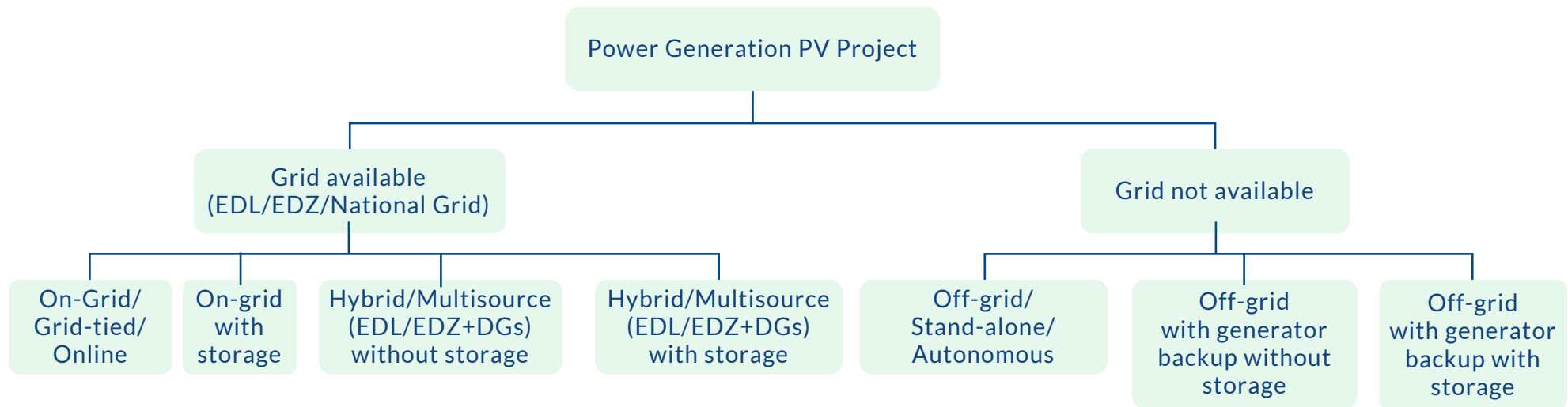
The difference between the cost of PV systems with storage and the cost of PV systems without storage reached around 1000 \$/kWp in 2020.



TYPES OF PV SYSTEMS USED FOR POWER GENERATION

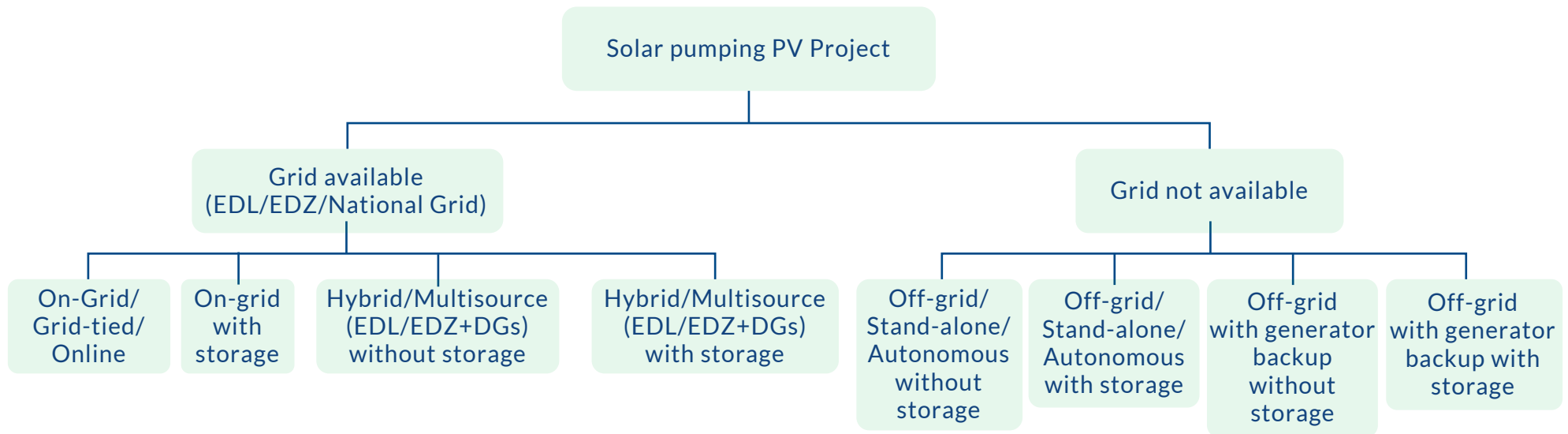
The “Off-Grid /Stand-alone /Autonomous type includes by default a storage component, necessary for the power generation purpose.

For simplicity purposes, the following graphs might include shorter terms representing the same types of systems. For example, “On-Grid” instead of “On-Grid /Grid-Tied /Online”. The complete definitions can be found on pages 11, 12, and 13.



TYPES OF PV SYSTEMS USED FOR SOLAR PUMPING

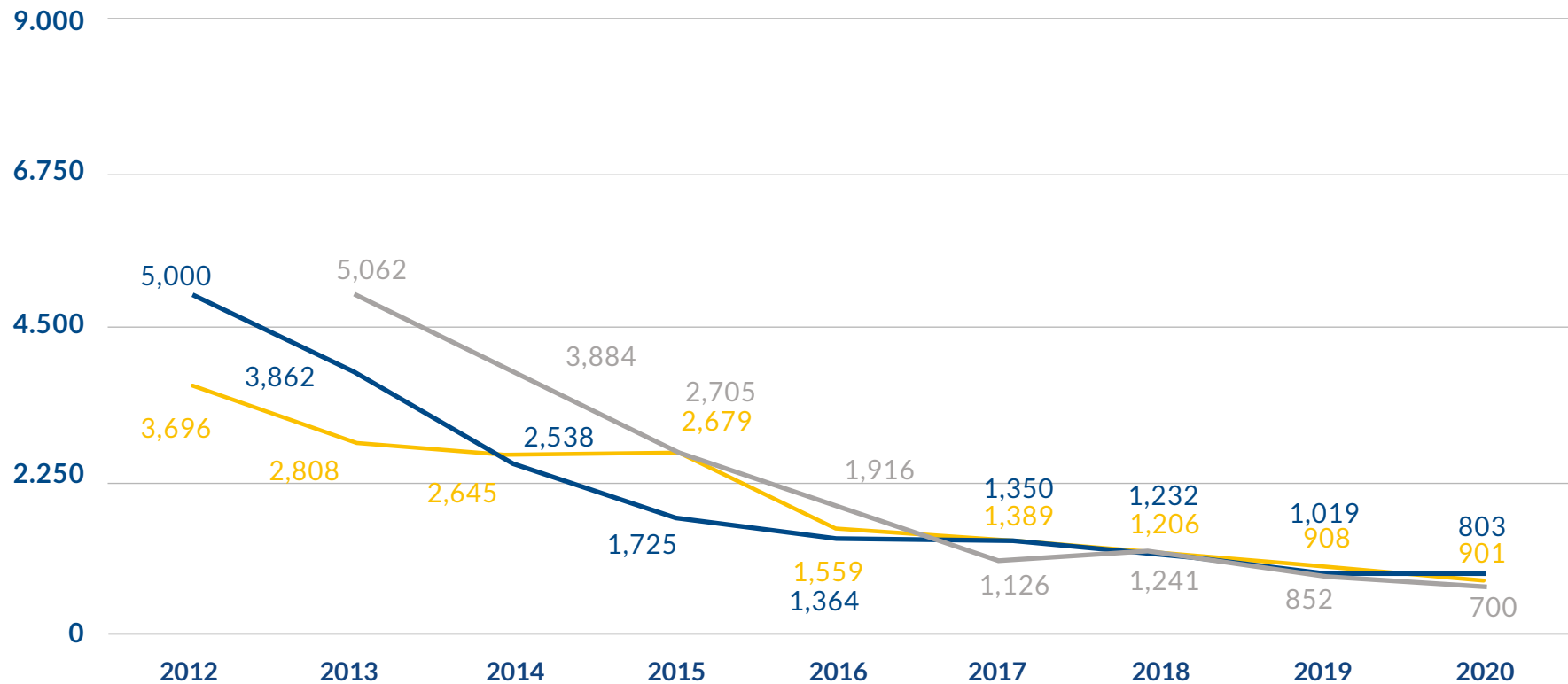
For simplicity purposes, the following graphs might include shorter terms representing the same types of systems. For example, “Hybrid /Multisource with storage” instead of “Hybrid /Multisource (EDL/EDZ+DGs) with storage”. The complete definitions can be found on pages 11, 12, and 13.



POWER GENERATION PV SYSTEMS WITHOUT STORAGE: YEARLY AVERAGE PRICE (\$/kWp)

The average turnkey price of PV systems without storage used for power generation, decreased between 75% and 85% between 2012 and 2020.

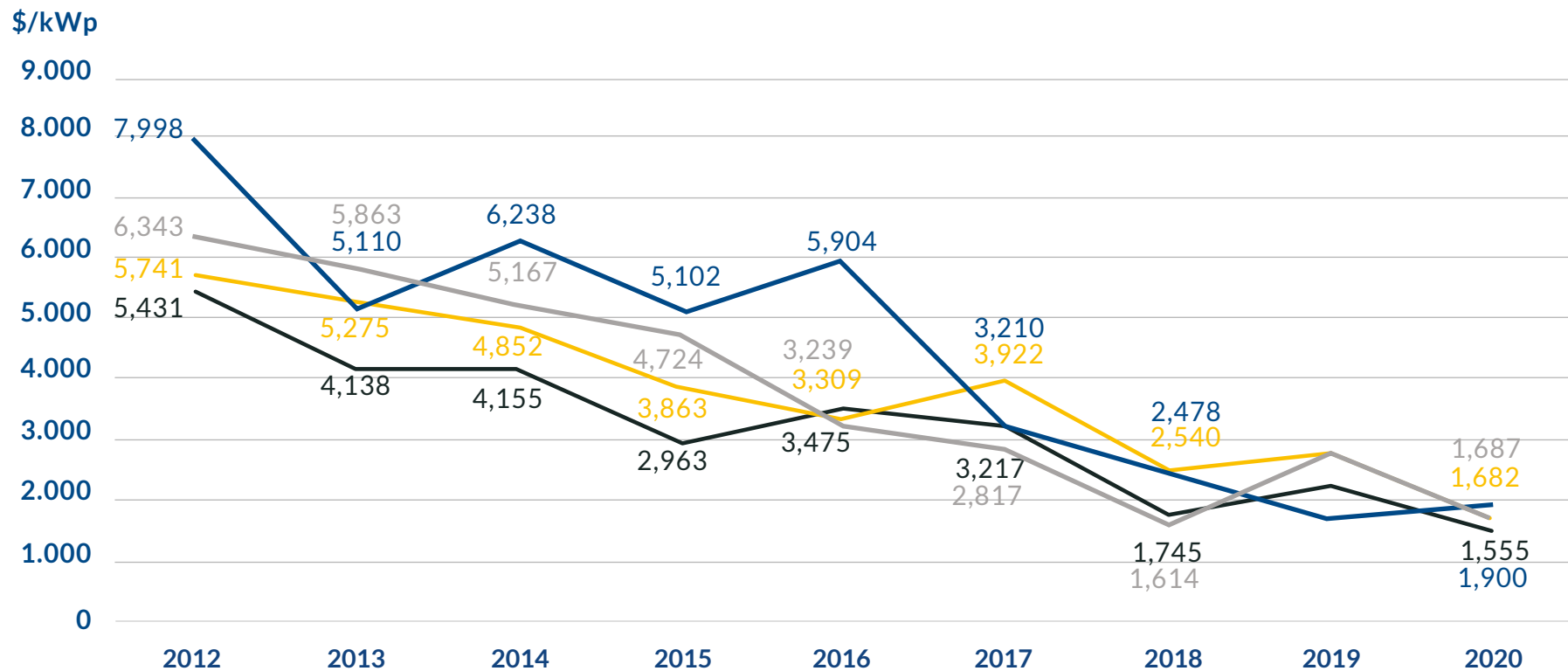
- Hybrid/Multisource (EDL/EDZ+DGs) without storage
- Off-grid with generator backup without storage
- On-Grid/Grid-tied/Online



POWER GENERATION PV SYSTEMS WITH STORAGE: YEARLY AVERAGE PRICE (\$/kWp)

The average turnkey price of PV systems with storage used for power generation, decreased between 70% and 80% between 2012 and 2020, the fluctuation in yearly prices per kWp is due to the different sizes of battery banks in kWh.

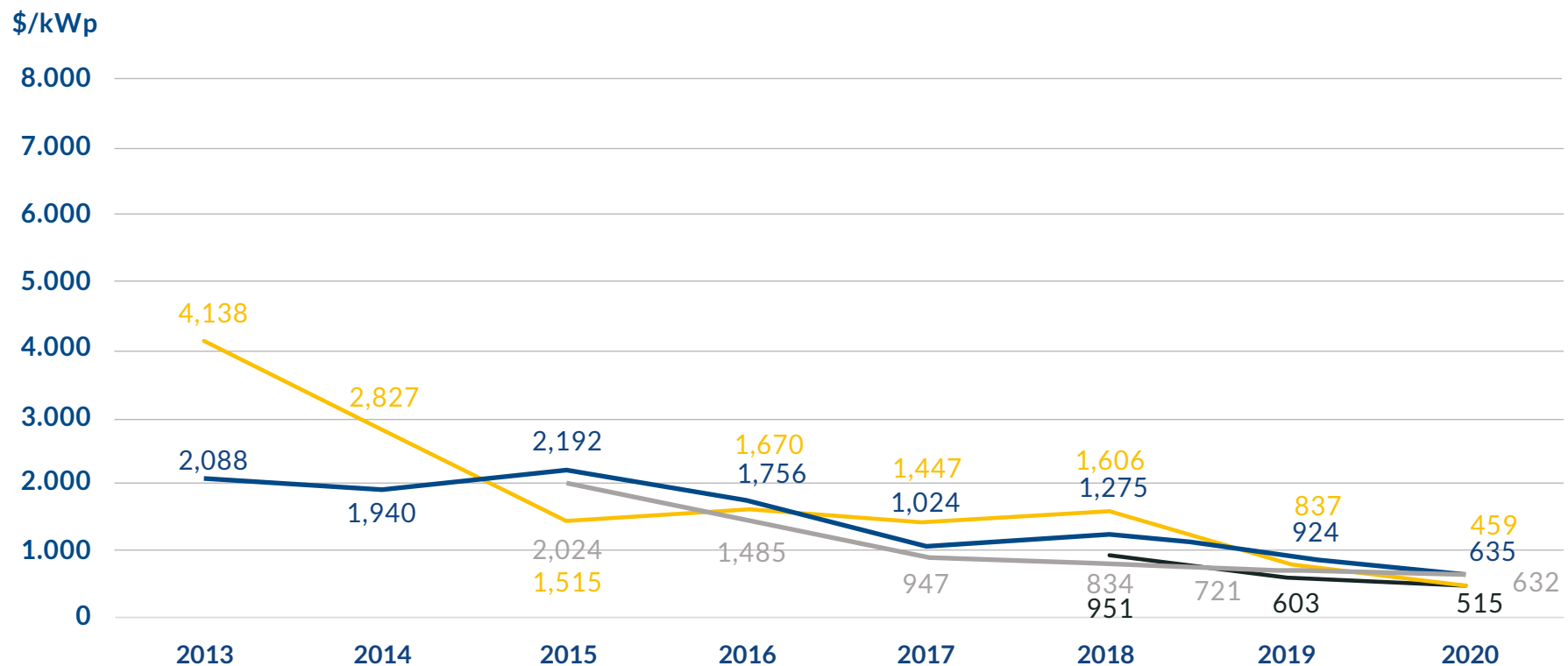
- On-Grid/Grid-tied/Online
- Off-grid/Stand-alone/Autonomous without storage
- Off-grid with generator backup without storage
- Hybrid/Multisource (EDL/EDZ+DGs) without storage



SOLAR PUMPING PV SYSTEMS WITHOUT STORAGE: YEARLY AVERAGE PRICE (\$/kWp)

The average turnkey price of PV systems without storage used for solar pumping, decreased between 70% and 90% between 2012 and 2020. The number of applications in the first few years is relatively low, which explains the big differences in prices, whereas in 2020 the margin was significantly narrowed.

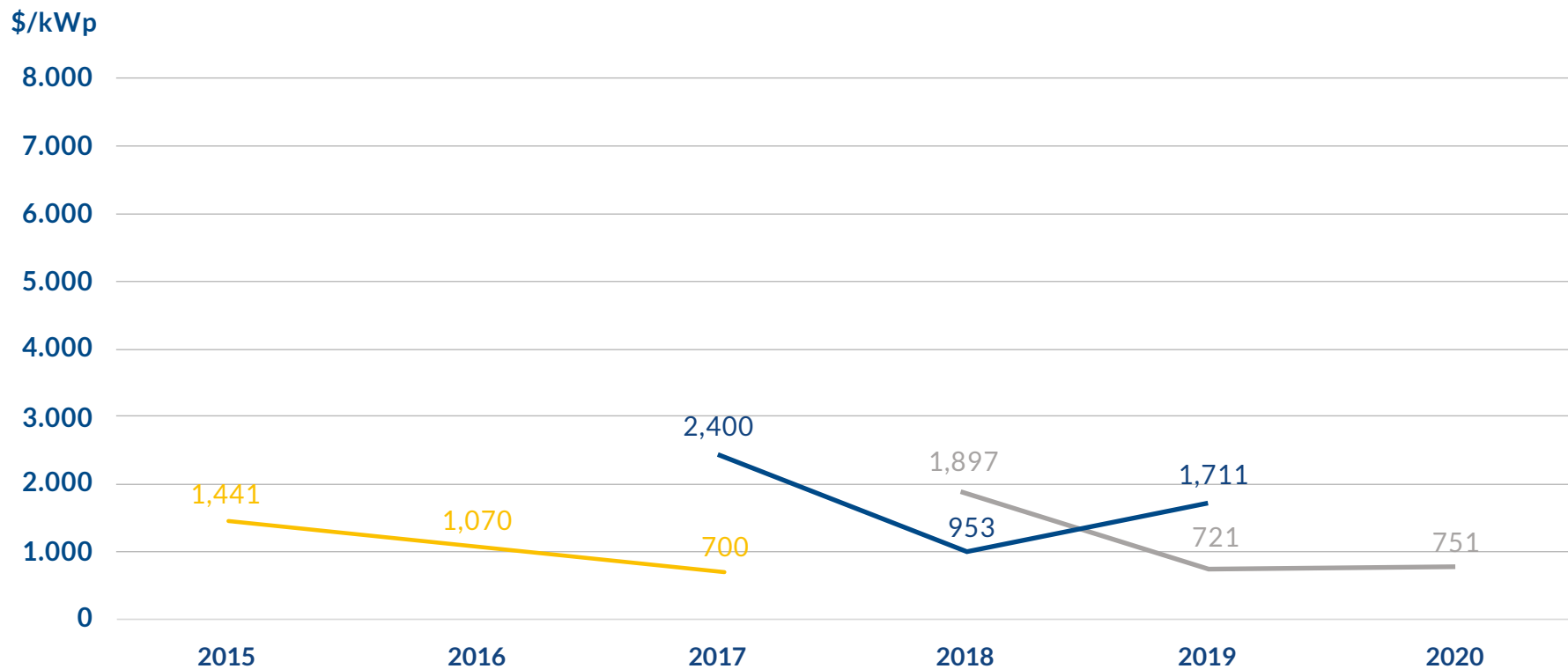
- On-Grid/Grid-tied/Online
- Off-grid/Stand-alone/Autonomous without storage
- Off-grid with generator backup without storage
- Hybrid/Multisource (EDL/EDZ+DGs) without storage



SOLAR PUMPING PV SYSTEMS WITH STORAGE: YEARLY AVERAGE PRICE (\$/kWp)

Solar pumping systems with storage are considered rare applications, and the storage component makes the costs per kWp as fluctuating as in power generation applications; depends on the battery banks capacities.

- Hybrid/Multisource (EDL/EDZ+DGs) + storage
- Off-grid/Stand-alone/Autonomous + storage
- On-Grid with storage

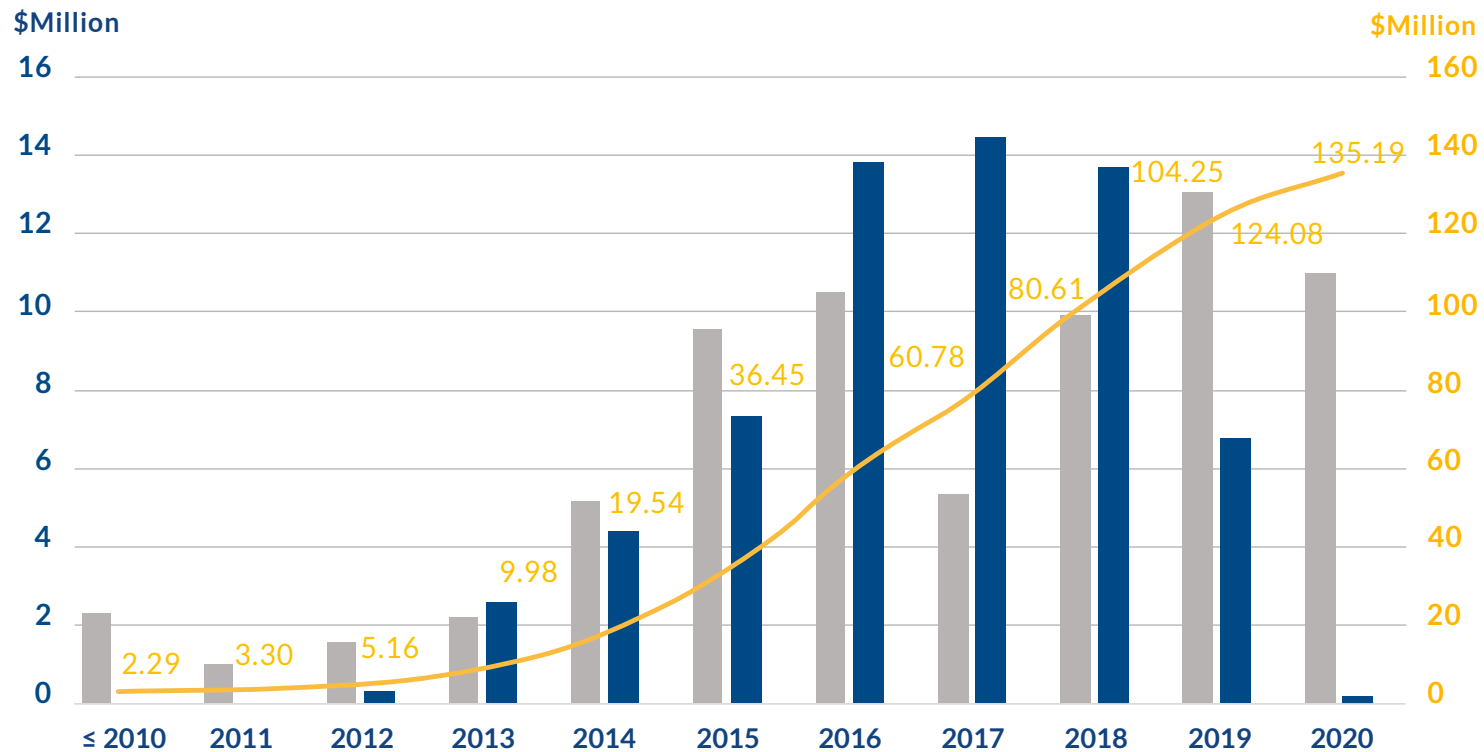


SOLAR PV INVESTMENTS (\$MILLION)

Due to the economic crisis, NEEREA financed projects in 2020 dropped by around 98% compared to 2019. In 2019, 65% of the investments were for non-NEEREA projects, whereas in 2020, around 1% only of the investments had access to the national subsidy program.

The absence of NEEREA had a negative impact on additional investments, thus additional installed capacities. On the other hand, due to increased public awareness around the importance of PV solutions as a reliable source of power amid the intermittency and insecurity of national electricity and fuel supply, investments in solar PV have been sustained.

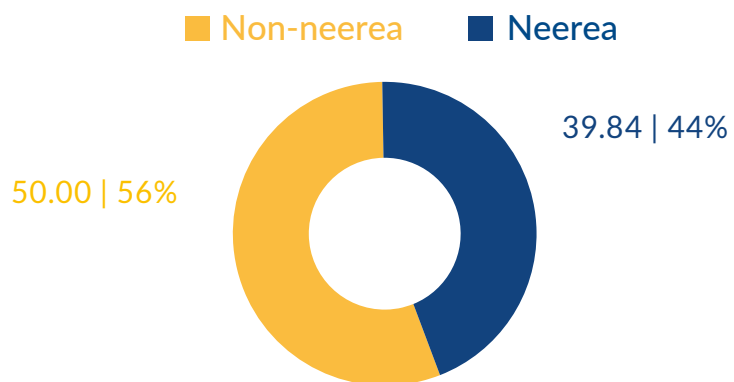
- Non-neerea
- Neerea
- Total investment (\$ million)



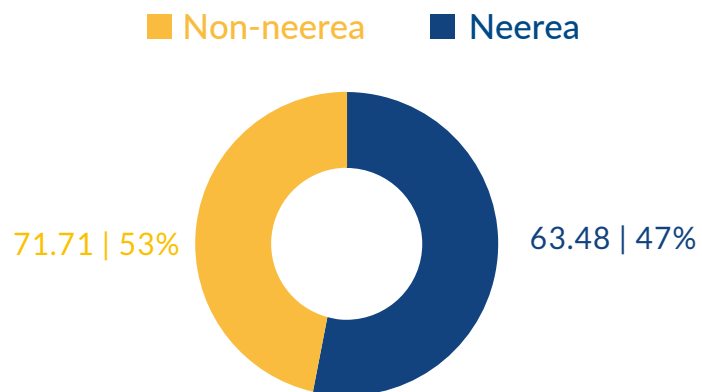
SOLAR PV INVESTMENTS

Throughout the last 10 years, 44% of the cumulative installed PV capacity is funded by NEEREA for a total investment of \$63.48 Million whereas 56% of the cumulative installed capacity was funded by non-NEEREA investments totaling \$71.71 Million.

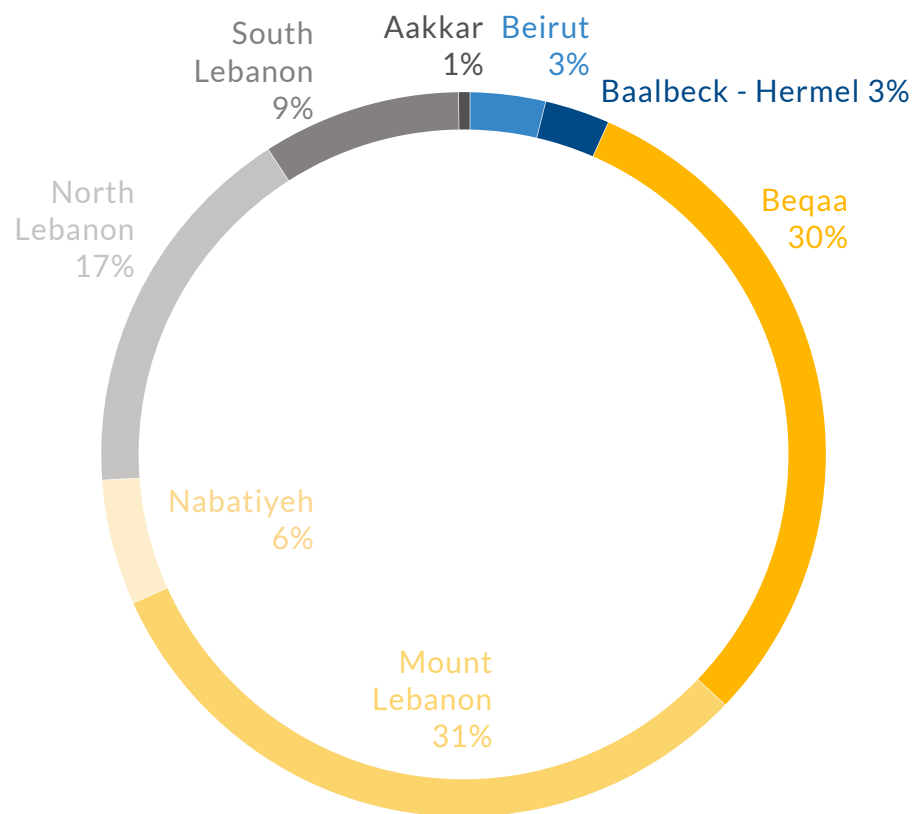
Capacity Share per Source of Funding (MWp | %)



Funding Share per Source of Funding (\$Million | %)



By end of 2020, Mount Lebanon and Beqaa governorates dominated the share of number of granted NEEREA loans for PV systems, totaling more than 60% of the total number of granted loans.

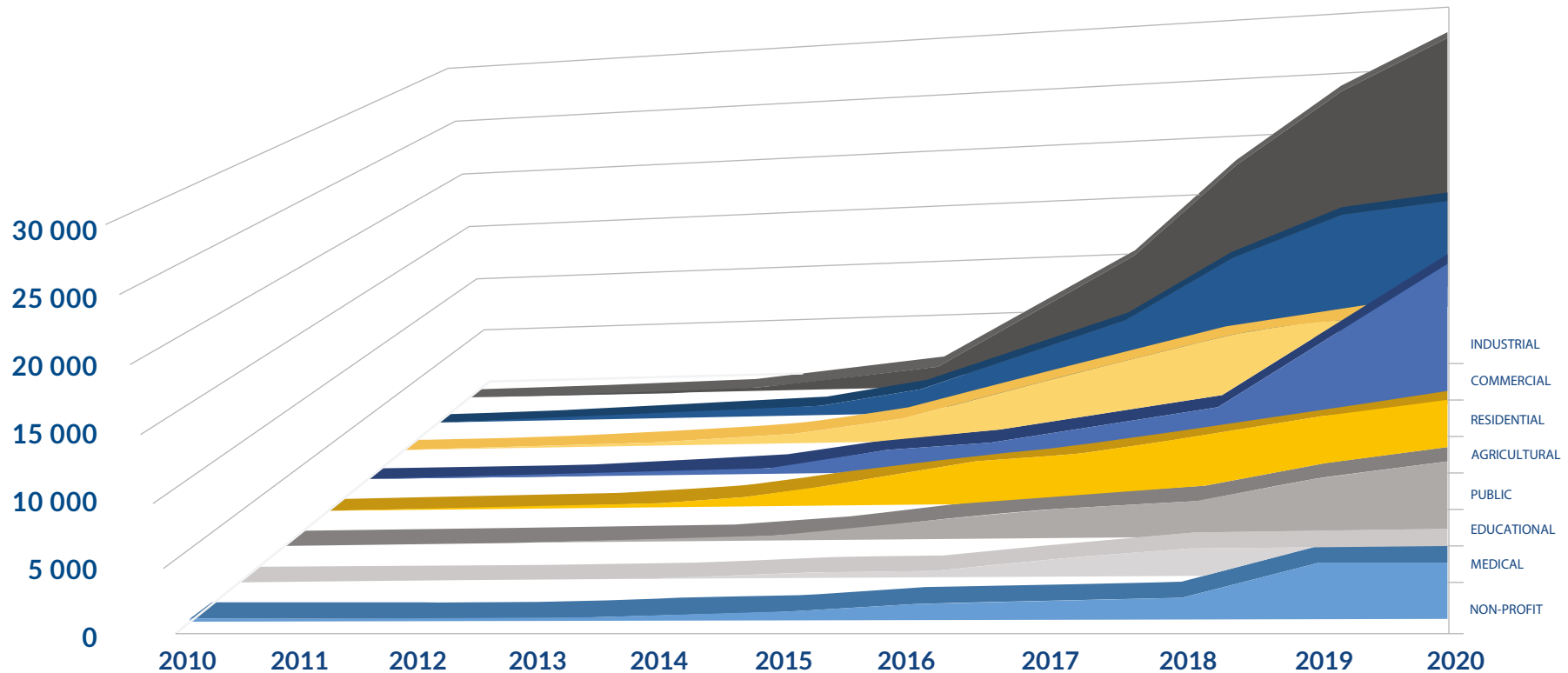




CUMULATIVE INSTALLED CAPACITY BY SECTOR (kWp)

During 2020, the agricultural and residential sectors recorded a growth of 138% and 93% respectively compared to the year before in terms of installed capacity. The economic downfall which resulted in an electric power crisis drove the market towards finding sustainable solutions for these essential sectors.

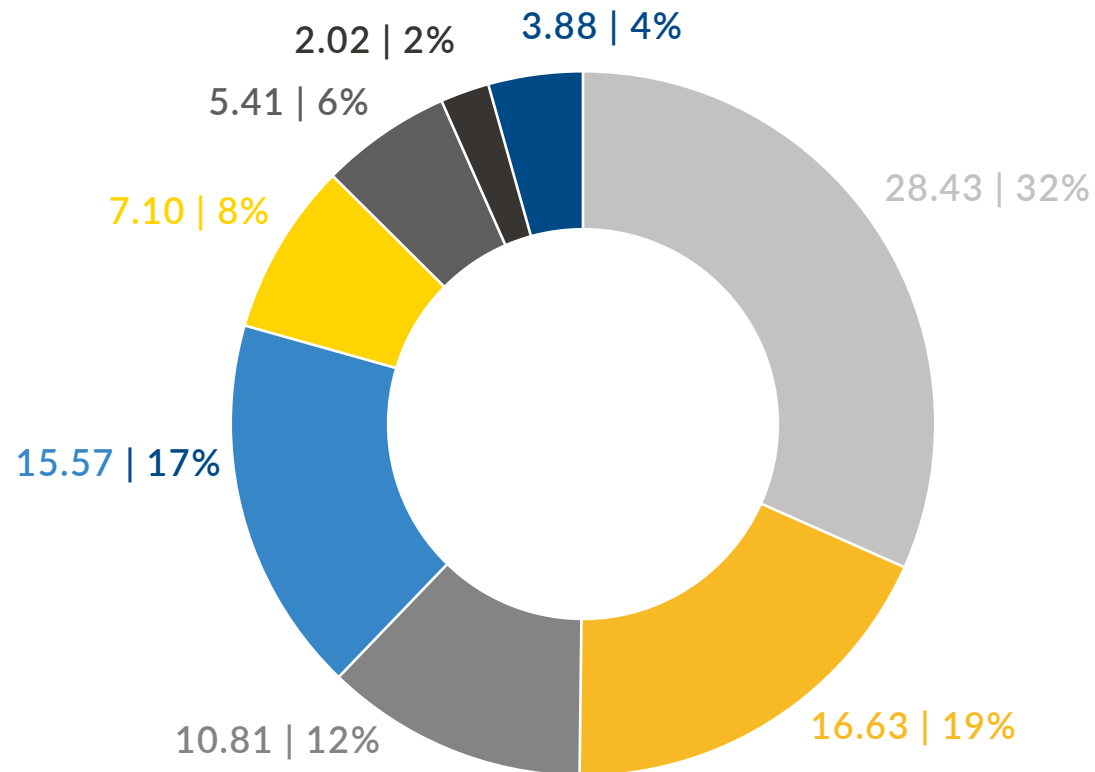
- Non-profit
- Educational
- Medical
- Public
- Agricultural
- Commercial
- Residential
- Industrial



SOLAR PV CAPACITY BY SECTOR (MWp | %)

The top three sectors leading the solar PV market in Lebanon in installed capacity are the industrial sector with 28.43 MWp, the commercial sector with 16.63 MWp, and the agricultural sector with 15.57 MWp.

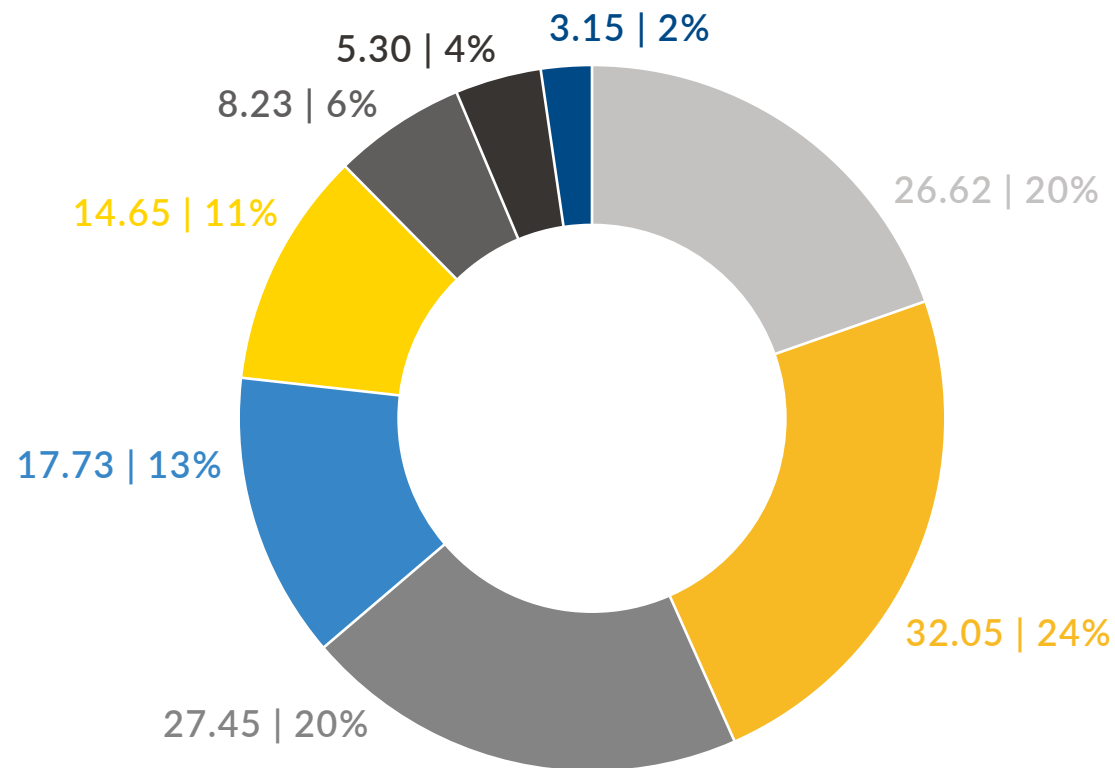
- Non-profit
- Medical
- Agricultural
- Residential
- Educational
- Public
- Commercial
- Industrial



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

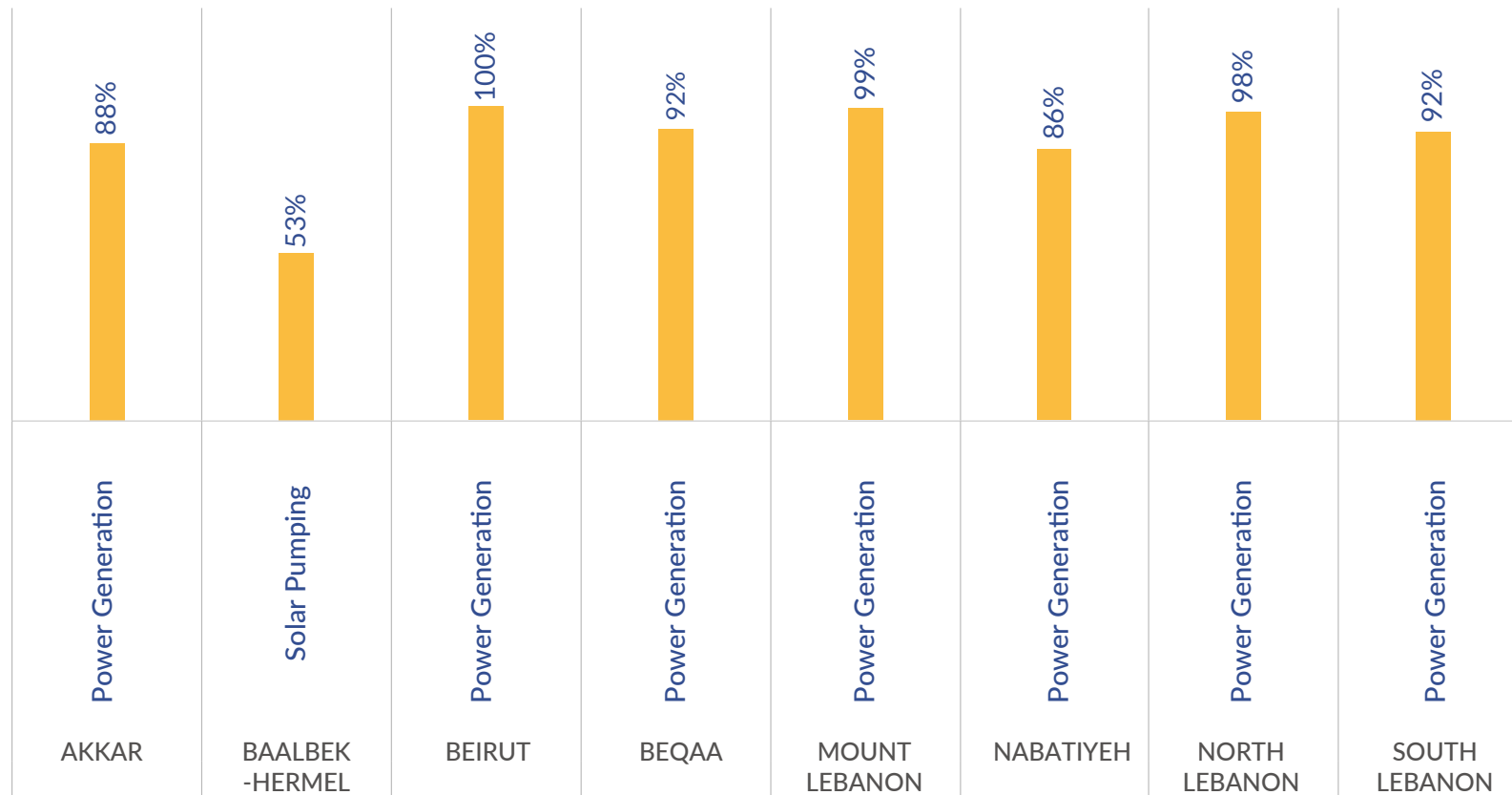
Just like 2019, the top three sectors leading the solar PV market in Lebanon in terms of investment are the industrial sector with \$32.05 Million, the commercial sector with \$27.45 Million, and the residential sector with \$26.62 Million.

- Non-profit
- Medical
- Agricultural
- Residential
- Educational
- Public
- Commercial
- Industrial



PV SYSTEM PURPOSE PER GOVERNORATE

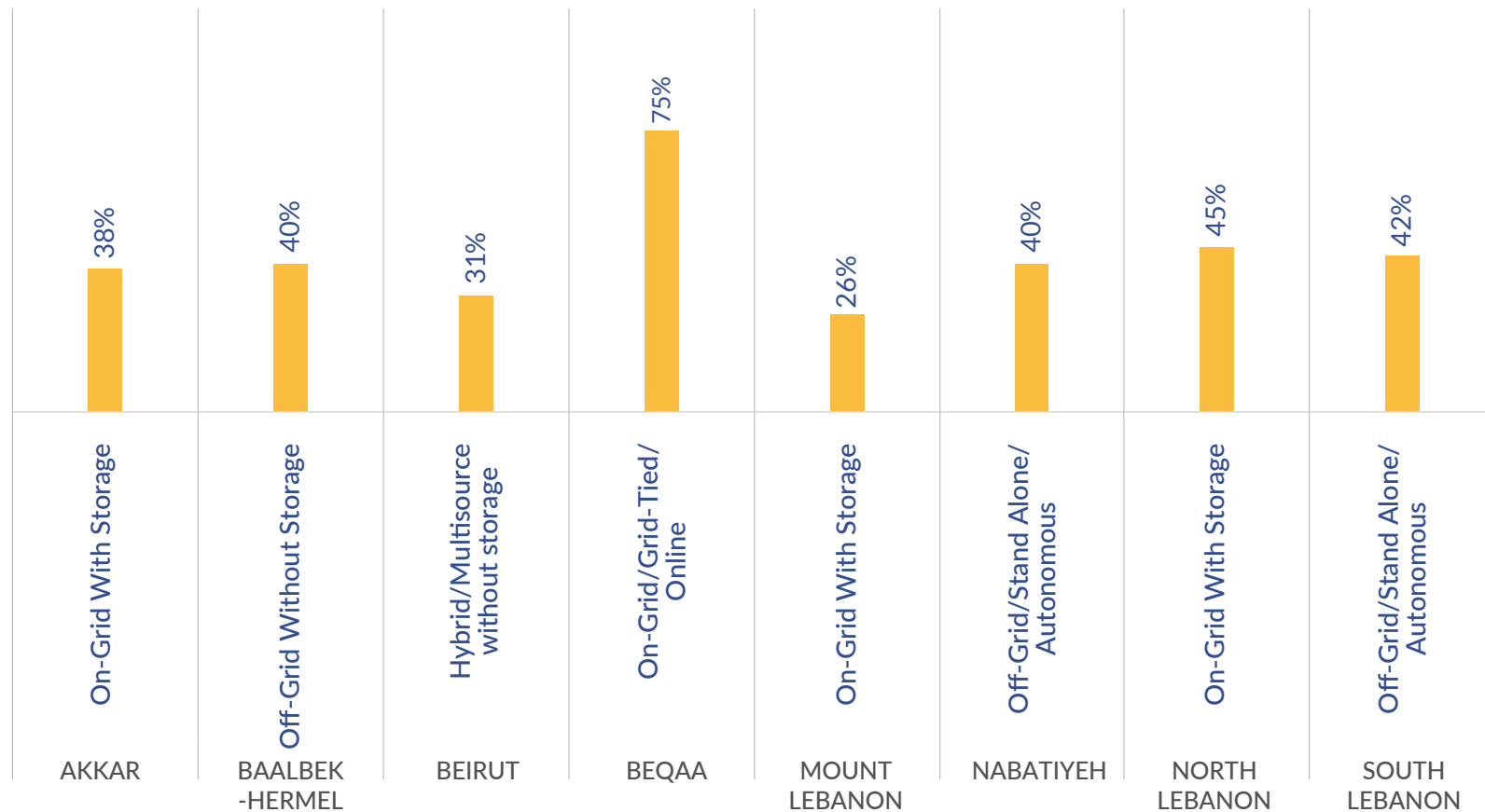
PV Projects that have been classified by purpose as either **power generation** or **solar pumping**, are installed in different governorates according to market needs. It is noticeable that solar pumping systems form the majority of projects in the Baalbek-Hermel governorate only.



PV SYSTEM TYPE PER GOVERNORATE

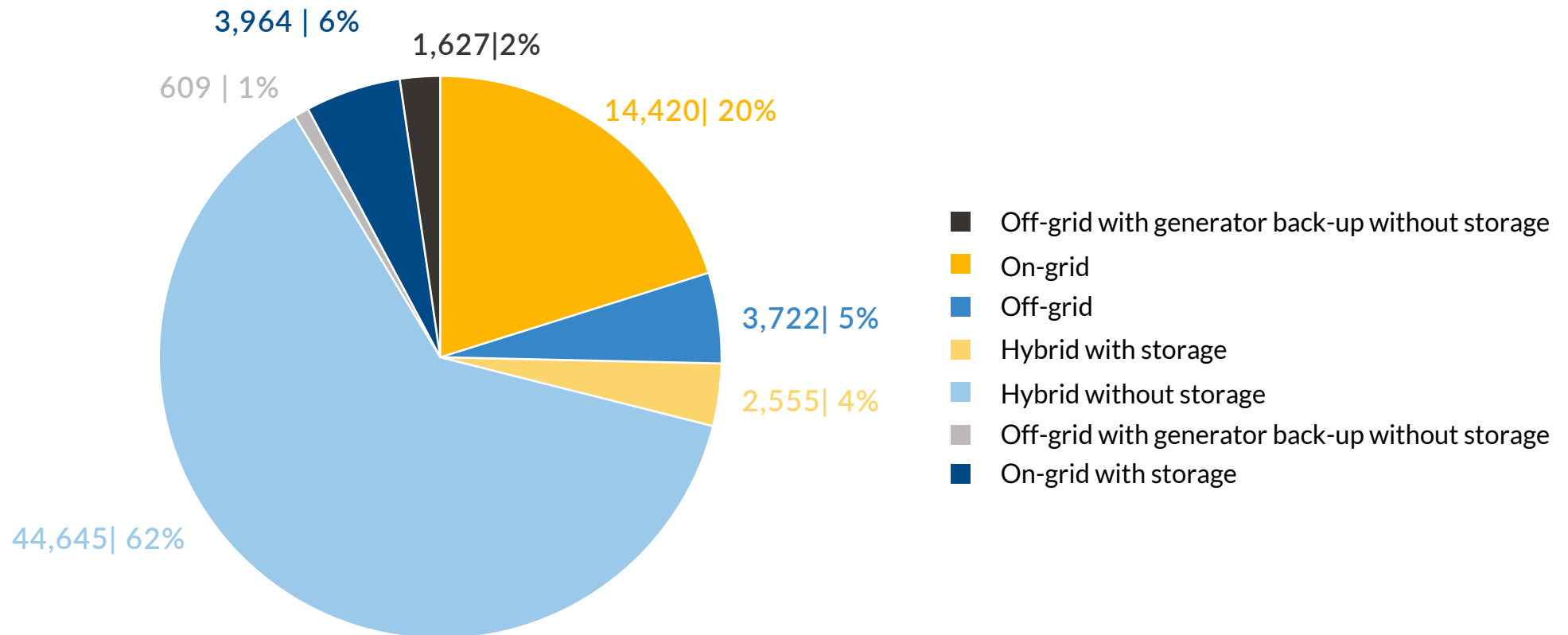
Similar to 2019, the agricultural aspect of Baalbek-Hermel governorate made solar pumping the predominant system in terms of purpose, with the Off-Grid without Storage type being used the most.

On the other hand, a relatively better electricity supply in Beirut and Beqaa (Zahleh area specifically) is reflected by the predominance of On-Grid PV systems. This could be compared to the poor quality of supply in other regions which necessitates storage.



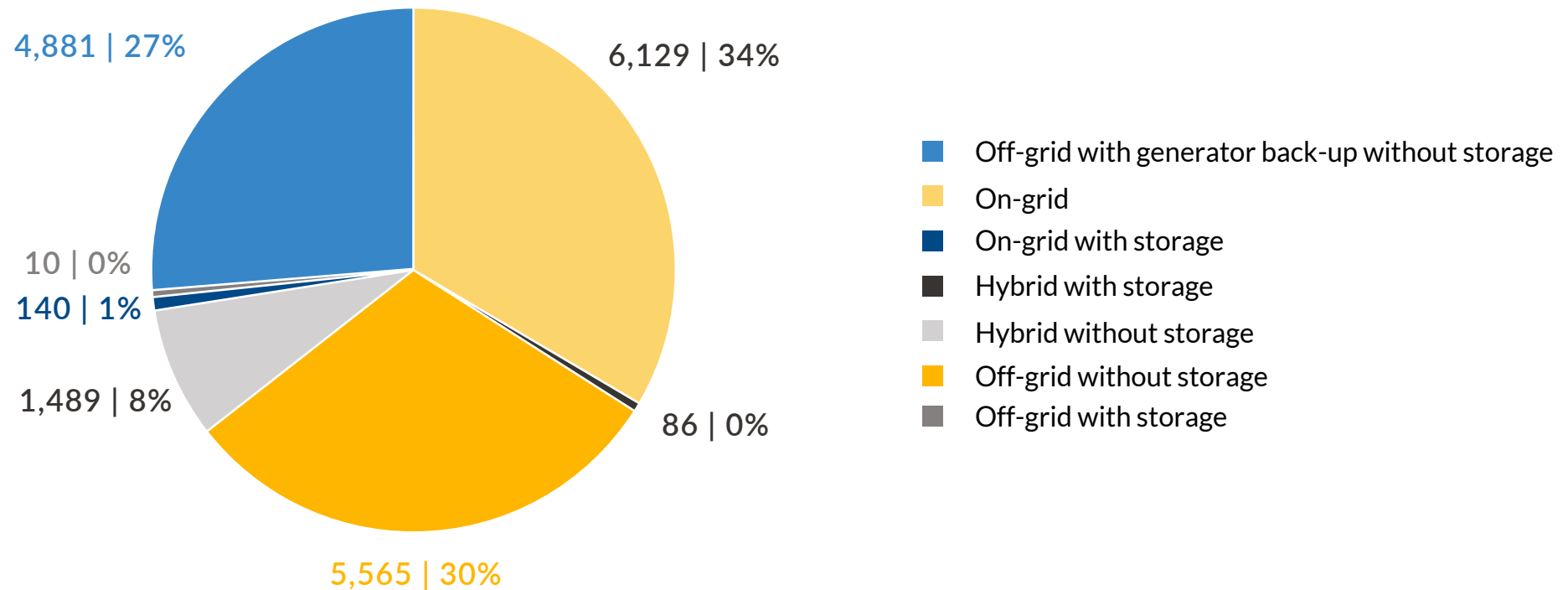
PV SYSTEM TYPES USED FOR POWER GENERATION (kWp | %)

The top three project types predominant in the PV market in Lebanon, having a purpose of power generation, are hybrid without storage (44.65 MWp), On-grid (14.42 MWp), and On-grid with storage (3.96 MWp).



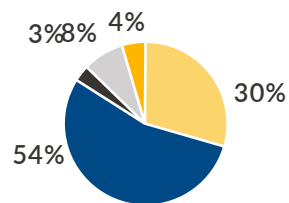
PV SYSTEM TYPES USED FOR SOLAR PUMPING (kWp | %)

The PV system types used for solar pumping were installed respectively as follows: On-grid (34%), Off-grid (30%), and Off-grid with generator backup without storage (27%).

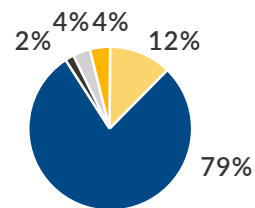


SHARE OF DIFFERENT POWER SOURCES OPERATING WITH PV SYSTEMS IN EACH GOVERNORATE & IN LEBANON

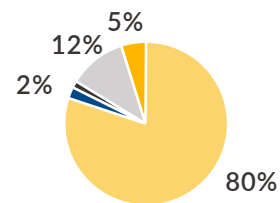
NorthLebanon



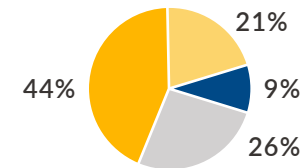
MountLebanon



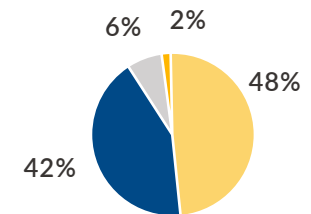
Aakkar



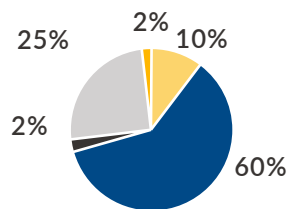
BaalbekHermel



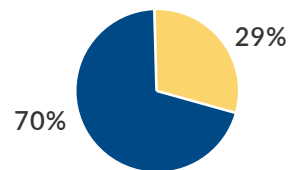
Beqaa



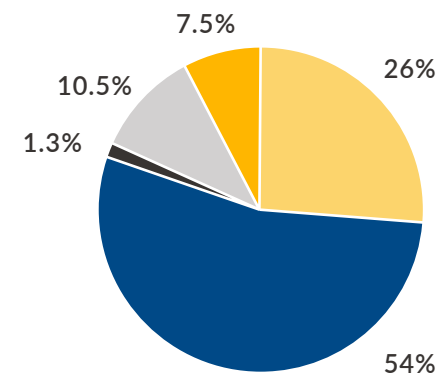
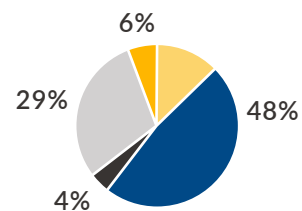
SouthLebanon



Beirut



Nabatiyeh



The Lebanese PV market clearly adapted to the different power sources available in the country's energy mix. More than 73% of the total installed capacity operates with diesel generators.

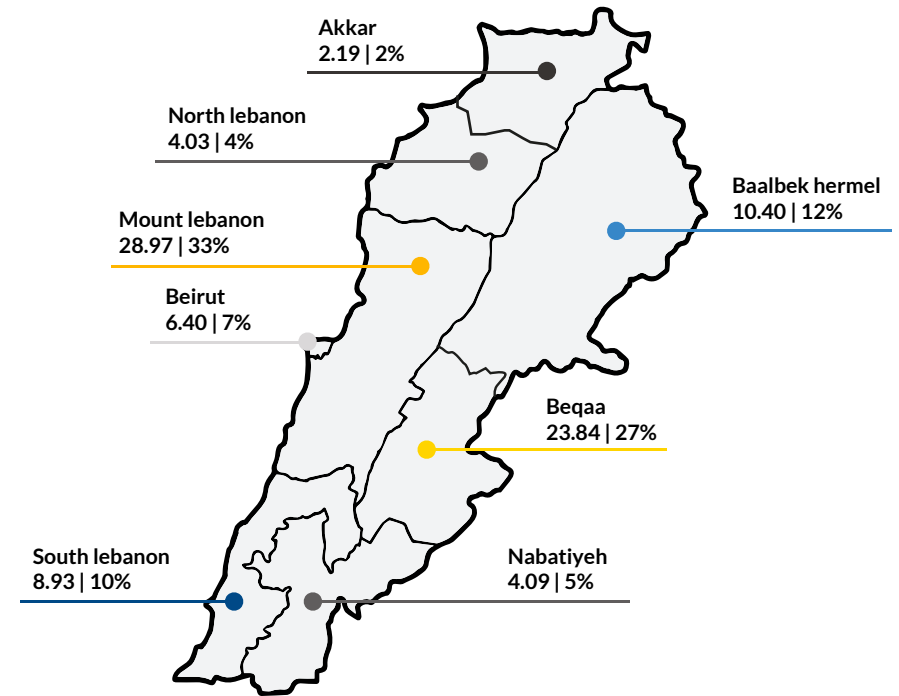
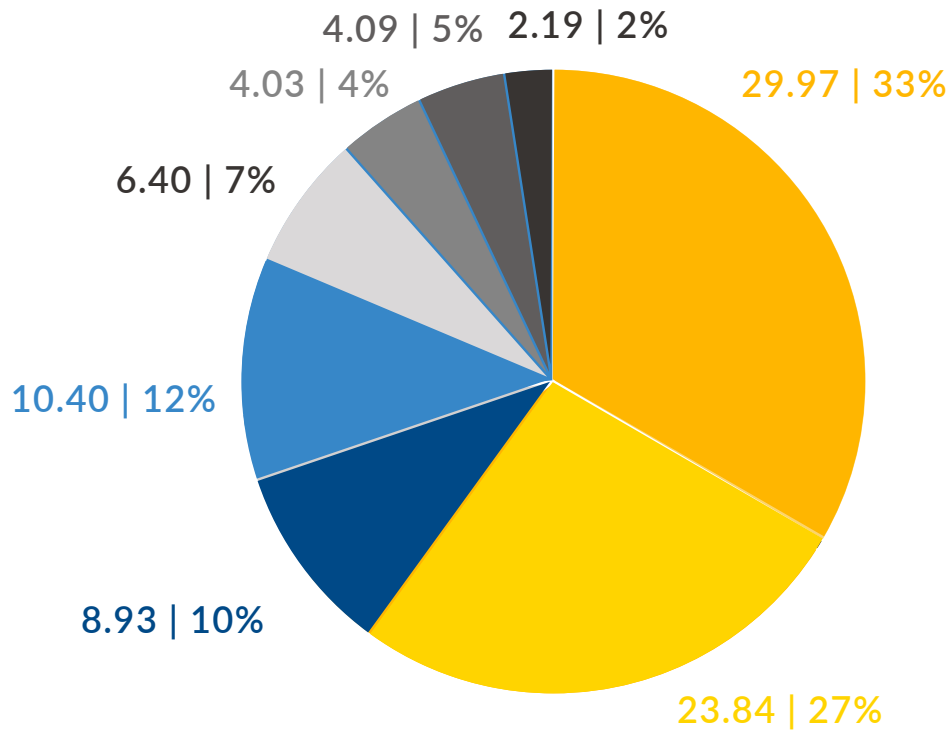
Note: Power sources with a share of less than 1% were removed. These include: Subscribed generators, private & subscribed generators, and national grid + private & subscribed generators.

- National Grid
- National Grid + Private Generator(s)
- National Grid + Subscribed Generator(s)
- No National Grid & No Generators
- Private Generator(s)

SOLAR PV CAPACITY PER GOVERNORATE (MWp | %)

The top three governorates leading the solar PV market remained Mount Lebanon with 29.97 MWp, Beqaa with 23.84 MWp, and Baalbek-Hermel with 10.4 MWp.

- Akkar
- Beqaa
- Baalbek Hermel
- North Lebanon
- Nabatiyeh
- Beirut
- South Lebanon
- Mount Lebanon



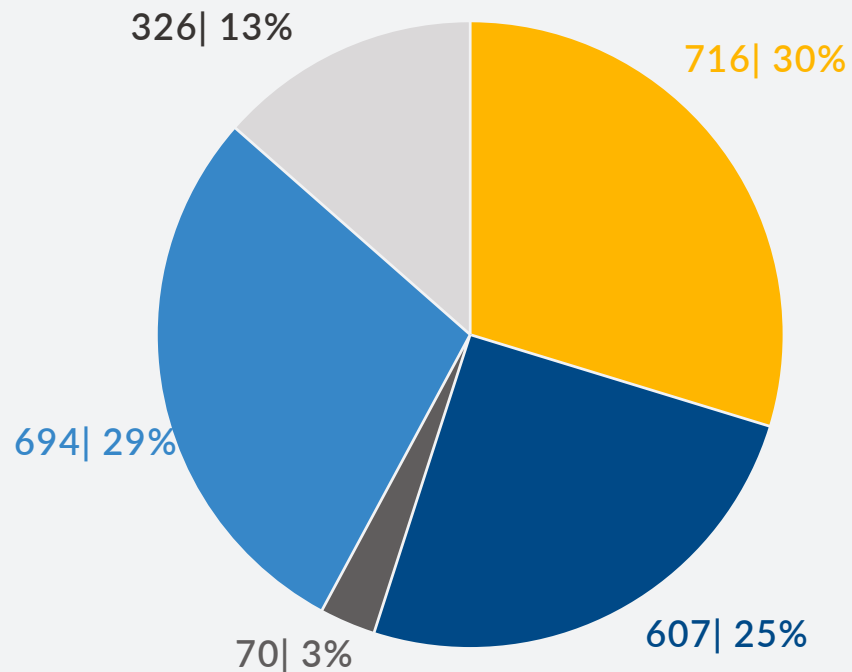
CLIMATIC ZONES & PV SYSTEM YIELDS

The coastal zone A (<200m) and inland zone are the climatic zones where 59% of the total number of PV systems are located.

Zone 1: Coastal A (<200m) and Coastal B
Zone 2 : Western Mid-Mountain
Zone 3: Inland
Zone 4: High Mountain

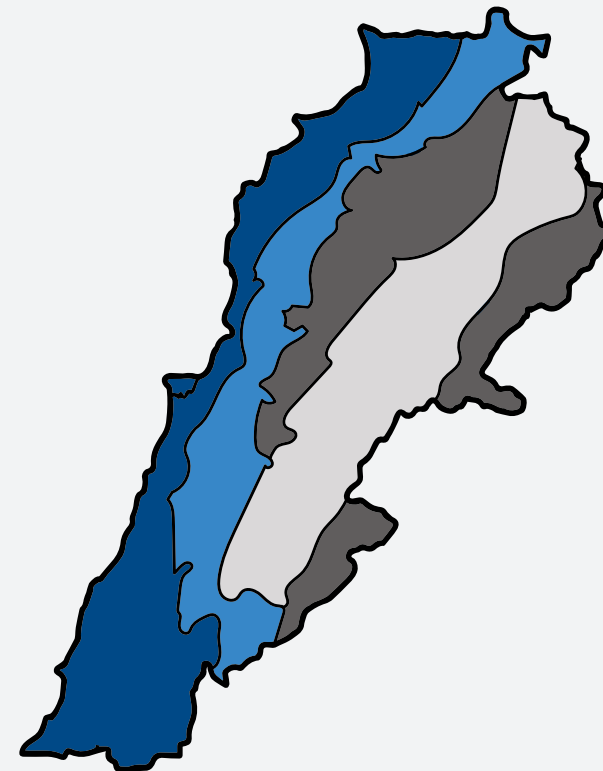
Number of PV projects per Climatic Zone

■ Inland ■ High Mountain ■ Western Mid Mountain
■ Coastal A ■ Coastal B



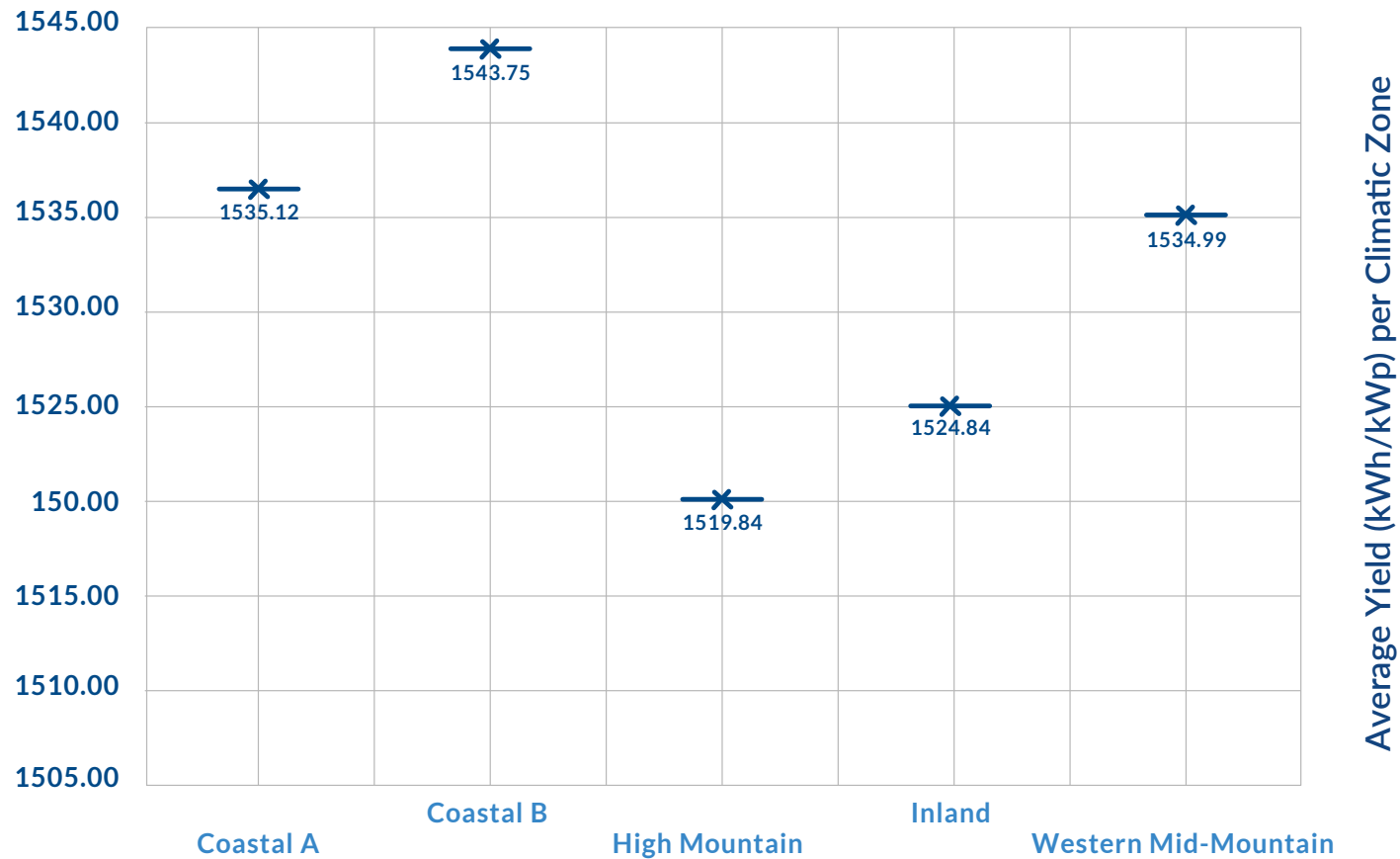
Legend

■ Zone 1 ■ Zone 2 ■ Zone 3 ■ Zone 4



CLIMATIC ZONES & PV SYSTEM YIELDS

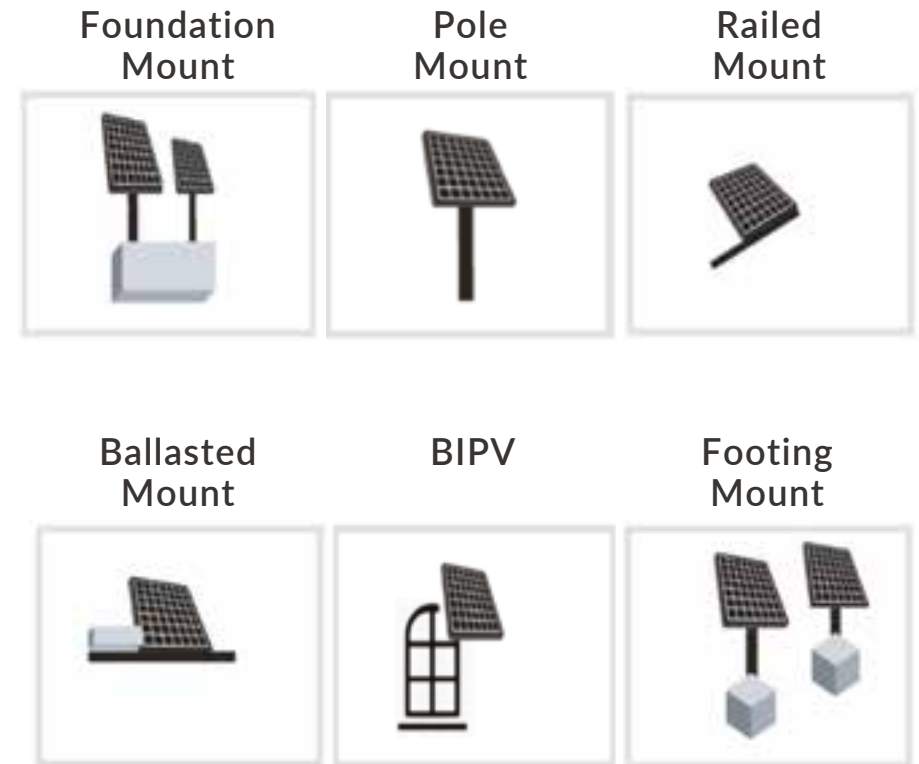
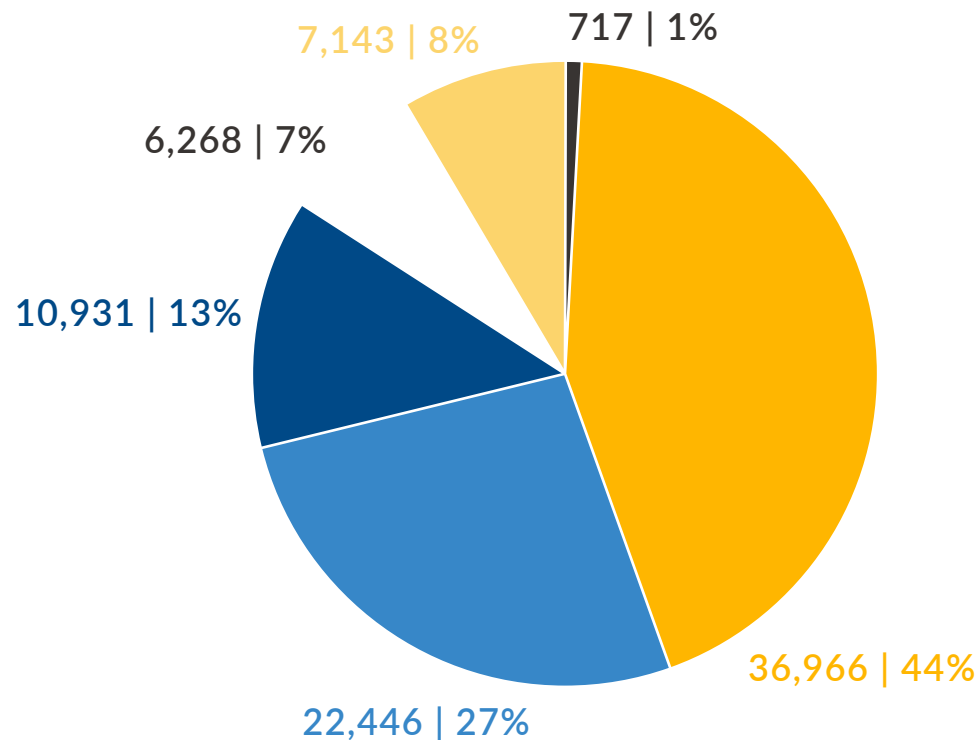
The average yield of installed PV systems was calculated excluding all misleading values below 1,000 kWh/kWp and above 2,000 kWh/kWp.



MOUNTING SYSTEM TYPES (kWp/%)

The three mounting system types used most are the Railed Mount (44%), Foundation Mount (27%), and Ballasted Mount (13%).

- Footing Mount
- Ballasted Mount
- Railed Mount
- Pole Mount
- Foundation Mount
- BIPV



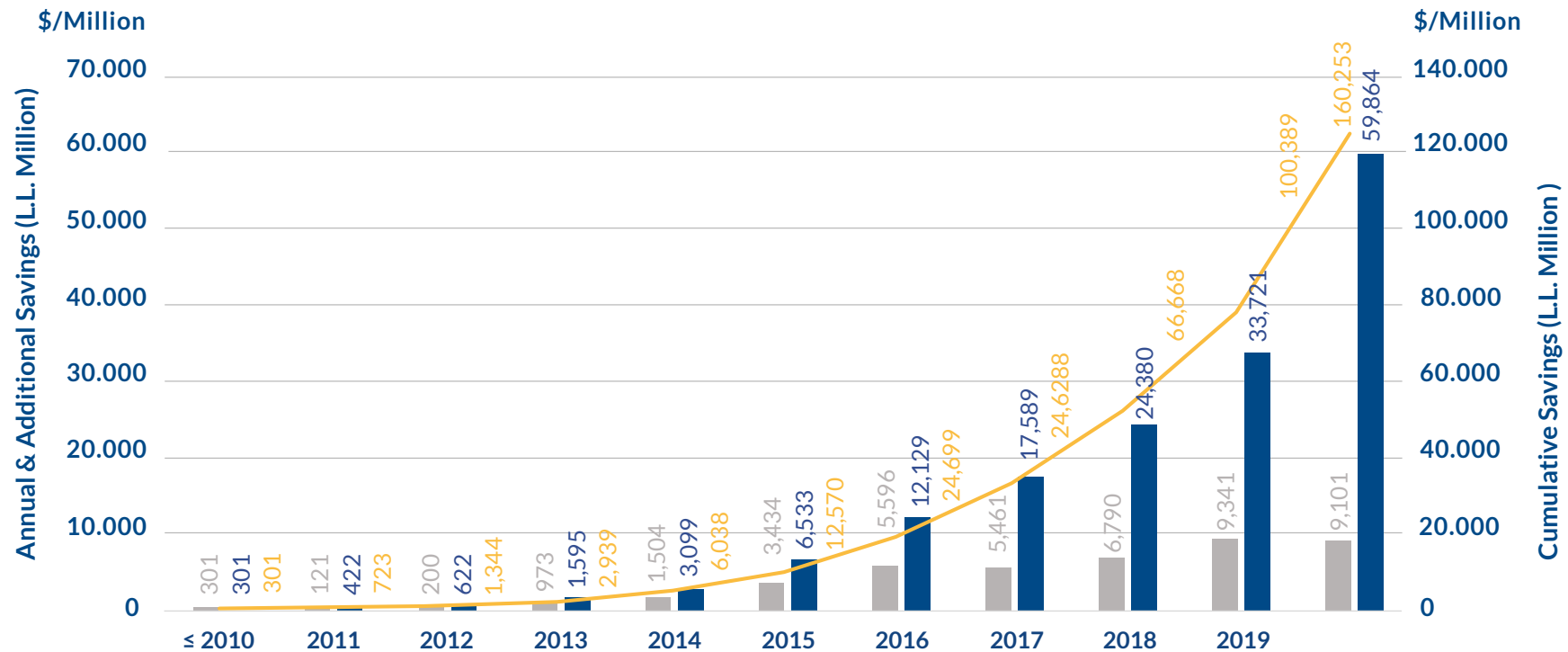


ESTIMATED SOLAR PV MONETARY SAVINGS (L.L. MILLION)

The estimated additional monetary savings from solar PV projects in Lebanon decreased from L.L. 9,341 Million in 2019 to L.L. 8,998 Million in 2020. The cumulative savings by the end of 2020 amounted to L.L. 160,253 Million, whereas the solar PV market in 2020 saved around L.L. 60,000 Million.

- Additional Savings
- Annual Savings
- Cumulative Savings

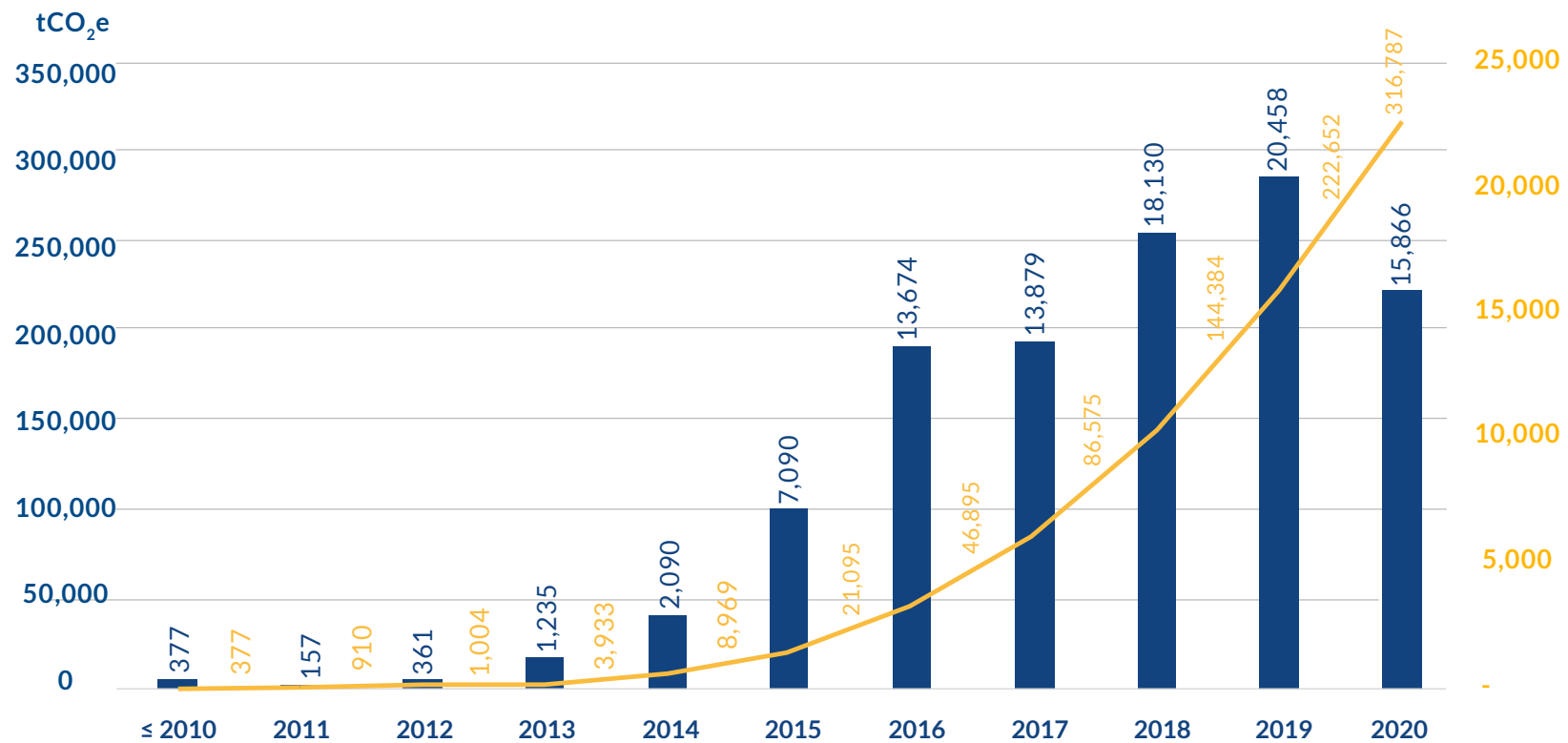
Subsidies on diesel were completely lifted in 2021, which will have a big impact on the savings figures in future reports.



ESTIMATED SOLAR PV EMISSION SAVINGS (tCO₂e)

The estimated annual emission savings from all solar PV projects in Lebanon fell from 20,458 tCO₂e in 2019 to 15,866 tCO₂e in 2020. Cumulative savings by the end of 2020 amounted to 316,787 tCO₂e.

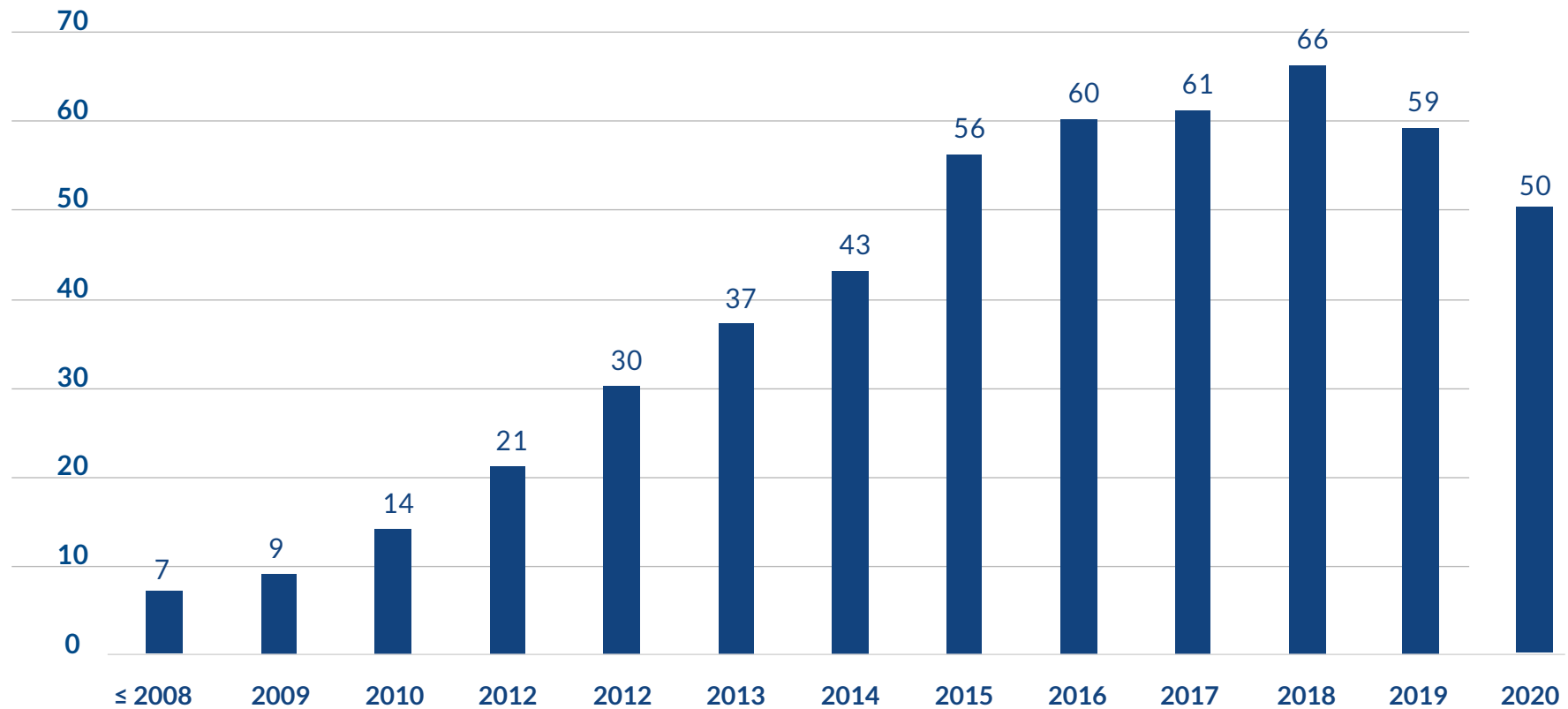
■ Annual Saving — Cumulative Savings



CUMULATIVE NUMBER OF ACTIVE SOLAR PV COMPANIES IN LEBANON

Only 7 Lebanese solar PV companies were operational up until 2008. This number started growing steadily from 14 companies in 2010 to 66 companies by the end of 2018. Since then, 16 companies stopped being responsive mainly due to the economic situation in the country.

* Companies that chose not to participate in the data collection conducted for this report could not be accounted for.



TAKEAWAY POINTS

Decentralized solar PV has proved to be a viable solution for power generation during the last ten years in Lebanon. For greater impact and a faster energy transition, MEW has delivered the draft renewable energy law (DRE) with the support of the European Bank for Reconstruction & Development (EBRD) and in partnership with EDL and LCEC. The draft law which was approved by the Council of Ministers in May 2022 constitutes an important pillar in the development of decentralized renewable energy projects, through the introduction of different mechanisms that integrate electricity generation by the private sector into the national grid.

The industrial sector continues to dominate the solar PV market with 28.43 MWp of installed capacity. Energy security is an essential factor that contributes to increasing the competitiveness & affordability of industrial products. In consequence, the increased penetration of solar PV solutions is indirectly contributing to sustaining and improving the Lebanese economy.

Solar PV continues to get less expensive year after year, with the average turnkey price falling to \$807 per kWp in 2020. However, it is important to note that the purchasing power in Lebanon started to drop significantly in 2020, limiting the ability of some consumers to benefit from the price drop.

Despite the reduction in the number of jobs in 2020 following the outbreak of COVID-19 and the ensuing economic crisis in Lebanon, the positive effect of the solar PV sector on job creation remains significant with at least 499 jobs generated & still active since 2008. These jobs are expected to increase at a higher rate given the promising market potential.

The solar PV market went through its first year of regression in 2020 in terms of annual addition, but this challenging year can transform into an opportunity for a better energy transition in Lebanon, as the need for reducing the gap between supply and demand widened, while PV energy production costs became fewer than the non-subsidized electricity tariffs, in addition to the necessity of reducing the country's continuous reliance on fossil fuel imports.

Despite all the barriers, belief in our ability to reach the chartered targets stems from the continuous investment of the private sector in sustainable technologies aiming to satisfy in-house energy needs as they look towards becoming independent energy producers thanks to the positive image of decentralized solar PV fulfilled over the past years.

List of Participating Active Lebanese Solar PV Companies

Company Name	Address and Email Address	Company Name	Address and Email Address
Arina Energy	Sin El Fil, Kore Center, 2nd Floor, info@arinaenergy.com	Smart Age	Zalka, Cité Moussa Center, Block C, elie.khoury@smartageeng.com
ME Green	Byblos Street 13, Khoury Business Center, info@me-green.net	Beta Engineering	Badaro Street, Al-Nakhil Building, betaengi@info.com.lb
TAKOM Energy	Ghazieh Main Road, Khalifeh Center, b.taki@takomenergy.com	Alternative Energy Group	Beirut, Makdessi Street, Matta Building, kelsolh@ae-mena.com
ECOsyst	Beirut Corniche Al Nahr, Holcom Building, g.geha@ecosys.com.lb	EAS Green	Jnah, United Nation Street, Assaf Building, barakat@eas-lb.com
GP Stellar	Hamra, Broadway Center, 10th Floor, ali@gpstellar.com	Renewable MED energy	Zouk El Khrab, Dbayeh Main Street, ziad.doumit@rmenergies.com
Future Power	Beirut, Tyre Main Road, Mix Center, info@fp-lebanon.com	Benta Power Tech	Zouk el Khrab, Dbayeh, BPI Building, elie.aboujaoudeh@benta.com.lb
Dawtec	Furn El Chebbak, LEMEC Building, dawtec@dawtec.com	Energies-Sport-Sante ESS	Kornet Chehwan, Batir Building, 7th Floor, info@energies-sport-sante.com
Solarnet	Mansourieh Old Road, Yazbeck Building, info@solarnet-online.com	Aquarius	Zalka, Arz Street, Aquarius Building, technical@aquarius.com.lb
Earth Technologies	Antelias, Sawma Jaber Street, CCI Building, gabboud@earthtechnologies.com	SolarWind	Sin El Fil, Horsh Tabet, Symposium Tower, solarwindme@solarwindme.com
RJR	Sin El Fil, Ghazal Street, Matta Building, rony.rihany@rjrtrading.com	Green Energy s.a.r.l.	Tyre, Abbassieh, Al Ruz Center, info@gree.solar
Acemco	Ain El Tineh, Bellevue Building, fatima@acemco.com.lb	Nicolas electric	Sin El Fil, Injilieh Street, Yazbeck Building, fayez@nicolaselectric.com
AEMS	Achrafieh, Adlieh Street, Olivetti Building, info@aems-lb.com	Green Power Generation	Zalka, Main Street, 4th floor, white building sabdo@gpglb.com
EEG	hrafieh, Monot Street, Rebeiz Building, rдиab@eegroup.info	ALBINA	Verdun, Vienna Street, Chatila Building, r.balesh@albinagroup.com

List of Participating Active Lebanese Solar PV Companies

Company Name	Address and Email Address	Company Name	Address and Email Address
Free SAL	Aintoura, Emile Wheibeh Building, toni.skayem@gmail.com	Est. Georges Azar	Zahle, Industrial Street, Azar Building, juanazar86@gmail.com
Manalco	Dora, Mar Youssef, Gemayel Building, maroun@pceups.com	SFR Energy	Aintoura, Main Road, Sfeir Building, info@sfr-energy.com
T.G.M. electronics	Zahle, Moualaka, Adel Khoury Building, tony-g-maalouf@hotmail.com	Sun for Free	Zahle, Highway, Hrawi 1597, bldgtonynkara@gmail.com
Makram Barakat Est.	Beirut Souks, Luis Vuitton Building, Makram@makrambarakat.com	Metasol	Beirut, Jnah, Al Yasmine Building, h.shawa@metasol.me
EMTC	Baabda-Hadath, Ramadan Building, fuadosseily@hotmail.com	Lebanese sustainable energy	Tripoli, Riad Soloh Street, Karim Center talal@lebenergy.com
Phoenix Energy	Safra, Hawa Chicken Street, energy@phoenixlb.com	Apex Energy	Zahle, Industrial Zone, said@apexmechatronics.com
Yelloblue	Mathaf, Berytech Building, tony.kaldany@yelloblue.com	Green wise energy	Beirut, Van Dyk Street, Ain Mreisse, alihraibi@greenwise.me
Technology hunter	North, Baddaoui, Jamyze Street, Info@technologyhunter.net	Corporate business solution	Bouchrieh, Cloud 7 Building, mohammadtrad@gmail.com
Green Power Tech	Chtaura, Jdita Mansour Building, dayehmohammad@yahoo.com	SIG	SIG Showground, Monsef Highway, bassemsalem@yahoo.com
Green essence	Zahle, St Elie Street, Jean Zaatar Building, francois@greenessencelebanon.com	CTI	Jal-El-Dib, Main road, Yachoui Building, marc.yachoui@cti-businesses.com
Mashriq Renewable Energy	Verdun, Rue 26, Al Andalus Building, m.mneimneh@mashriqenergy.com	Kypros	Dora, Cebaco Building, Block A, info@kyprossolar.com
Elements Sun & Wind	Dbayeh, Ziad Bou Dagher Building, elias@elementssw.com		
Plemicor industries	Beirut, Shell Street, Plemicor Building, info@plemicor.com		







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