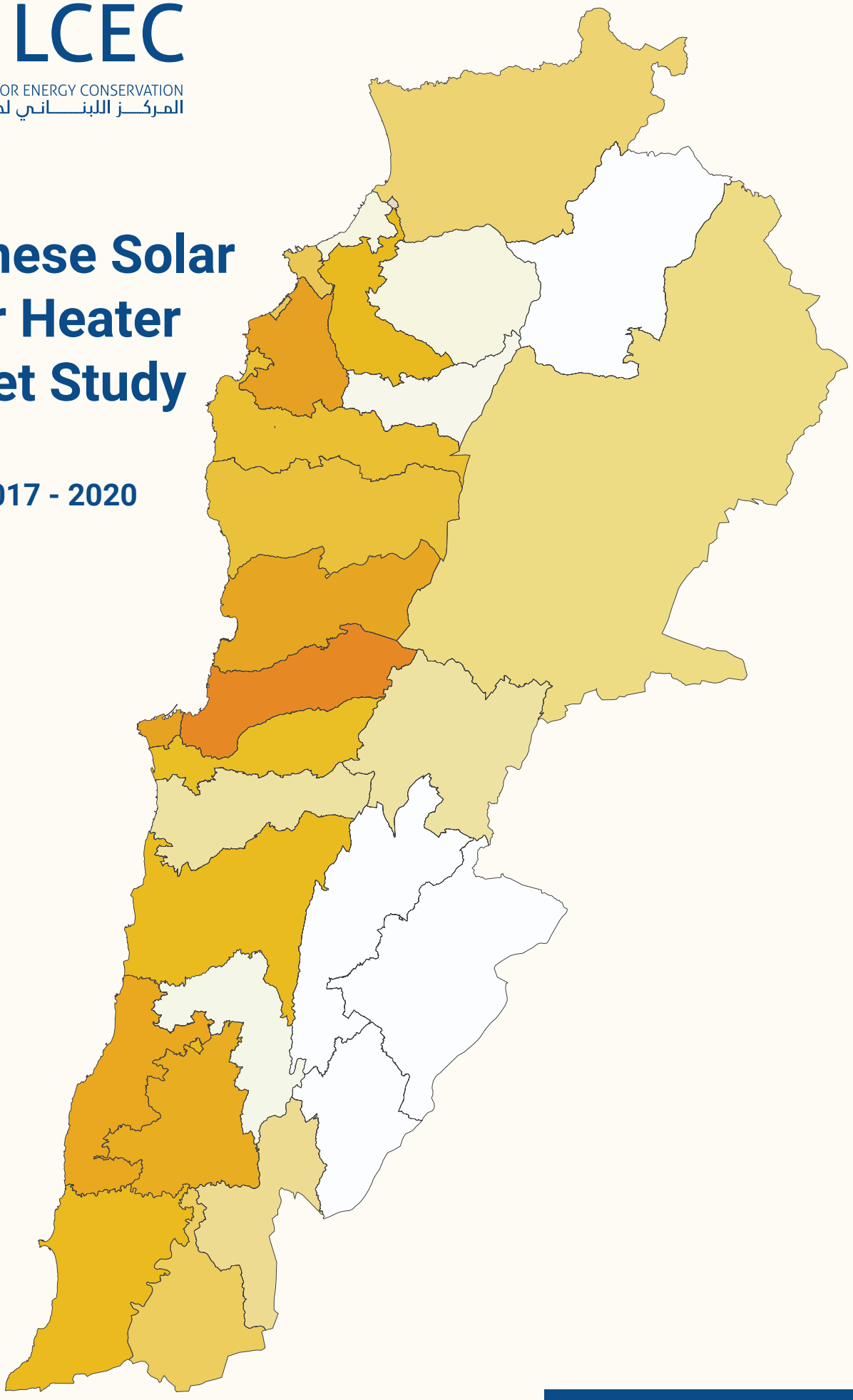
LCEC

LEBANESE CENTER FOR ENERGY CONSERVATION

المركز اللبناني لحفظ الطاقة

Lebanese Solar Water Heater Market Study

Update 2017 - 2020



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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 and 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.

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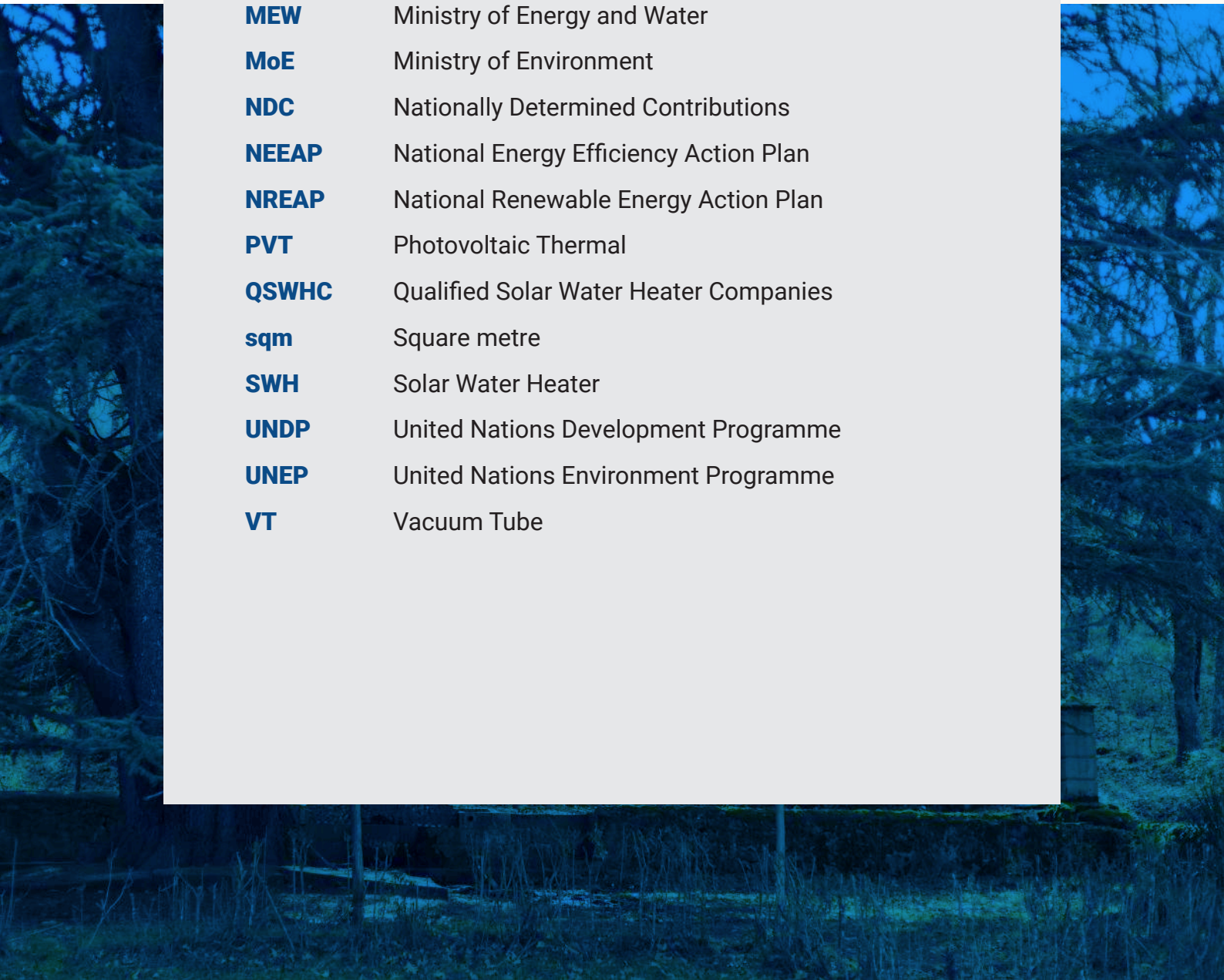
BDL	Banque du Liban (Central Bank of Lebanon)
FP	Flat Plate
GEF	Global Environment Facility
GWh	Gigawatt-hour
ICA	International Copper Association
LCEC	Lebanese Center for Energy Conservation
MEW	Ministry of Energy and Water
MoE	Ministry of Environment
NDC	Nationally Determined Contributions
NEEAP	National Energy Efficiency Action Plan
NREAP	National Renewable Energy Action Plan
PVT	Photovoltaic Thermal
QSWHC	Qualified Solar Water Heater Companies
sqm	Square metre
SWH	Solar Water Heater
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
VT	Vacuum Tube



1. Introduction

The global market for Solar Water Heaters (SWH) started to recover in 2017 and 2018 after a steady decline between 2014 and 2017 as reported in the IEA SHC Solar Heat Worldwide report. (Werner Weiss, Monika Spörk-Dür, 2021)

Globally, the SWH market saw a 16 per cent decline in 2019 with a trend for a slight recovery in 2020. In parallel, 2017 witnessed developments in the market of photovoltaic thermal (PVT) collectors. This market, still inexistent in Lebanon, experienced a steady global growth between 2018 and 2020 as reported in the IEA SHC Solar Heat Worldwide report. (Werner Weiss, Monika Spörk-Dür, 2021)

The SWH market in Lebanon was heavily affected by global and national circumstances. It witnessed a drastic decrease in the number of installed projects between 2017 and 2020.

When checking the number of installed SWH units, it was found that around 11,655 systems were installed in 2017. A slight decrease was noticed in 2018 where the number of units reached 10,079 systems. This figure shrank further by almost 14 per cent in 2019 to reach 8,642 installed systems while in 2020 it dwindled to only 4,751 newly installed SWHs in Lebanon, which could be translated into a reduction of the market size by 45 per cent compared to 2019. In summary, the market suffered from a size reduction of 59 per cent during these four years.

There were many reasons behind this drastic decrease in installations, including:

01 The restructuring of all subsidized loans from BDL in 2017, which affected the SWH market as local banks stopped granting residential SWH loans.

02 The economic crisis that started in the last quarter of 2019 and escalated in 2020 which led to a substantial devaluation of the national currency.

03 The global COVID-19 pandemic and lockdowns in 2020.

According to the Lebanese Nationally Determined Contributions (NDCs), updated in 2020, Lebanon is committed to generate 11 per cent of its heat demand by 2030 using renewable energy unconditionally. In addition, if international support is granted, this contribution could reach conditionally 16.5 per cent of the heating demand in the building sector in 2030 (MoE, 2020). Consequently, more efforts need to be invested in the SWH market to reverse the current trend and reach national objectives.

2. Overall Solar Water Heaters Market

In 2009, a target of 1,050,000 sqm of total installed SWH surface area by 2020 was set within the Global Solar Water Heating Market Transformation and Strengthening Initiative, a joint program launched by the United Nations Development Programme (UNDP) and United Nations Environment Programme (UNEP) and funded by the Global Environment Facility (GEF) and the International Copper Association (ICA).

This target, elaborated into annual increases in cumulative SWH surface area installations as per the chart shown in Figure 1, was officially adopted within the National Energy Efficiency Action Plan for the Republic of Lebanon (NEEAP 2011-2015) developed by the Lebanese Center for Energy Conservation (LCEC) and adopted by the Ministry of Energy and Water (MEW) and consequently by the Council of Ministers in November 2011 (LCEC, 2011). It was subsequently re-affirmed within the National Renewable Energy Action Plan for the Republic of Lebanon (NREAP 2016-2020) published in November 2016 (LCEC, 2016).

Figure 1 shows the actual cumulative installed surface area of SWH systems compared to the projected installations between 2005 and 2020. At the beginning of 2010, the total installed SWH surface area was 173,988 sqm which increased by 561,413 sqm by the end of 2020 to exceed 735,000 sqm. In 2017, the Lebanese market added 55,659 sqm to its previously installed 571,840 sqm of SWH surface area. In 2018, 43,824 sqm were installed. The year 2019 saw the installation of 40,456 sqm, while in 2020, only 23,622 sqm were added. This led to a total of 735,401 sqm of installed surface area by the end of 2020, short by 314,599 sqm of the goal initially set in 2009.

On the other hand, total investments between 2010 and 2020 in the solar water heaters market reached $191,714,215 while the total added capacity during the same period reached 32,668,913 litres. Moreover, the total number of systems installed between 2010 and 2020 reached 108,256 systems.

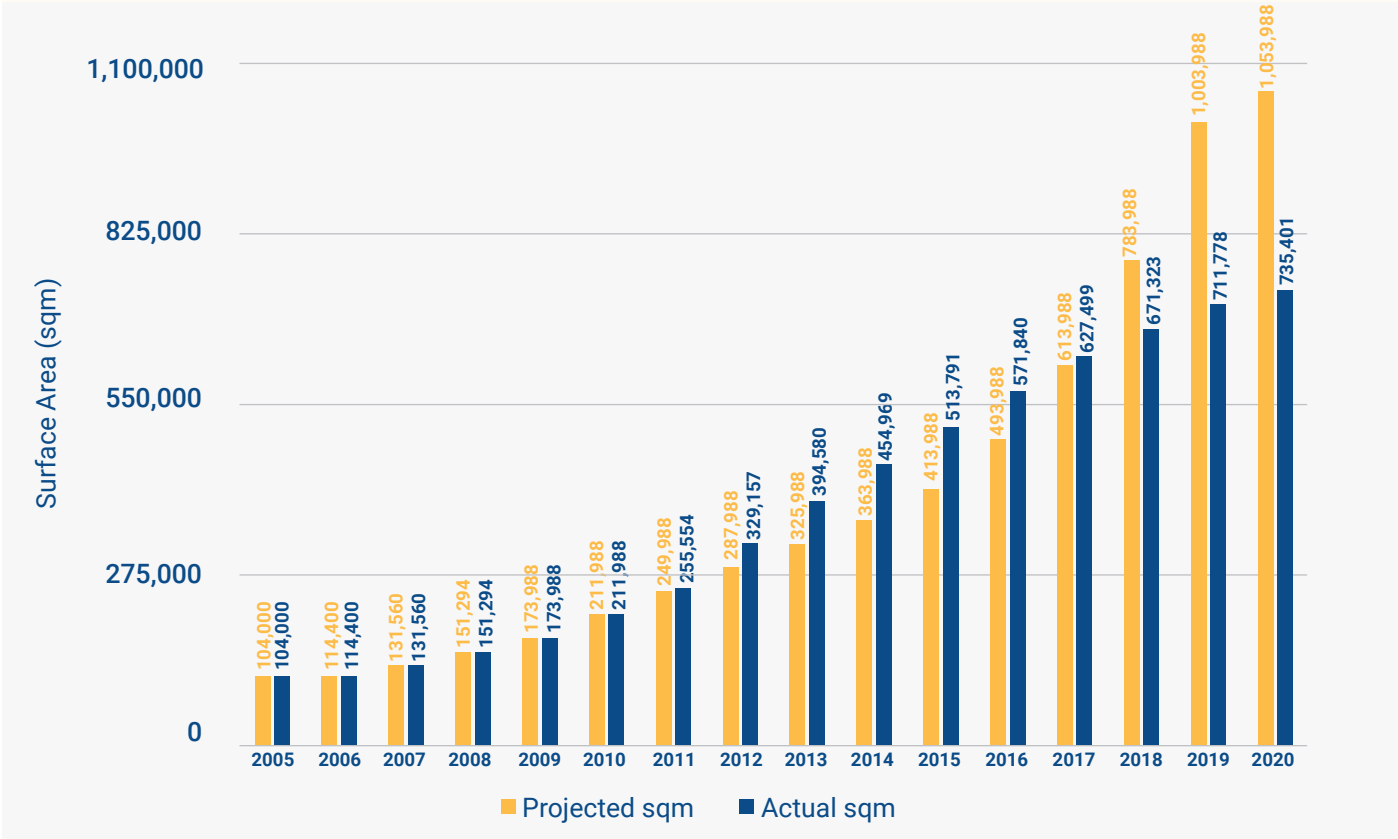


Figure 1: Cumulative SWH surface area in sqm: projected vs actual installations

3 Qualified Solar Water Heater Companies

LCEC issues the list of Qualified Solar Water Heater Companies (QSWHC) on a quarterly basis on its website. The list contains information on these companies and their products. A star-based system is used to rate both the companies and their products. Company and product ratings are based on information provided during the qualification process.

The number of qualified companies increased from 54 in 2017 to 61 in 2019. However, due to the economic crisis and the devaluation of the Lebanese currency as well as the global pandemic that hit Lebanon in early 2020, the number of qualified companies decreased by 21 per cent to reach 48 qualified SWH companies.

The following paragraphs studying the progress of the installed surface area, installed capacity, and monetary value, are based on data and figures provided by the companies that are on the QSWHC list.

1. Installed Surface Area

Figure 2 details the development of the annually installed surface area by QSWHC in Lebanon in sqm throughout the period between 2010 and 2020. The newly installed surface area dropped by 57 per cent between 2017 and 2020, from 26,268 sqm in 2017 to 11,130 sqm in 2020.

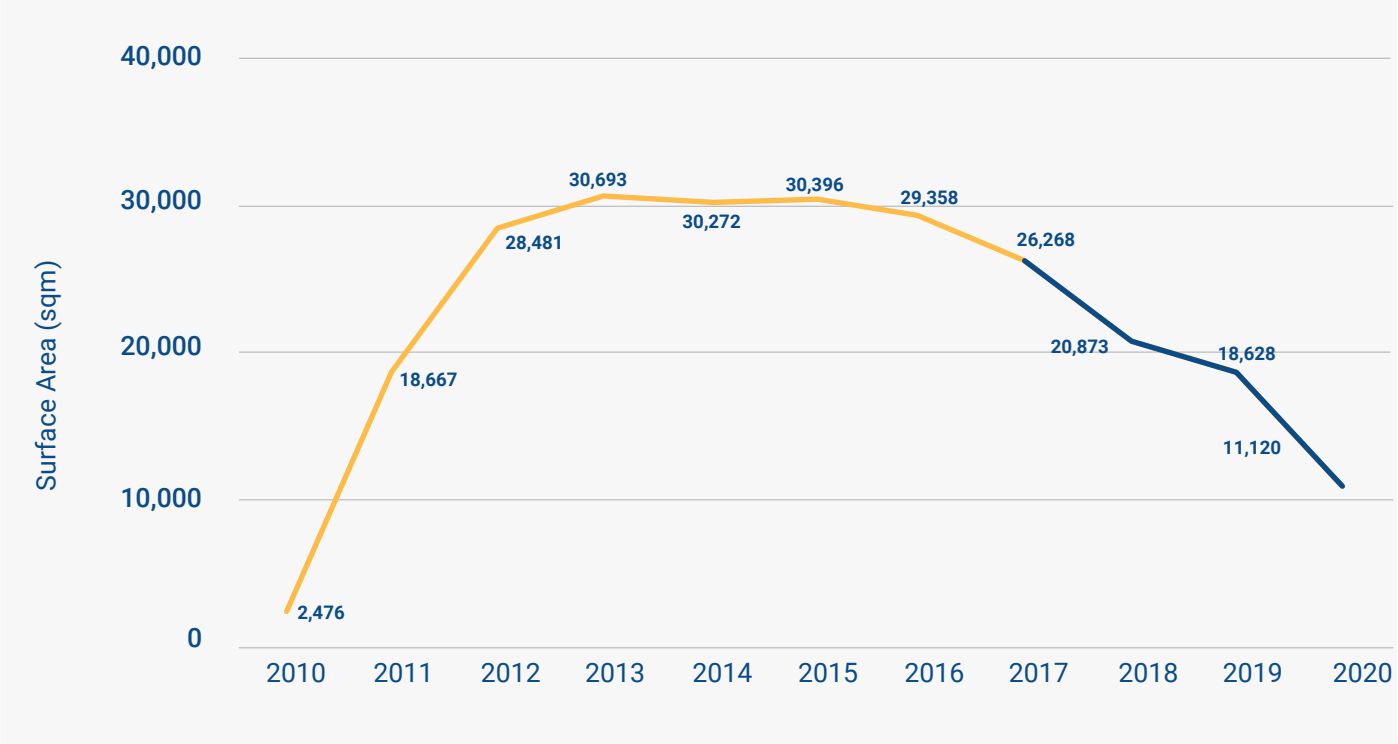


Figure 2: Installed surface area by QSWHC between 2010 and 2020

The cumulative installed surface area between 2010 and 2020 is shown in Figure 3. It reached 247,511 sqm of installed surface area by QSWHC in 2020.

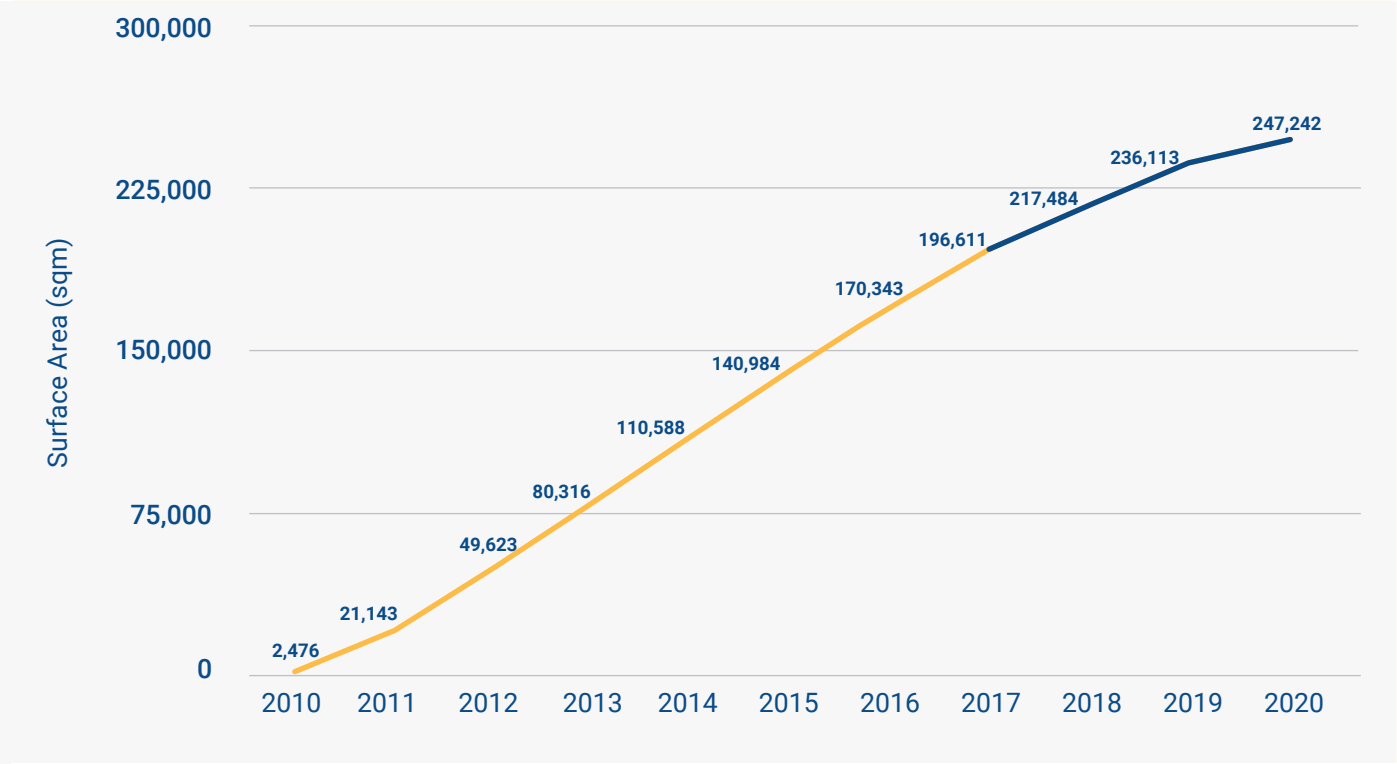


Figure 3: Cumulative installed surface area by QSWHC between 2010 and 2020

2. Installed Capacity

Figure 4 shows the yearly installed capacity in litres by QSWHC between 2010 and 2020. This graph reveals that annual capacity kept decreasing throughout the years from 2017 to 2020. In 2017, the installed capacity was 1,801,796 litres which dropped by 64 per cent to reach 645,915 litres in 2020.

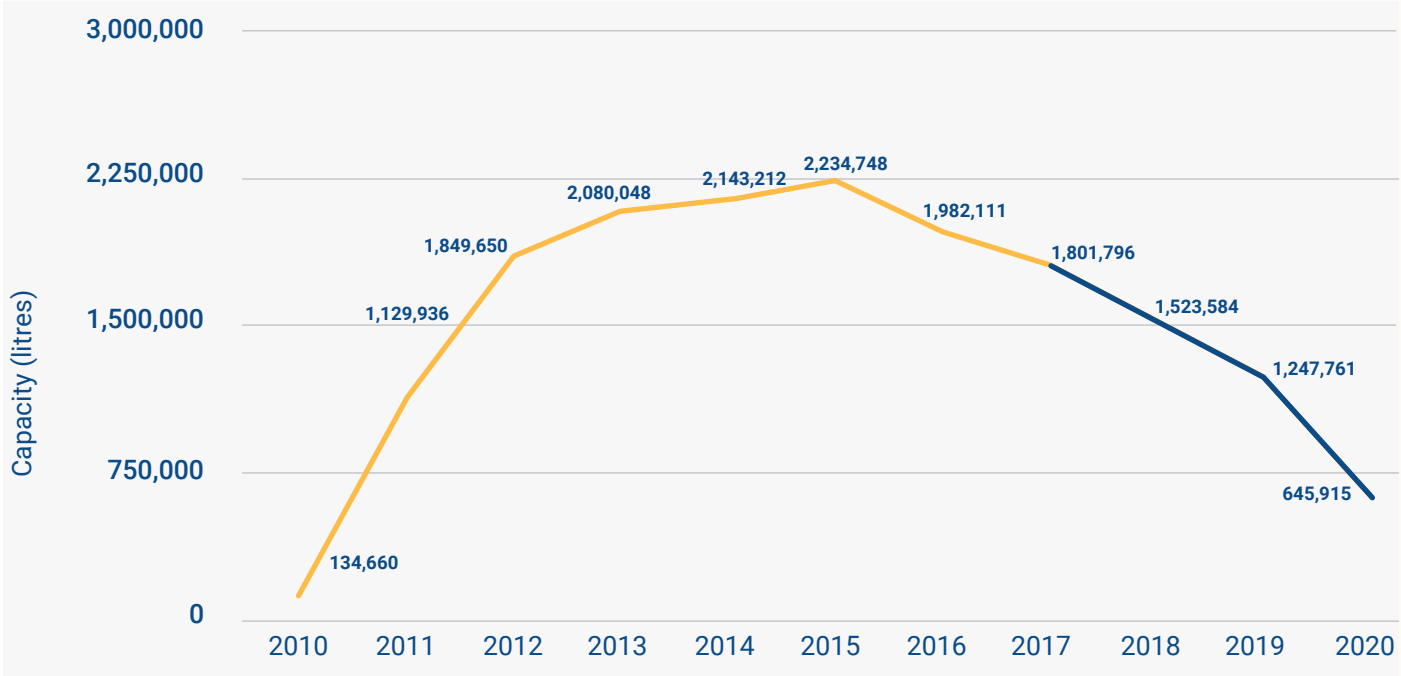


Figure 4: Yearly installed capacity in litres by QSWHC between 2010 and 2020

Figure 5 shows the cumulative installed capacity, in litres, by QSWHC in Lebanon during the period between 2010 and 2020. The installed capacity reached 16,773,421 litres by the end of 2020.

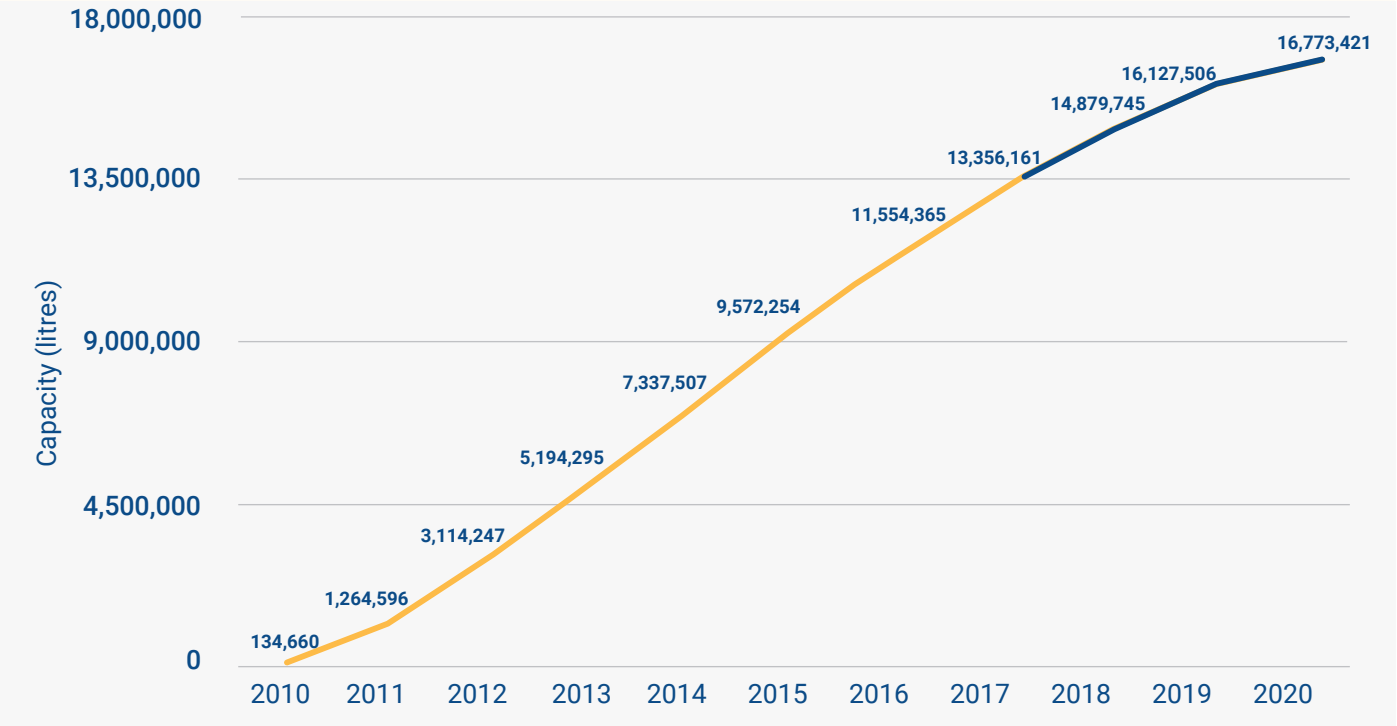


Figure 5: Cumulative installed capacity by QSWHC in litres between 2010 and 2020

3. Market Value

Annual investments made in residential SWH projects are shown in Figure 6. The decrease in the number of installed projects yearly is also reflected in the monetary values as indicated in Figure 6. The monetary value of SWH systems installed annually by QSWHC fell by 61 per cent from $7,554,836 in 2017 to reach $2,927,957 in 2020.

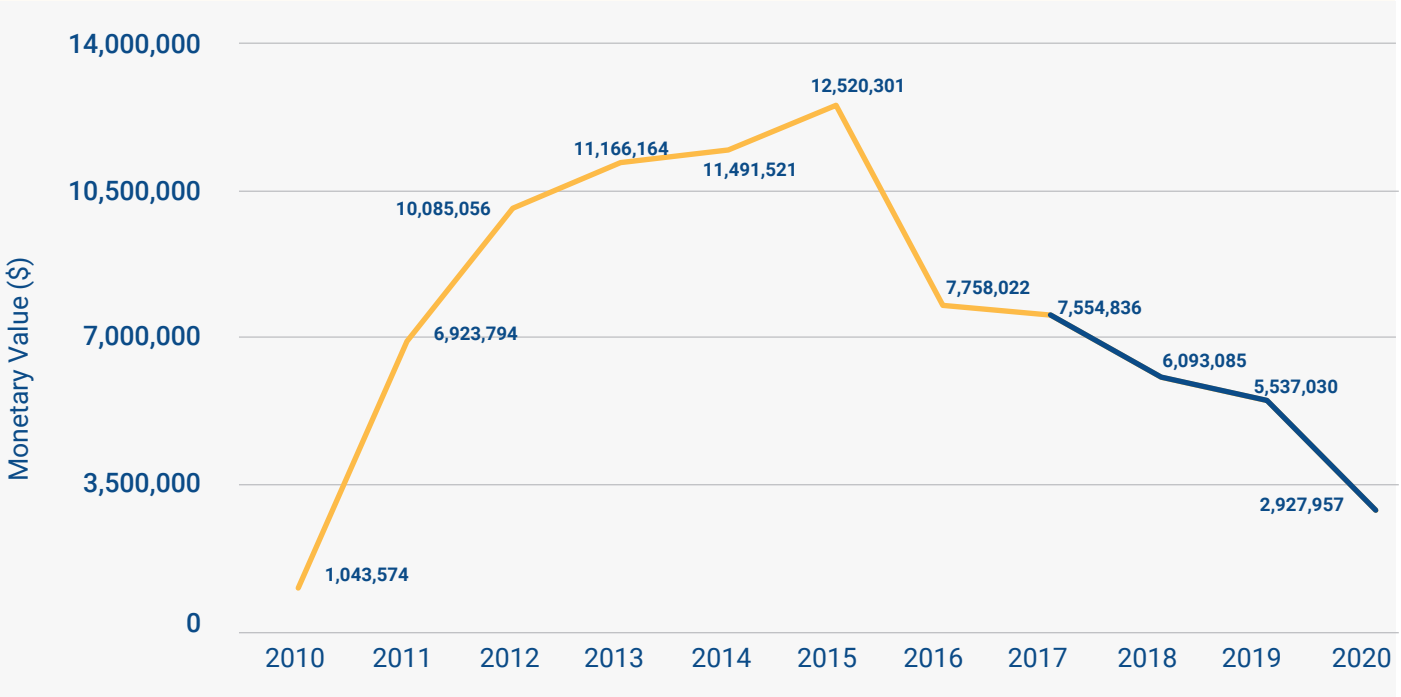


Figure 6: Yearly monetary value of installed SWH systems by QSWHC between 2010 and 2020

The cumulative amount of investments in residential SWH systems installed by QSWHC is shown in Figure 7. The monetary value of systems kept increasing to reach $83,101,340 by end of 2020.

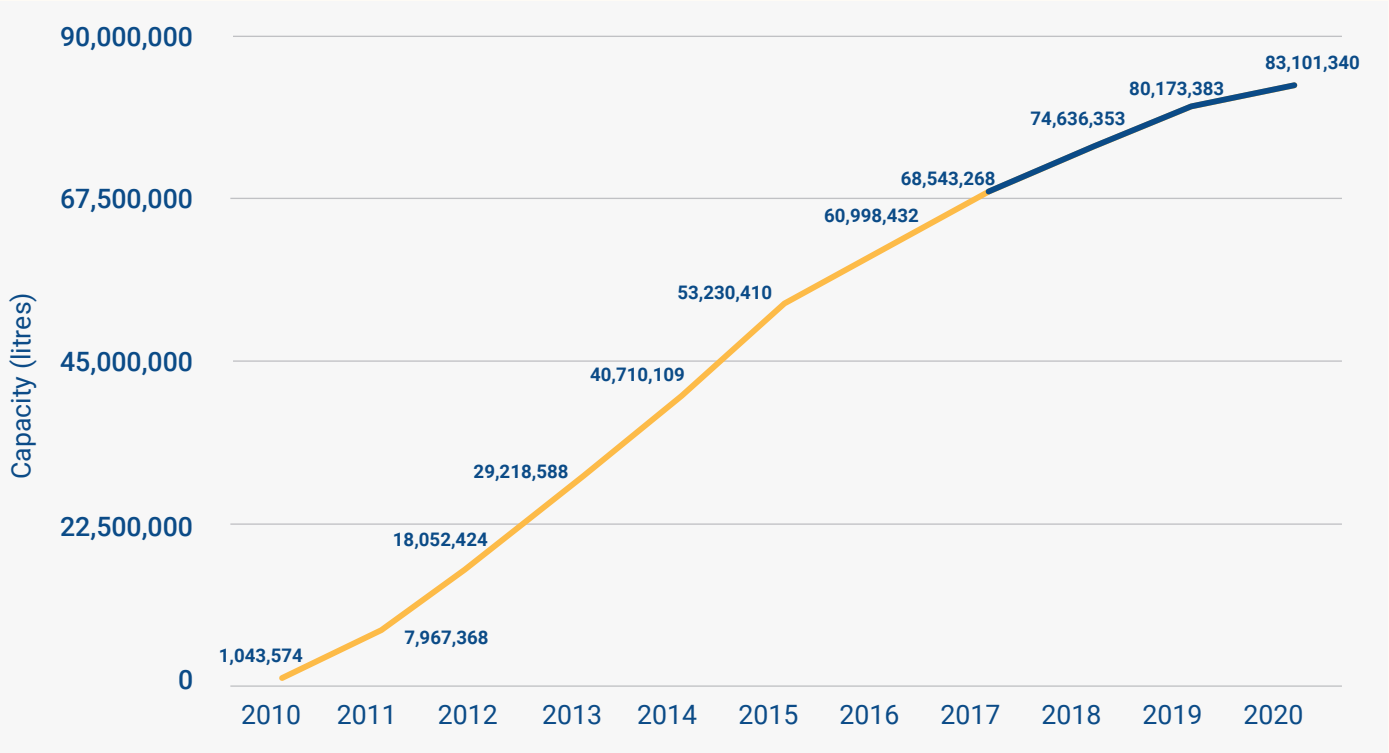


Figure 7: Cumulative monetary value of Installed SWH Systems by QSWHC between 2010 and 2020

4. SWH Installations by Type

In this section, several SWH types, namely thermosiphon, pressurized thermosiphon, and forced circulation systems, are reviewed.

A thermosiphon system operates by gravity. The hot water tank is installed directly above the SWH panels. Water circulates from the cold-water tank to the SWH and then to the usage port, without the need for pumping. In this system, the cold-water tank must be placed higher than the SWH, & the SWH should be higher than the highest water faucet to be used.
In the pressurized thermosiphon system, the water tank is at the same level as the SWH, thus a pump should be used to force the water to go from the cold-water tank to the SWH.

In the forced circulation system, the solar panel is on the roof while the hot water tank is in a separate place in the house or facility. Then, a pump is used to circulate heat transfer fluid (HTF) from the solar panel to the hot water tank.

Figure 8 illustrates the cumulative number of systems (by type) installed by QSWHC in the Lebanese market between 2010 and 2020 while Figure 9 shows the market share of each type in the Lebanese market during the same period. Thermosiphon systems are the most widely used as a typical Lebanese household can install a SWH on its roof and tends to raise the cold-water tank to increase water pressure. Pressurized thermosiphon systems come in second while forced circulation systems come last with less than 2,750 installed systems.

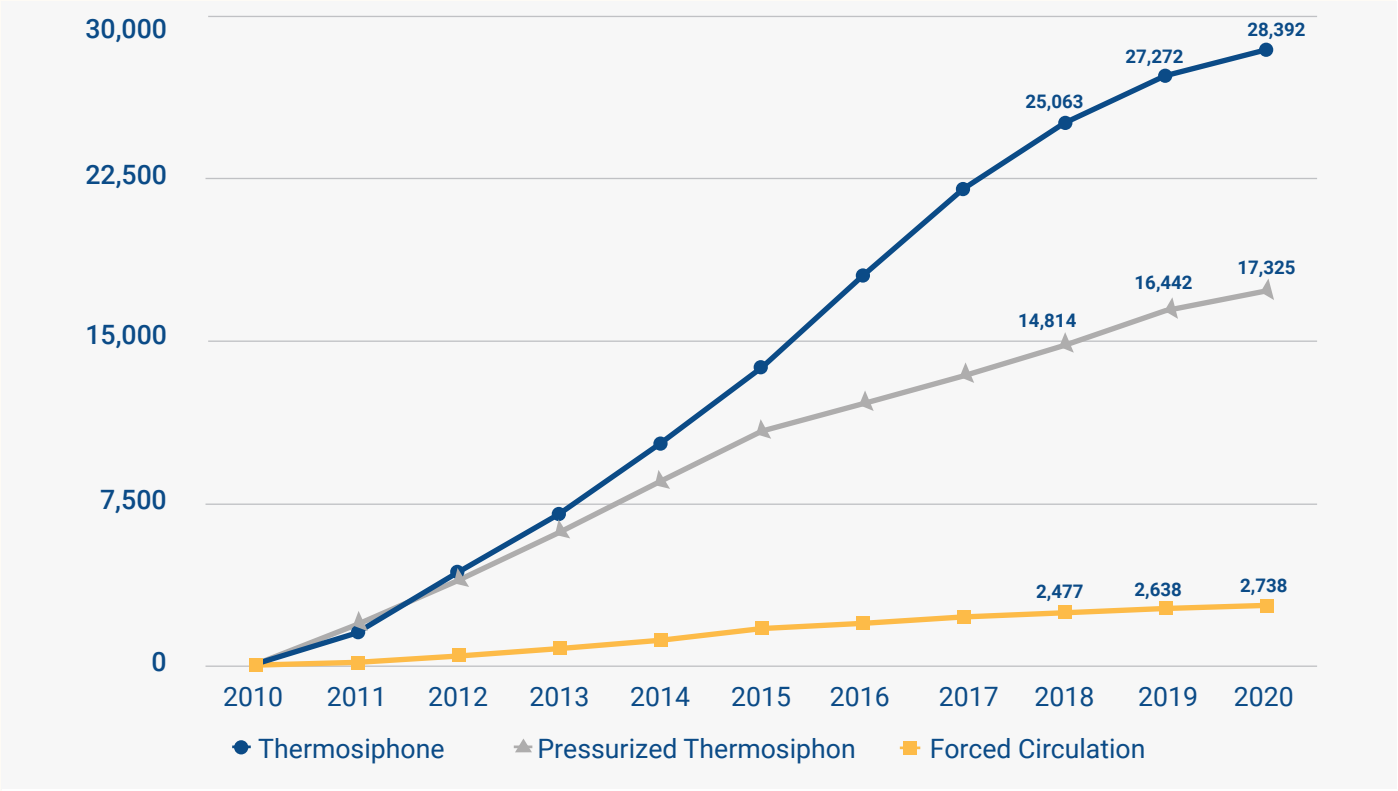


Figure 8: Cumulative number of systems (by type) installed by QSWHC in the Lebanese market between 2010 and 2020

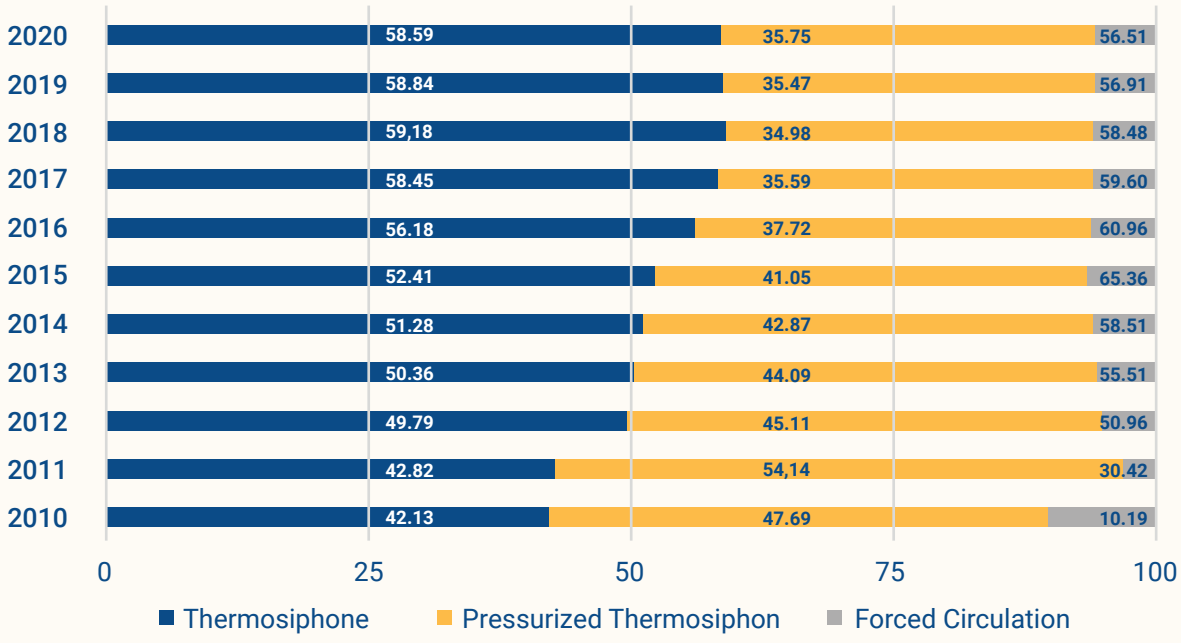


Figure 9: Market share of systems (by type) installed by QSWHC in the Lebanese market between 2010 and 2020.

5. Countries of Origin of Systems

A sizable portion of the SWH systems is manufactured in Lebanon, but some systems and components were imported primarily from the following ten countries (listed alphabetically): Austria, Bulgaria, China, Czech Republic, Germany, Greece, Italy, Netherlands, Spain, and Turkey.

The total number of imported components surpasses the number of systems, as a single system may have an imported panel from one country while the tank is from another country. Figure 10 shows the breakdown by country of origin for the different components entering the Lebanese market from each of the ten countries and from Lebanon. China represents the top country of origin as Chinese components have the largest share of installed tanks and panels in the market. Lebanon ranks second, followed by Germany, then Turkey. These four countries represent 93 per cent of the total QSWHC market, while the other countries have a combined share of seven per cent.

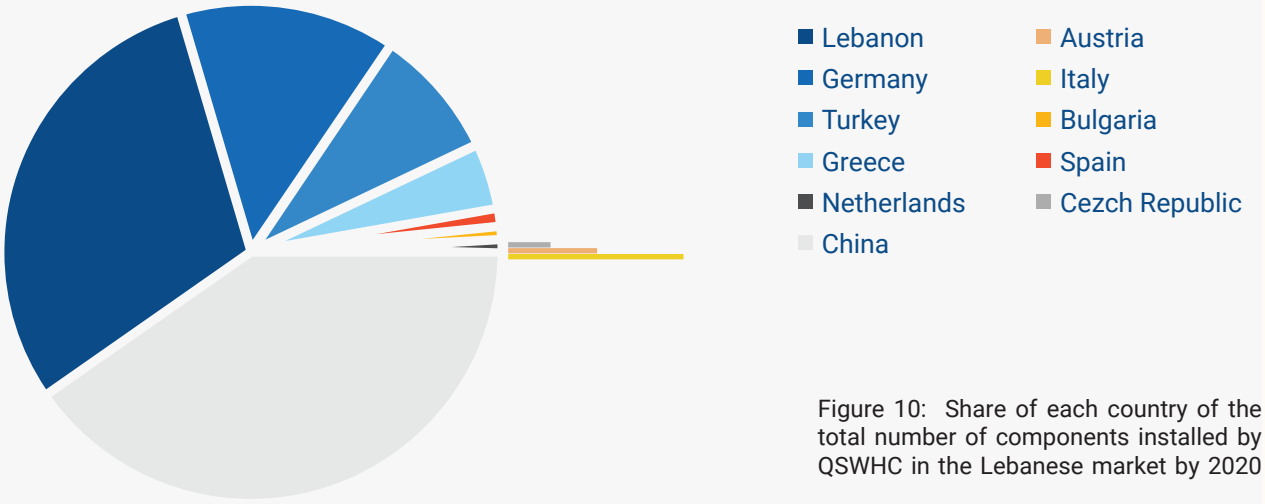


Figure 10: Share of each country of the total number of components installed by QSWHC in the Lebanese market by 2020

The below Figure 11 highlights the annual evolution of locally manufactured vs imported components. It demonstrates a steady increase in the share of locally manufactured components that reached 69 per cent in 2020.

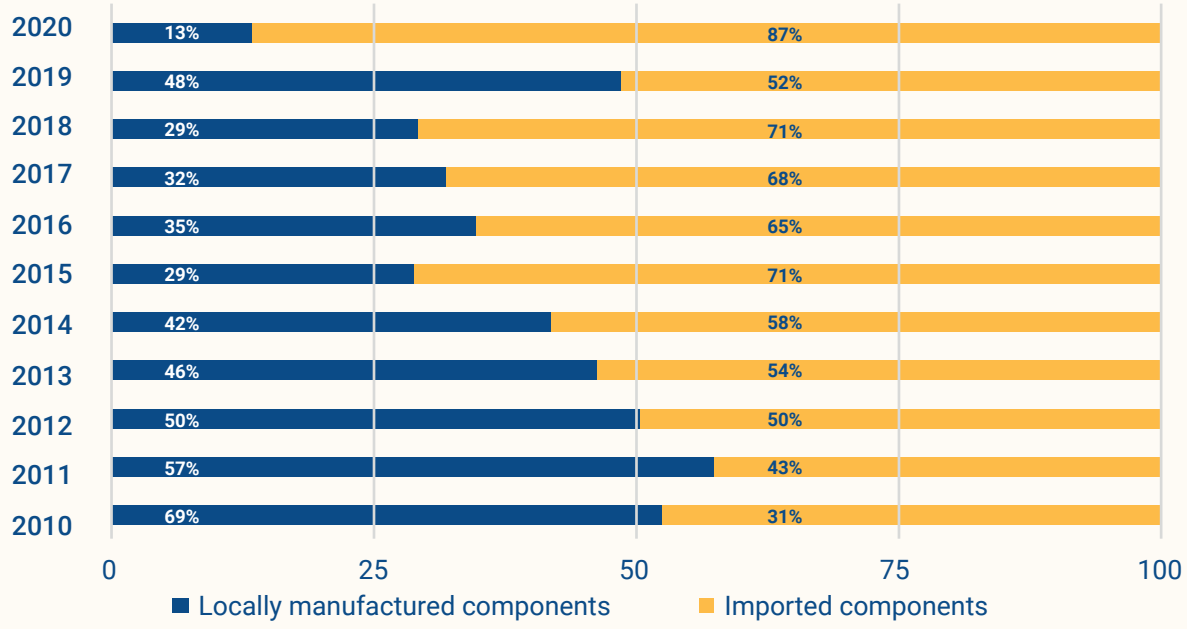


Figure 11: Evolution of locally manufactured components between 2010 and 2020

6. Geographical Distribution of the QSWHC Market in Lebanon Within Districts

Figure 12 represents installed systems in each of the Lebanese districts. Metn comes in first with a total share of 13.3 per cent of the Lebanese market. The top five districts—Metn, Koura, Beirut, Kesrouan, and Saida—have a combined share of 41.7 per cent of installed systems in the QSWHC market while seven other districts have the lowers share of only 4 per cent of the QSWHC market. This indicates the need to implement an awareness campaign that targets these areas where a satisfying development in the SWH sector has not yet been realized.

Figure 13 represents installed capacity in litres in each of the districts of Lebanon. Some districts such as Nabatieh and Koura have a lower rank in installed capacity compared to their rank in terms of number of installed systems, which represents a tendency for clients in these districts to choose small individual systems. Beirut ranks higher in terms of installed capacity, which reflects a tendency to install larger collective systems.

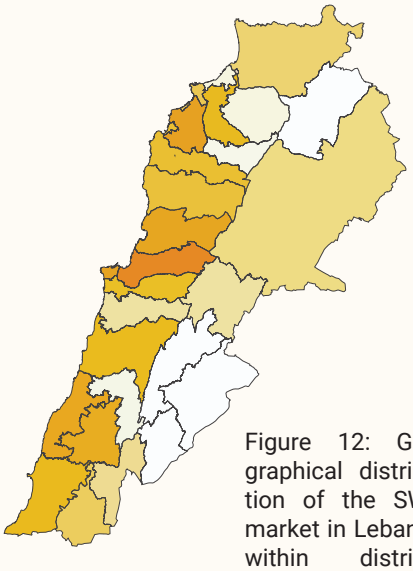


Figure 12: Geographical distribution of the SWH market in Lebanon within districts

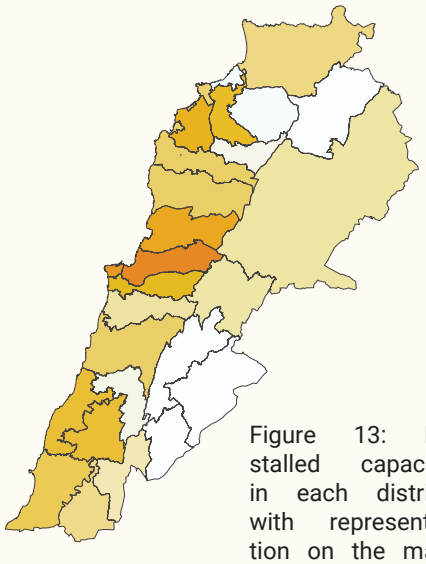


Figure 13: Installed capacity in each district with representation on the map

District	Percentage
Metn	13.3
Koura	7.5
Beirut	7.4
Kesrouan	7.0
Saida	6.4
Nabatiyeh	6.3
Zgharta	5.0
Tyr	4.7
Chouf	4.7
Baabda	4.4
Batroun	4.3
Jbeil	4.1
Tripoli	4.0
Bint Jbeil	3.7
Akkar	3.2
Baalbek	2.6
Marjeyoun	2.5
Aley	2.4
Zahle	2.3
Jezzine	1.2
Bcharre	1.0
Miniyeh-Danniyeh	0.9
Western Bekaa	0.3
Hasbaya	0.3
Rashaya	0.2
Hermel	0.1

District	Percentage
Metn	15.3
Beirut	10.4
Kesrouan	7.7
Koura	6.6
Baabda	5.9
Zgharta	5.3
Saida	4.7
Nabatiyeh	4.7
Tyr	4.3
Chouf	4.0
Jbeil	4.0
Batroun	3.8
Tripoli	3.5
Akkar	3.2
Bint Jbeil	3.0
Aley	2.9
Baalbek	2.5
Zahle	2.3
Marjeyoun	2.0
Jezzine	1.4
Bcharre	0.9
Miniyeh-Danniyeh	0.8
Western Bekaa	0.3
Hermel	0.2
Hasbaya	0.2
Rashaya	0.2

7. Technology Market Share

1. Number of Installed SWH Systems

Figure 14 details the evolution of the number of installed projects by QSWHC since the SWH Program began. According to this figure, Flat Plate (FP) collectors dominated the market with a 56 per cent market share in 2011. One year later, Vacuum Tube (VT) collectors gained a lot of market share, reaching 65 per cent, showing an annual increase of almost 30 per cent up till 2016. The VT collector market then witnessed a drop of 59 per cent of installed projects during the period between 2017 and 2020, while the number of installed FP collector projects fell by 67 per cent during the same period.

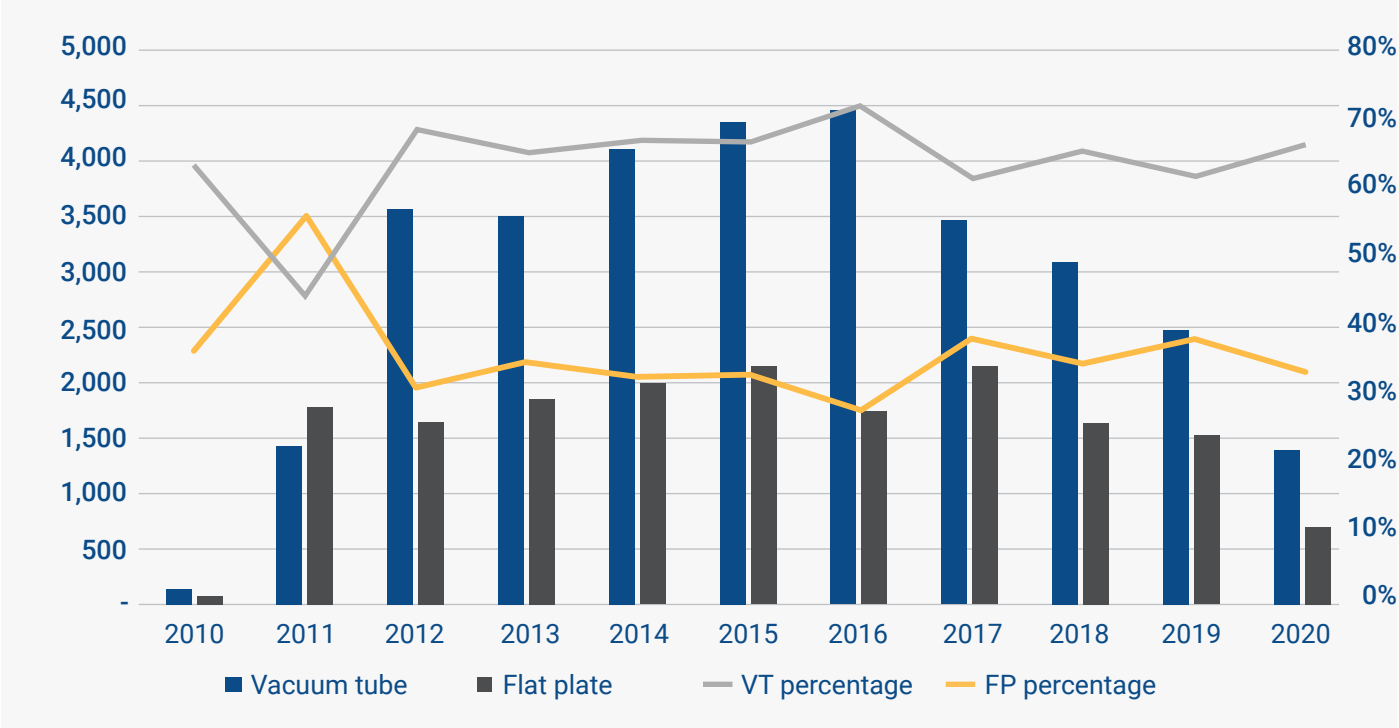


Figure 14: Number and percentage of SWH systems by collector type, 2010-2020

To have a broader look at the QSWHC market, the technology market share is further analysed into small-scale systems and large-scale systems. Small-scale systems have capacities that are less than 500 litres and are mostly used for residential applications. Large-scale systems have capacities larger than 500 litres and are mostly used for industrial and commercial applications.

Figure 15 displays the number of systems installed by technology for small-scale systems, while Figure 16 shows the number of systems installed by technology for large-scale systems. On the other hand, Figure 17 and Figure 18 illustrate the Lebanese market share for both small and large-scale SWH systems respectively during the period between 2010 and 2020.

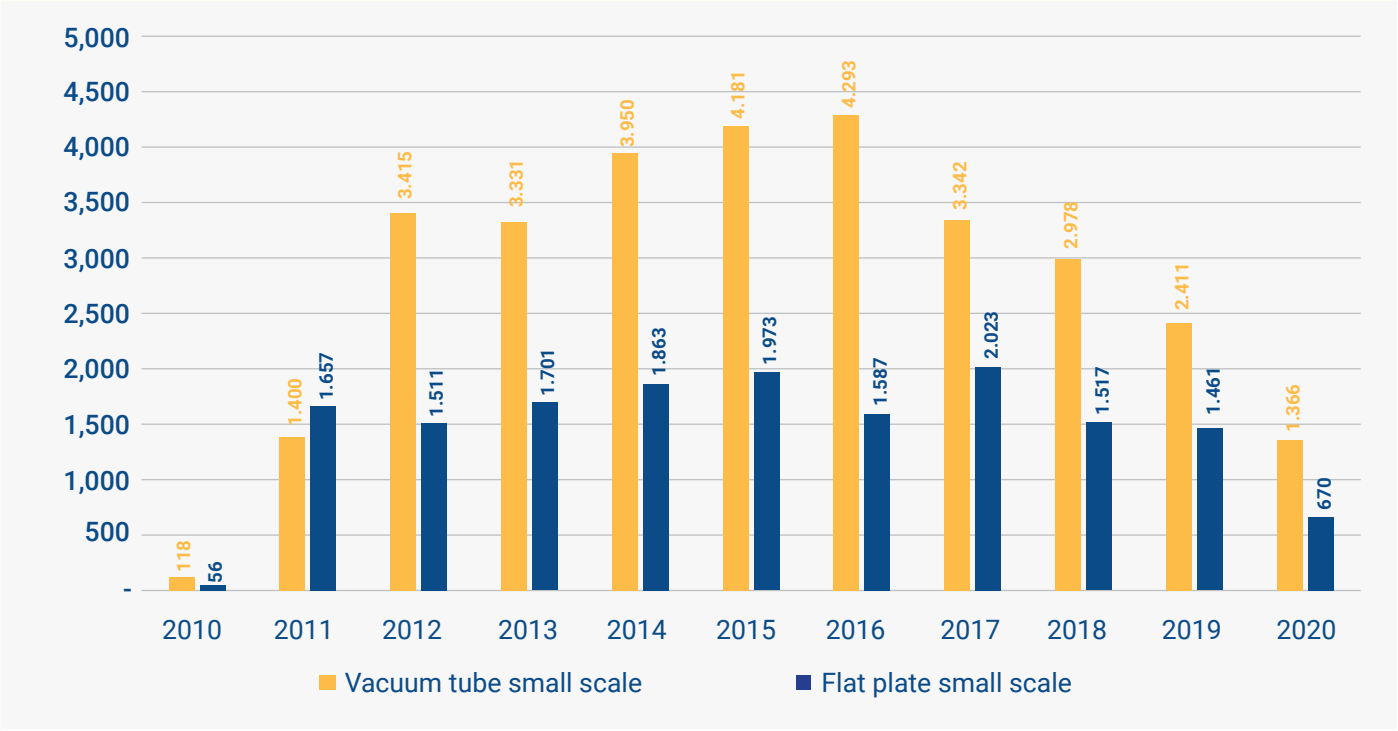


Figure 15: Number of small-scale SWH systems by technology, 2010 – 2020

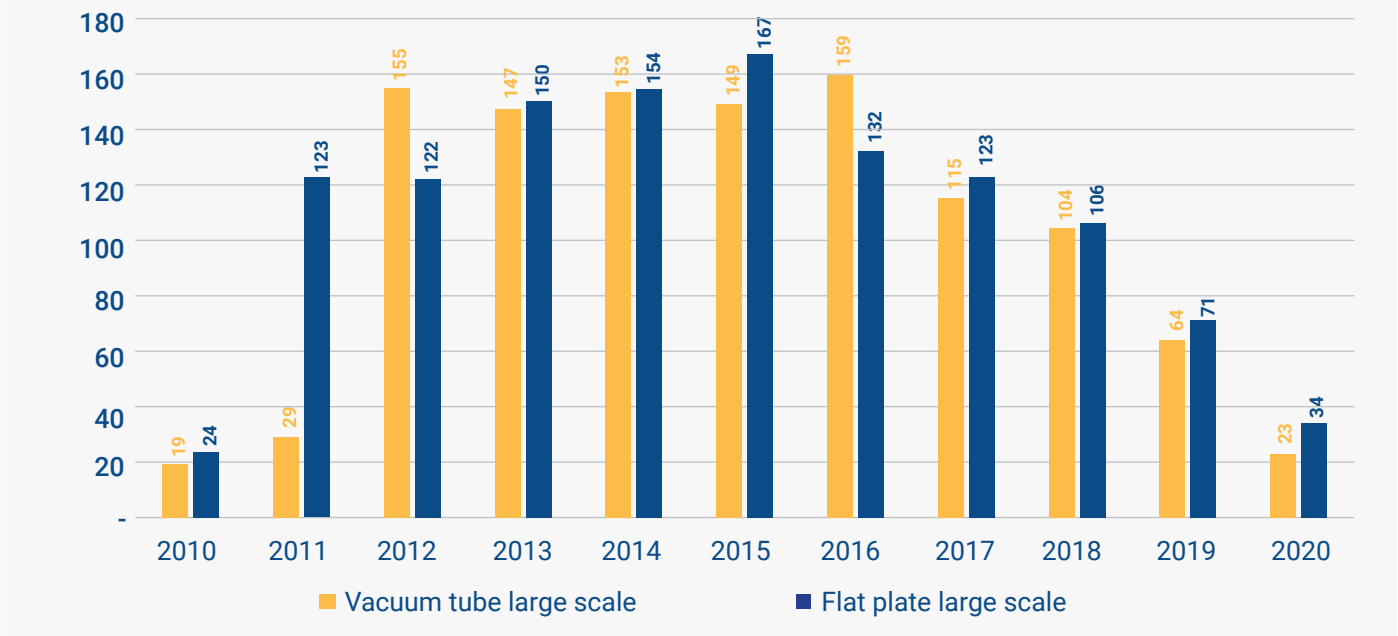


Figure 16: Number of large-scale SWH systems by technology, 2010 – 2020

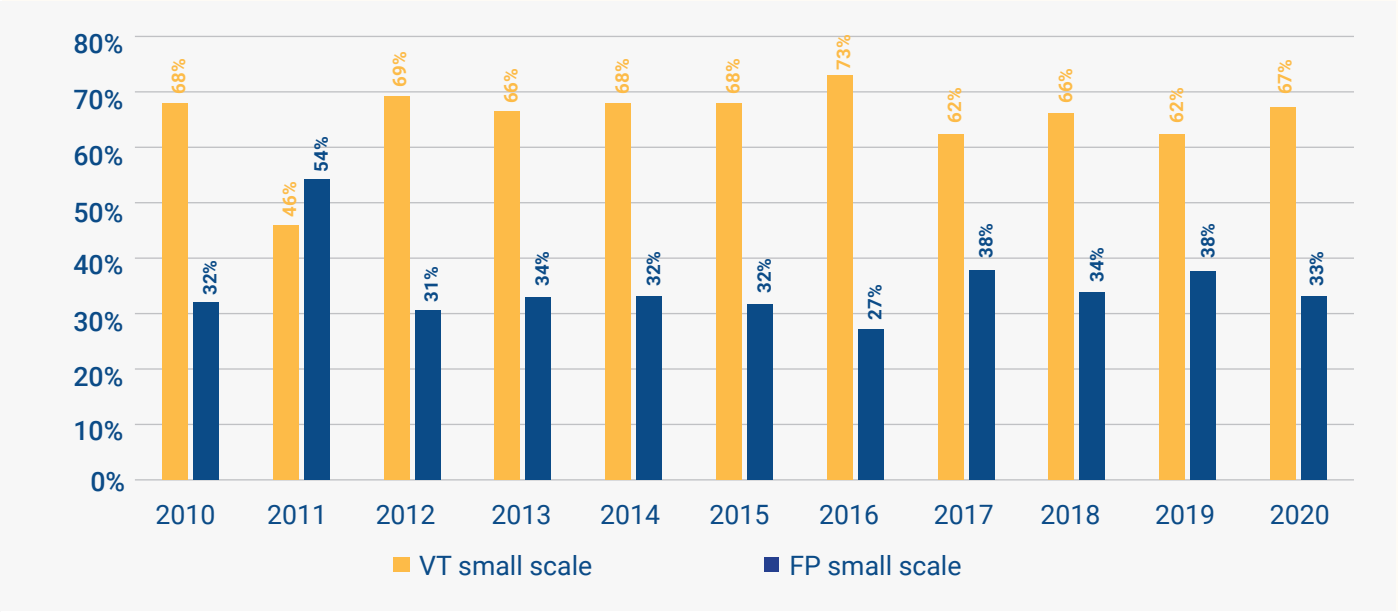


Figure 17: Market share of small-scale SWH systems by technology, 2010 – 2020

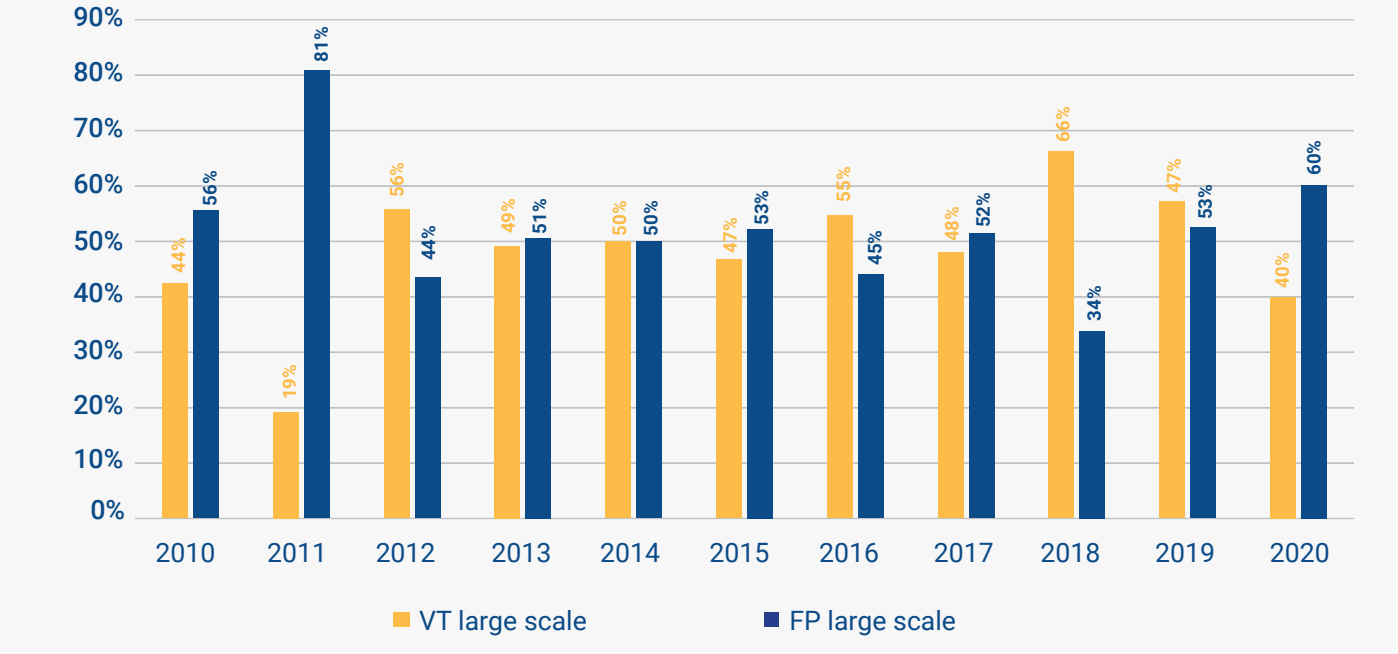


Figure 18: Market share of large-scale SWH systems by technology, 2010 – 2020

Figure 15 shows that for small-scale systems, and since 2012, the market share for VT collectors has been nearly double that of the FP market. Figure 16 shows that for large-scale systems, and since 2012, the market share of VT has been almost the same as FP collectors, albeit it is worth noting that the market share for large-scale systems is less than ten per cent of the number of the small-scale systems, indicating a very small market in terms of number of systems.

2. Installed Surface Area and Capacity

Figure 19 shows that both VT and FP technologies had a steep increase in the annually installed surface area between 2010 and 2012. From 2012 to 2014, both technologies had a similar installed surface area. However, in 2014, the gap between VT and FP increased and installed capacity for VTs kept growing until 2017. Between 2017 and 2020, the gap between VT and FP did not remain steady because the dominant technology changed each year, and the total installed surface area was decreasing during that period. Figure 20 shows that VT has a higher installed capacity than FP between 2011 and 2017; however, the gap between the two technologies shrunk in 2020.

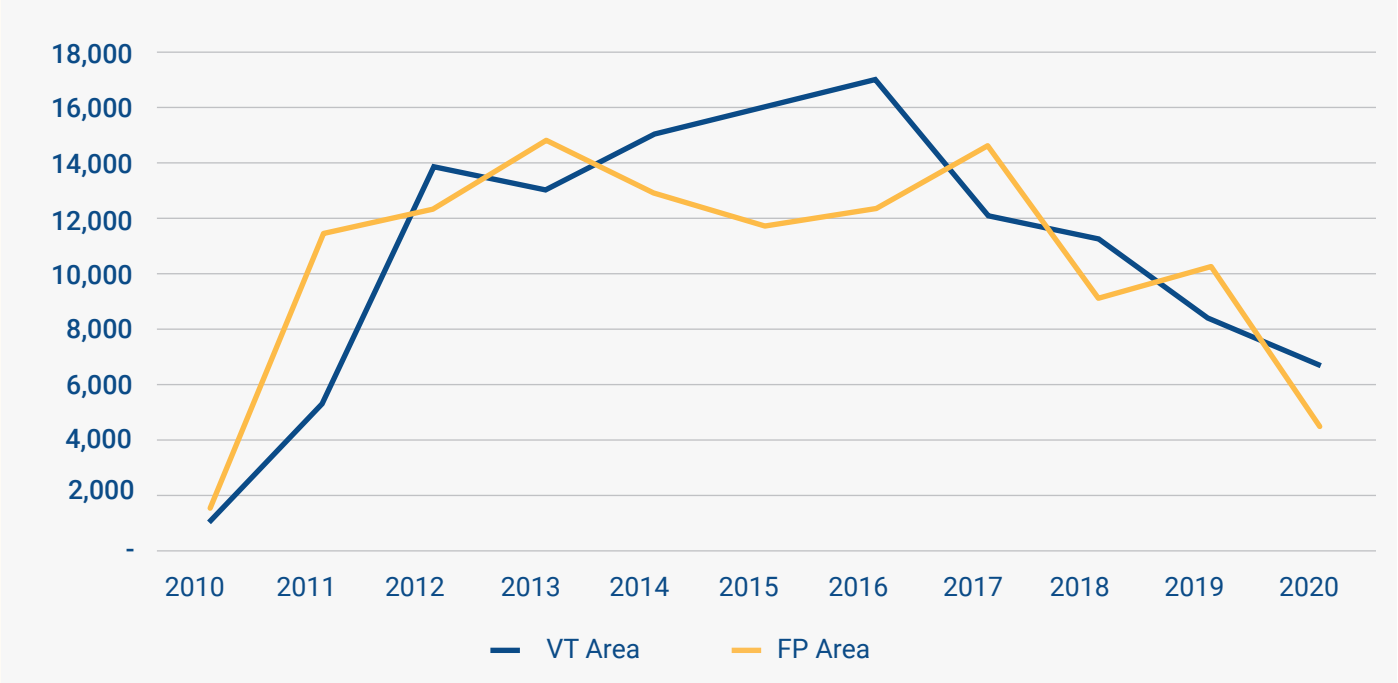


Figure 19: Yearly installed SWH surface area in sqm by technology, 2010 - 2020

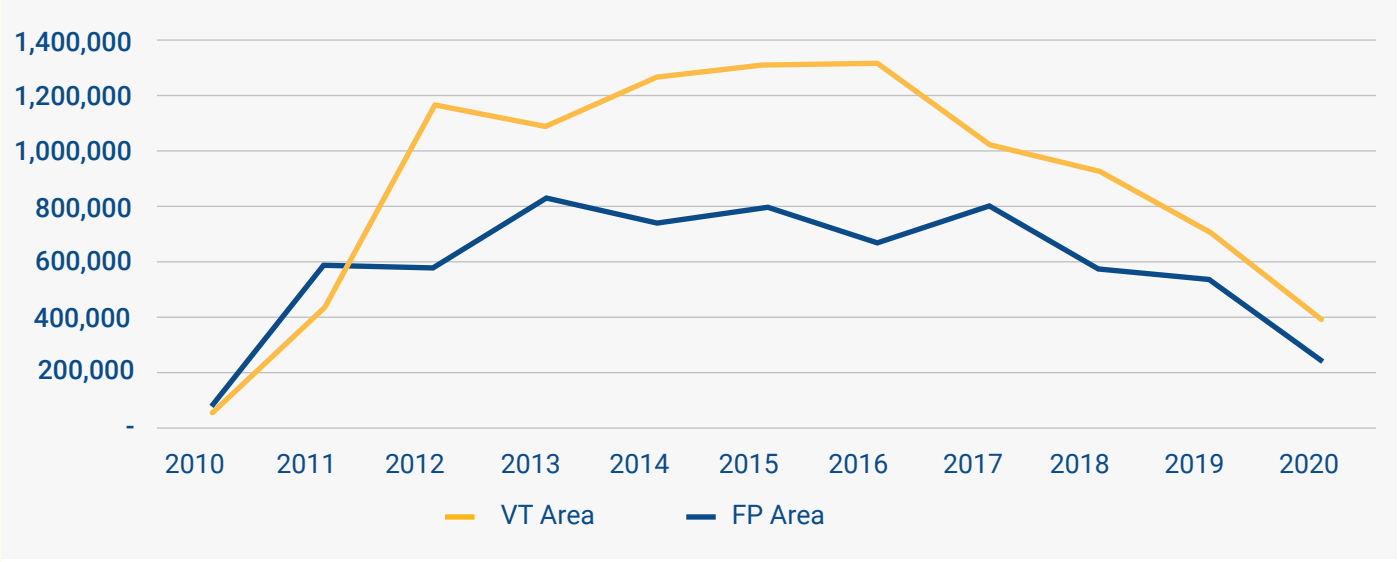


Figure 20: Yearly installed SWH capacity in litres by technology, 2010 – 2020

Comparing the two technologies in the small-scale systems category for their average surface area and capacity per system, Figure 21 shows that VT SWH systems require a lower average surface area per system than FP, while FP SWH systems have a higher installed surface area per system. Figure 22 shows VT SWH systems had a higher average capacity per system until 2016 when FP systems started to have a higher average capacity per system than VT. The fluctuation in 2019 and 2020 in the average area for small-scale systems is related to the drastic decrease in the number of installed projects that the Lebanese market had witnessed as previously mentioned.

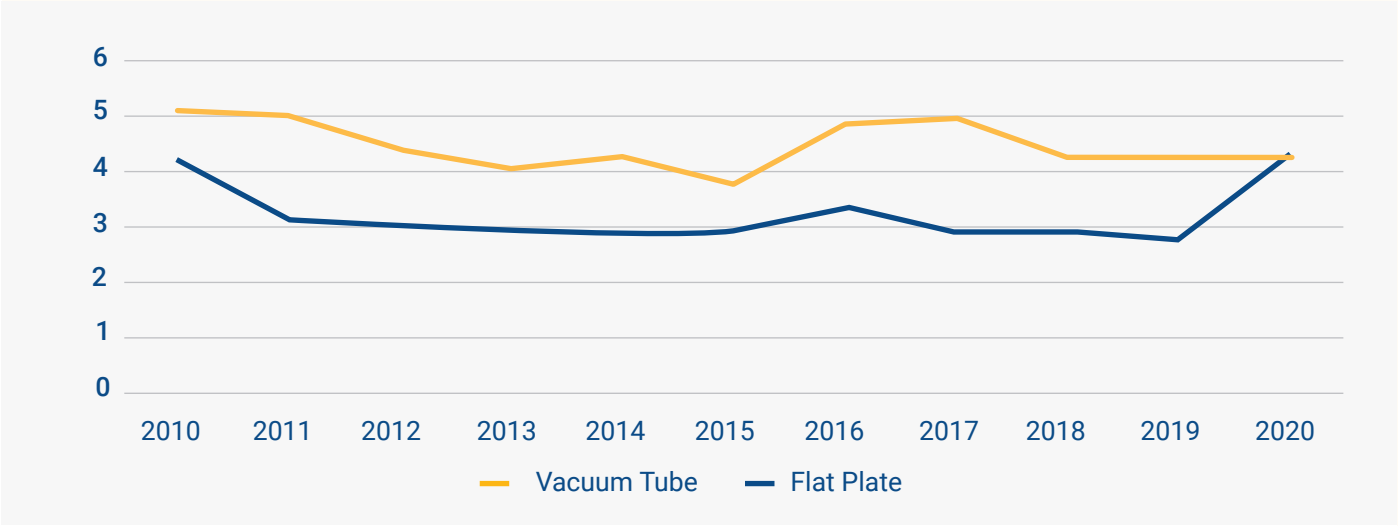


Figure 21: Average area per SWH system in sqm by technology for small-scale systems, 2010 - 2020

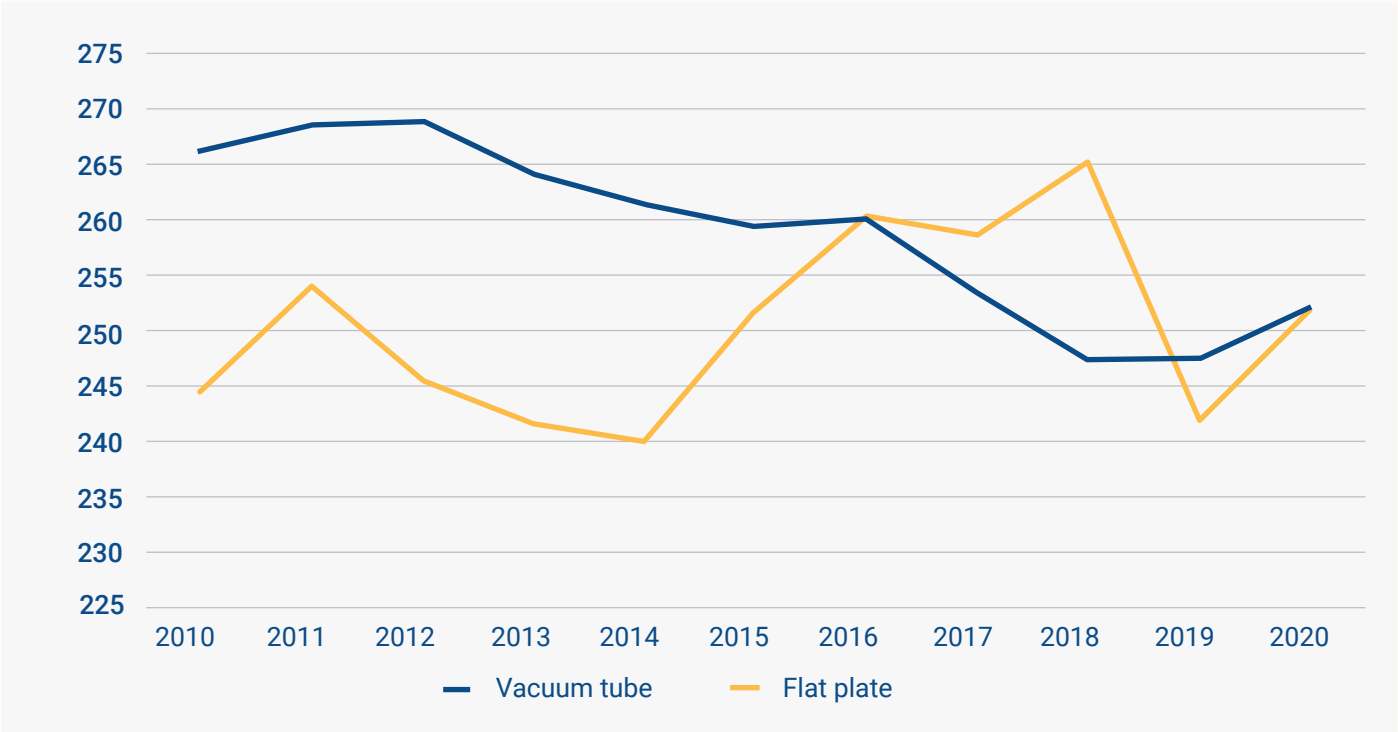


Figure 22: Average capacity in litres per SWH system by technology for small-scale systems, 2010 – 2020

Figure 23 shows that large-scale FP SWH systems are normally larger in area than large-scale VT SWH systems. Figure 24 shows that large-scale FP SWH systems also have a higher average capacity (in litres) than VT systems. Due to the low number of installations of large-scale systems (an average of around 200 systems per year), fluctuations can be seen within the graph.

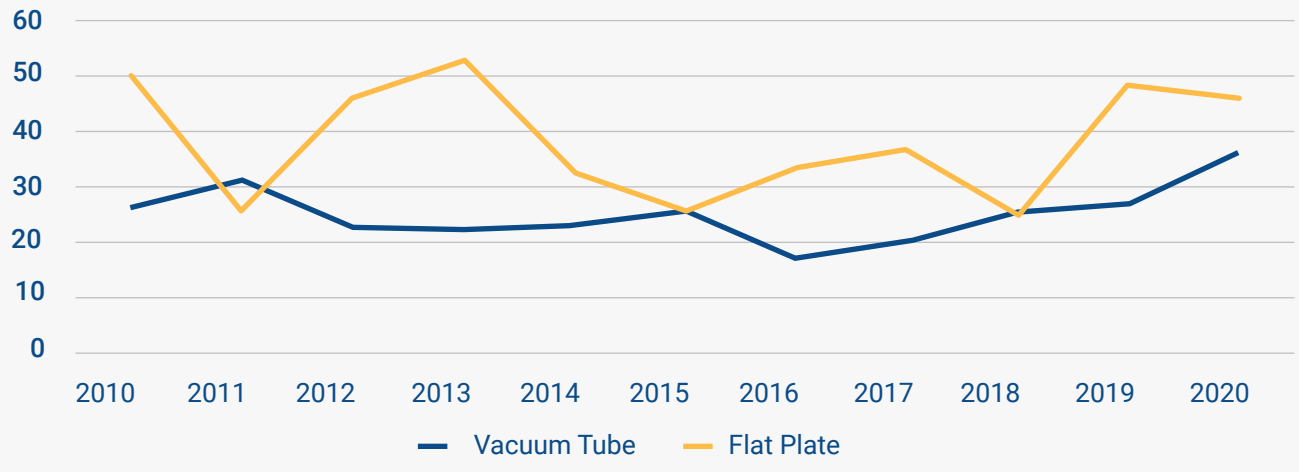


Figure 23: Average area in sqm per SWH system by technology for large-scale systems, 2010 - 2020

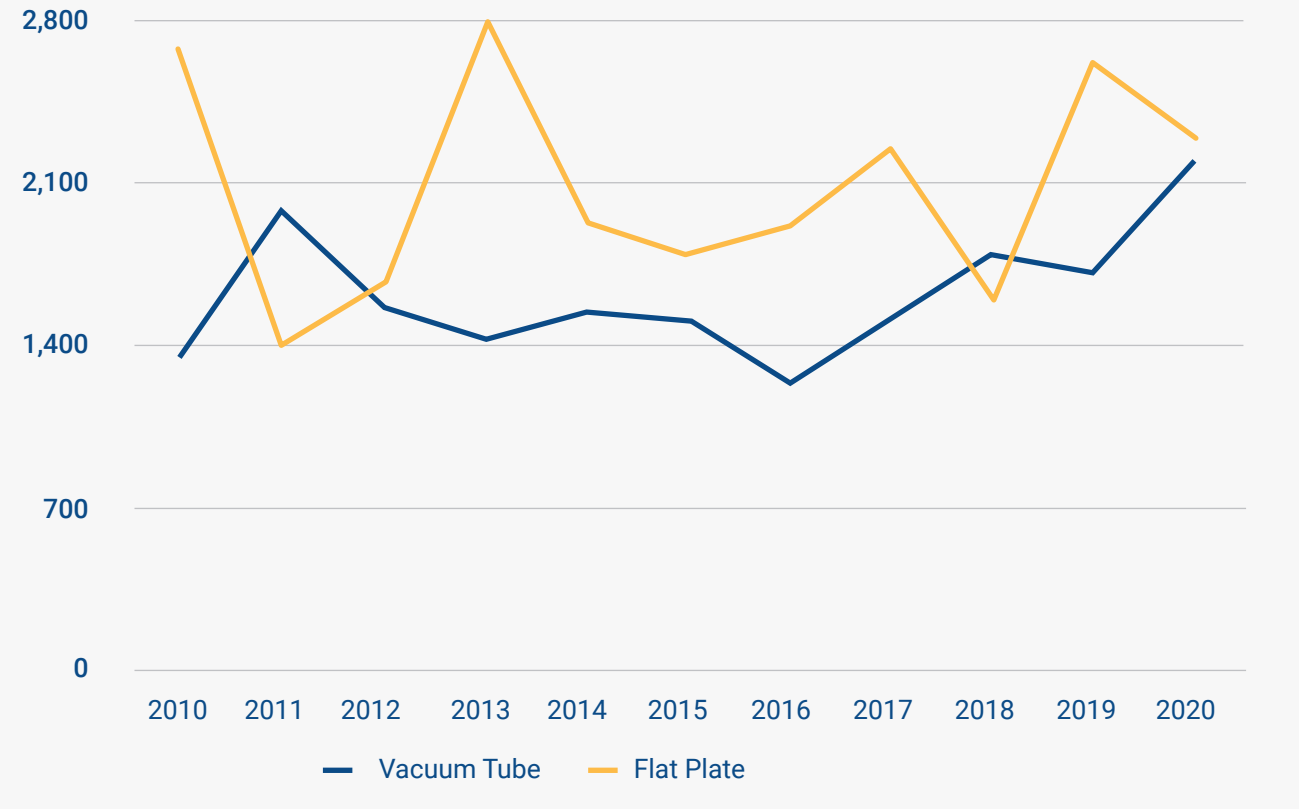


Figure 24: Average capacity per SWH system in litres by technology for large-scale systems, 2010 - 2020

4. Average System

In this section, the average SWH system installed in Lebanon during the period between 2010 and 2020 is presented in terms of surface area, capacity, and monetary value. The calculation for the average system was based on systems that are less than or equal to 500 litres in capacity.

Figure 25 shows the average system surface area per year installed between 2010 and 2020, while Figure 26 presents the average capacity installed in litres for systems below or equal to 500 litres during the same period.

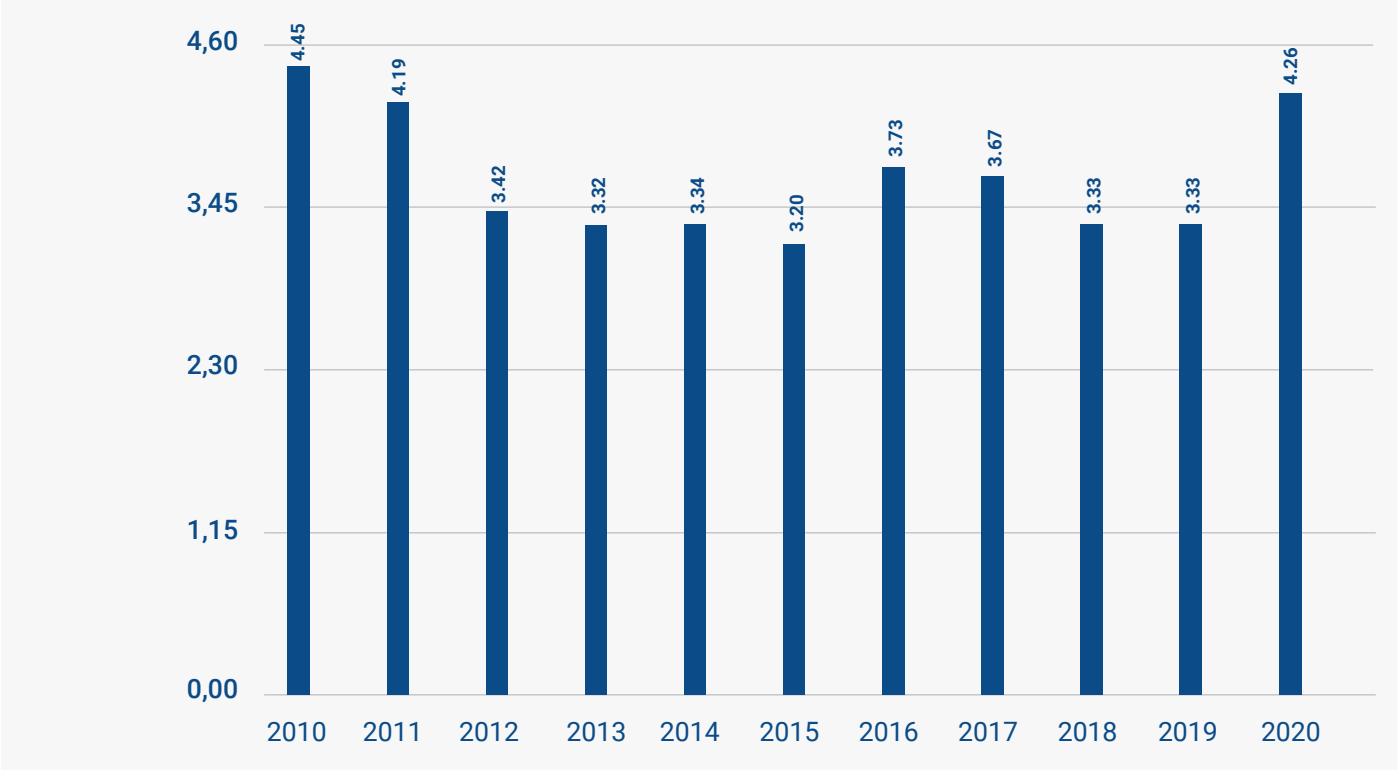


Figure 25: Average surface area in sqm installed between 2010 and 2020

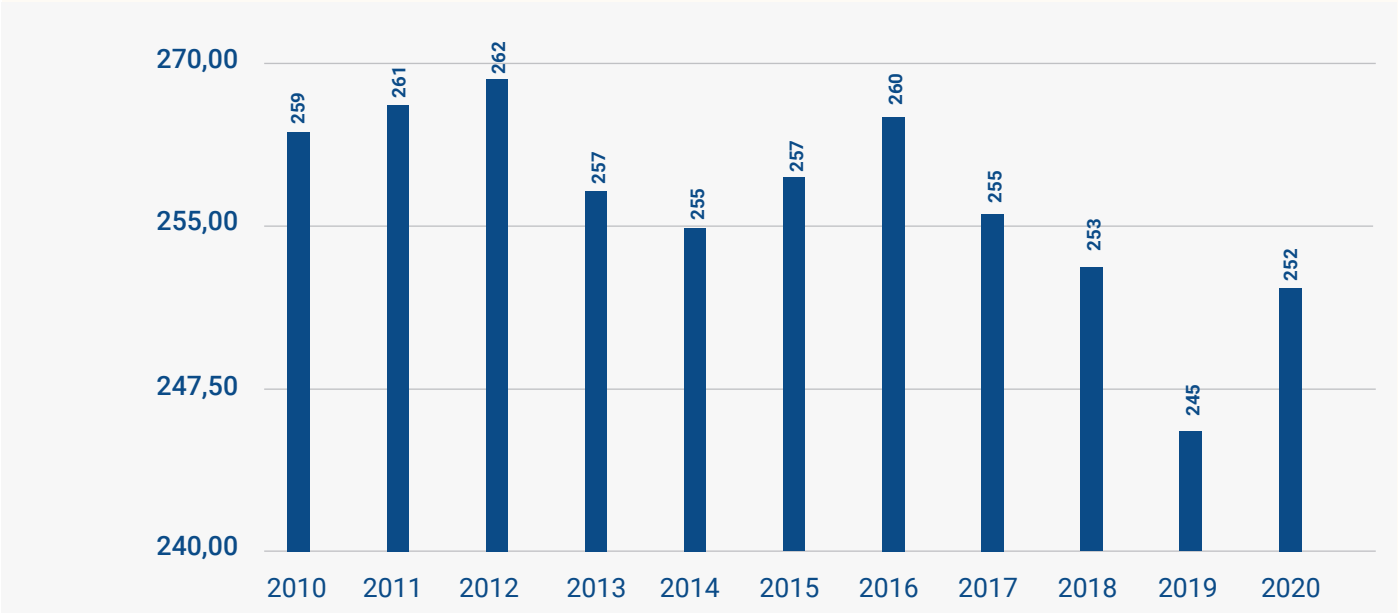


Figure 26: Average capacity installed in litres between 2010 and 2020

Figure 27 shows the average system cost installed between 2010 and 2020. The decrease in the cost of the system is due to the development of the SWH technology as well as the fact that 30 per cent of the cumulative installed systems are now manufactured in Lebanon.

In 2020, the cost for installing a SWH system below 500 litres capacity is $1,113.9 for a system of 4.26 sqm surface area and 252 litres of installed capacity.

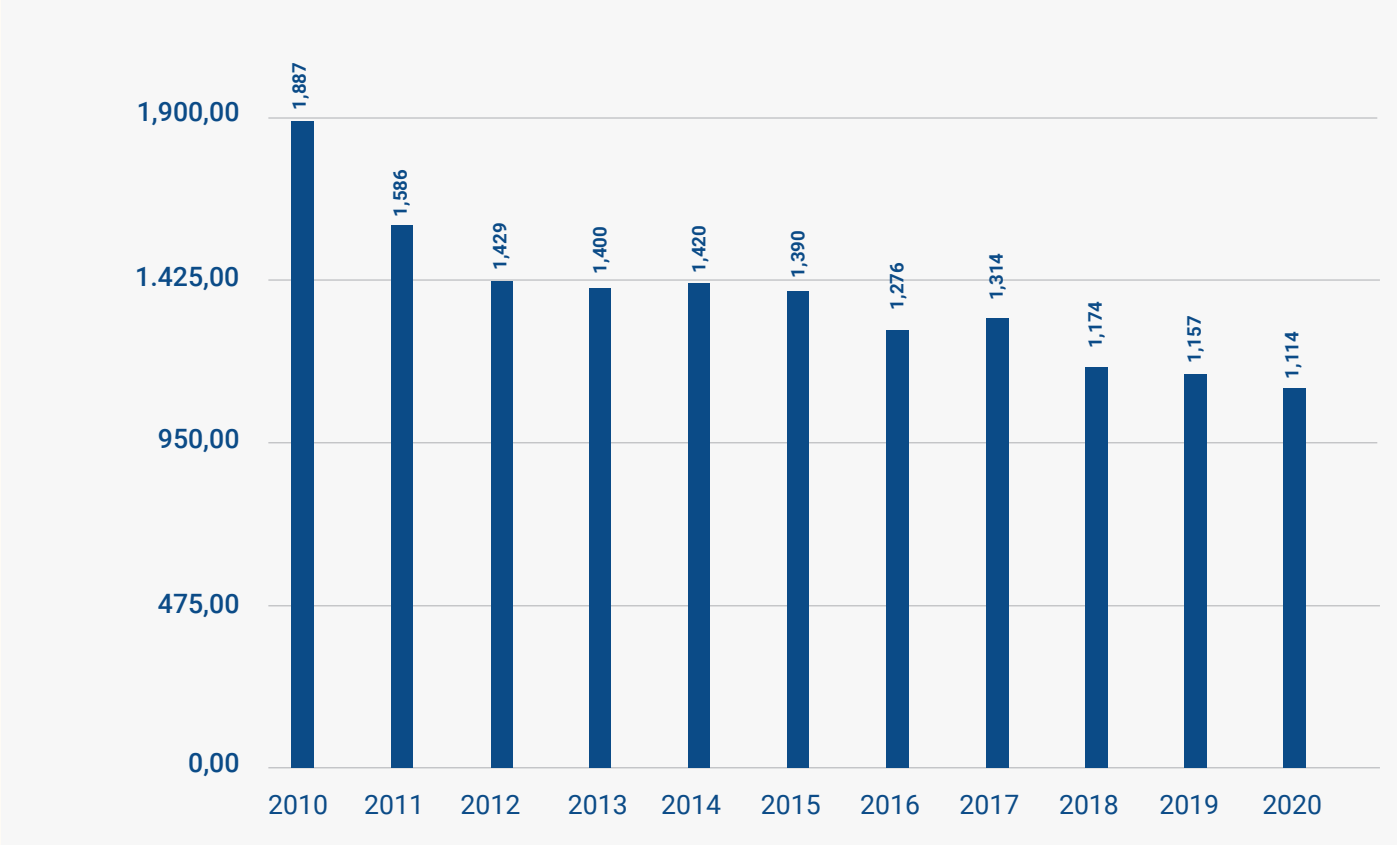


Figure 27: Average system cost in ($) for installed systems between 2010 and 2020

5. Economic, Environmental and Social Impact

According to a study done by LCEC, a liter of installed SWH saves 8.54 kilowatt-hours (kWh)/year(y). The study explores the performance of a solar hot water system in a single-family dwelling. The results showed that a 208-litre thermosiphon system saves 1,776 kWh/y of electricity (LCEC, 2009). According to this information and the number of installed capacity in litres, the yearly energy savings are calculated for all systems installed by QSWHC, the installed systems that benefited from low interest loans, and, finally, for all systems installed in the Lebanese market between 2010 and 2020 as presented in Table 1.

Table 1: Energy savings by consumers from SWH system installations, 2010–2020

Category	Capacity (litres)	Energy savings (kWh/y)	Offset CO_2 production (tonnes CO_2/y)
Systems installed by qualified companies	16,793,780	143,418,880	93,222
Systems installed by other entities	15,632,951	133,505,405	86,779
Systems financed via the low interest loan	3,645,840	31,135,474	20,238
Overall Lebanese market	**32,709,909**	**279,342,620**	**181,573**

Actual energy savings can reach 321,244,013 kWh/y at the level of Electricité du Liban (EDL) electricity generation. This value takes into consideration the 15 per cent loss during power transmission and distribution from the plant to the consumer as per the 2010 Policy Paper for the Electricity Sector (Bassil, 2010).

The grid emissions factor for Lebanon states that each kWh produced corresponds to 0.65 kg of CO_2 (United Nations Framework Convention on Climate Change, 2012). Thus, systems financed with low interest loans contributes to reduce 20.23 ktonnes of CO_2 per year, while the systems installed by the QSWHC helps in reducing 93.22 ktonnes of CO_2 per year. Moreover, the total reduction in CO_2 emissions for the Lebanese market between 2010 and 2020 were 1,376 ktonnes.

The solar water heater sector in Lebanon generated around 875 jobs for engineers, technicians, and laborers as per the QSWHC register data. Taking into consideration the total number of installations, the number of jobs in qualified and non-qualified SWH companies could be estimated at 1,550.

6. Road to 2030

The NREAP 2021-2025 that will be published soon suggests that the SWH market will witness a yearly increase of approximately 54,000 sqm. Thus, it is assumed that the total installed surface area will reach 1,028,486 sqm by 2025 and 1,296,854 sqm by 2030. It should be noted that the prediction for 2020 is to have a cumulative installation of 760,119 sqm, while the actual installation reached 735,401 sqm. Similar to 2020 and due to the economic situation, it is expected that NREAP projections for 2021 and 2022 will not be reached. This needs to be compensated for in the following years, especially with the enforcement of a solar ordinance mandating the installation of SWHs and/or air-to-water heat pumps in new buildings and buildings undergoing major renovation.

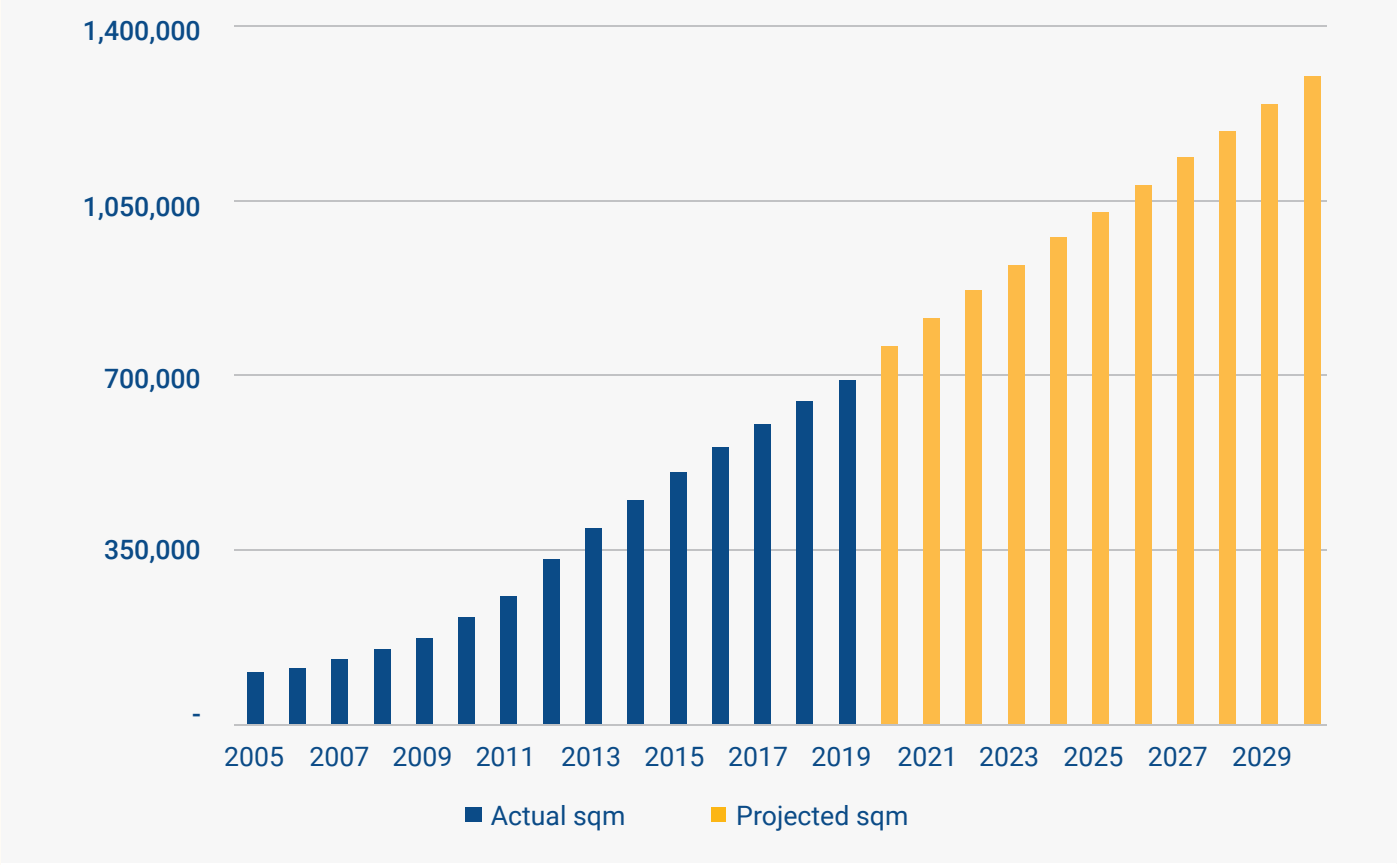


Figure 28: Forecasted installations as per NREAP 2021-2025

The NREAP 2021-2025 considers three scenarios. The first scenario looks at a three per cent yearly growth for the SWH sector with an additional heating demand being picked up by heat pumps and that is equivalent to half of the SWH market. In this scenario, 268,367 sqm of SWH will be installed between 2021 and 2025, translating to an extra 29.8 GWh of energy savings each year, in addition to the annual savings achieved by the end of 2020. An additional 14.9 GWh will be saved due to the installation of heat pumps, leading to a total yearly reduction of energy consumption by 44.7 GWh in addition to the previously installed systems.

The second scenario considers the same growth rate for SWHs without having advancements in the heat pump sector. This will lead to the same surface area installation, but savings will not include those achievable by heat pumps, leading to yearly savings of 29.8 GWh.

The third scenario assumes only half of the SWH surface area will be installed without any contribution by heat pumps, leading to additional yearly savings of 14.9 GWh.

7. Conclusion

The shrinking trend of SWH installations in Lebanon started in 2017 due to changes in subsidized loan procedures adopted by commercial banks followed by the economic crisis and later because of the global COVID-19 pandemic. This negative trend will worsen if no incentivizing measures are implemented in the near future specifically if the economic situation does not improve. Until then, measures such as the solar ordinance might help overturn the current trend. Even though the number of new buildings during this period is not expected to be as large as in previous years, major renovations of existing buildings are expected to take place to cut down costs. It is here where the ordinance will have a great impact.

Other initiatives would include strengthening the local production sector that could lead to lower prices of SWH systems. Additional initiatives may also lighten the burden on the sector, such as tax reductions for companies that work in the SWH field, and other tax incentives for end consumers. These tax reductions, while straining further the economy of the country on the short term, will help create job opportunities which in turn would help improve the economic cycle of Lebanon.

Finally, starting end of 2020, a new competitor for rooftop space started to emerge. Decentralized solar PV systems have started witnessing an important growth in demand, thanks to their continuous drop in cost, increase in efficiency, and increase in storage lifetime, combined with a reduction in electricity supply by both the EDL and private generators. Domestic electricity being of higher priority than hot water, SWHs will have to reinvent their image in the Lebanese market, capitalizing on their affordability, higher efficiency, lower use of roof space, and contribution to the local market. Most importantly, hot water, especially in winter, should be promoted as a basic need that should be available, even in times of economic hardship.

8. References

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9. Annex A: Qualified Solar Water Heater Companies

List of Qualified Solar Water Heaters Suppliers/ Installers
Version 26, dated December 21, 2021

- This list is issued by the Lebanese Center for Energy Conservation (LCEC) based on a set of criteria translated into a grading system.
- Companies are listed in alphabetical order.
- The list is not in any way a guarantee of quality but merely an interpretation of their certifications and the past performance of the companies. The client is responsible for checking what the company is installing for him/her.
- Company ratings range between 0 and 3 stars. A 3-Star rating corresponds to a well-established and experienced company while a 0-Star rating represents a company that is in the beginning of the growth stage.
- Product ratings range between 0 and 3 stars. A 3-Star rating corresponds to high-end certified products while a 0-Star rating represents an acceptable product.
- Qualified Systems are generally endorsed by LCEC.
- Passing Systems are generally acceptable but not recommended by LCEC.

Warnings:

- Attempting to use the list in an unethical manner or to use the subsidy and soft loan to market anything other than solar water heating will result in immediate blacklisting of the company in all current and future activities related to the Ministry of Energy and Water and the Lebanese Center for Energy Conservation.
- Customers who willingly install systems which are not solar water heaters using this soft loan will be charged an interest of a standard bank loan.
- It is the company's responsibility to keep checking the validity date of its product certificates. If LCEC finds any certificate to be outdated, the corresponding product will be re-evaluated without warning.
- Water stored in galvanized tanks is not suitable for drinking and cooking.

Akiki Pom Trading			
Contact Person: Ephrem Akiki	Contact Number: 03 217031	Address: Mazraat Kfardebian	
Item	**Qualified System**	**Passing System**	
System Name		JHC-5818-xx	FD-SC-xx★
Collector			
Tank			

Al Bina★★		
Contact Person: Salah Tabbara	Contact Number: 01 374287	Address: Clemenceau
Item	**Qualified System**	**Passing System**
System Name	Maltezos Sunpower xE/xxxL★★★ Maltezos Glass xE/xxxL★★★ Maltezos Inox xE/xxxL★★★	
Collector	Maltezos SAC Maltezos BAC Maltezos NCS	
Tank	Maltezos BLS1/2-C xxx	

Amec★			
Contact Person: Fadi Abousleiman	Contact Number: 04 715073		Address: Antelias
Item	**Qualified System**		**Passing System**
System Name	Mark 4-xxx★★★	FC-S1/L1/L2 ★★★	
Collector		M4-200	
Tank		CL2	

Aqua Solar ★★					
Contact Person: Michel Khairallah	Contact Number: 04 546511/2				Address: Dbayeh
Item	**Qualified System**				**Passing System**
System Name	FS 1/2★	FS 3/4	FS 5/6/7★	WTS System★	
Collector	AL 2000 /2600	HP/DF	SOL200/ 250/250H	AL 2000 /2600	
Tank	Si200.500	Si200.500	Si200.500	Chappee	

Binateck		
Contact Person: Ragheb Bou Fakhereddine	Contact Number: 05 370804	Address: Kobieh
Item	**Qualified System**	**Passing System**
System Name		TSF/TSFX★
Collector		AFS
Tank		HTJ

Consolidated Technology Industries (CTI) ★★★				
Contact Person: Marc Yachoui	Contact Number: 04 721800			Address: Jal El Dib
Item	**Qualified System**			**Passing System**
System Name	CTI-S-1…24★★			
Collector	CTI-TU-xxx	CTI-TE-xx	Gasokol/ Planetsol	
Tank	Enameled Tank			

Dawtec★★★						
Contact Person: Sandra Aoun	Contact Number: 01 288688					Address: Jisr El Bacha
Item	**Qualified System**					**Passing System**
System Name	Flat Plate-ECO★	Sigma★	RTPS	KSPT/ ARTL	Deema S	Deema
Collector		MED				
Tank			Kodsan	Kodsan	Stainless Steel	Galvanized

Earth Technologies★		
Contact Person: George Abboud	Contact Number: 04 444961/3	Address: Antelias
Item	**Qualified System**	**Passing System**
System Name	ET-Megasun xxx★★	
Collector	SP-xxx	
Tank	M xxx	

Electro-mechanical and Automation Systems (EAS)				
Contact Person: Ahmad Barakat	Contact Number: 01/843024	Address: Jnah		
Item	**Qualified System**	**Passing System**		
System Name		TZ58/1800★	TZ58/1800-S	TZ58/1800-R5
Collector		TZ58/1800	TZ58/1800-S	TZ58/1800-R5
Tank		TZ58/1800	TZ58/1800-S	SST-two coil

Elias Bou Melhem & Sons		
Contact Person: Sayed Abou Melhem	Contact Number: 81 239000	Address: Kferhata Zgharta
Item	**Qualified System**	**Passing System**
System Name	AS xxx/x.x★★★	
Collector		
Tank		

Ezzedine Solar Energy★★		
Contact Person: Mohammad Ezzeddine	Contact Number: 07 381456	Address: Deir Kanoun El Naher
Item	**Qualified System**	**Passing System**
System Name		ESE ESE REH ESE pressurized ESE pressurized reheated ESE collector ESE collector reheated ESE collector anti-freeze ESE collector anti-freeze reheated
Collector		VT58mm/xx VTHP58mm/xx
Tank		

FASCO★		
Contact Person: Khaled Abi El Cheikh	Contact Number: 07 730630 03 645406	Address: Saida
Item	**Qualified System**	**Passing System**
System Name	KA9x/CN-xxxLTR(P) 1.2M Txx★ KA60099x/CN+xxxLTR SS316 1.5M Txx COIL★ KA400303 1/SPLIT UNIT TR24/1.8	KA6009x/LB-xxx LTR SS316L Txx KA7x/CN-xxxLTR 1.2M Txx
Collector		
Tank		

GAPS				
Contact Person: Badri Kiwan Merwan Kiwan	Contact Number: 71 548387 03 334555	Address: Shouf		
Item	**Qualified System**	**Passing System**		
System Name		Integrated Pr.	Split Pr.★	Split Pr.★★
Collector		DAC	SCM	Navi+
Tank		DAC	SHSDH Schneller Tank	SHSDH Schneller Tank

GEM★				
Contact Person: Jean Bou Chaaya	Contact Number: 03 580705	Address: Dekwaneh		
Item	**Qualified System**	**Passing System**		
System Name		Open Loop	High Pressure	Compact Solar
Collector		YYJ-R01	YYJ-S01	YYJ-IP01
Tank				

Ghaddar for Commerce and Construction★		
Contact Person: Zouhour Ghaddar	Contact Number: 07 220197	Address: Ghazieh
Item	**Qualified System**	**Passing System**
System Name		
Collector		SolColl P/T
Tank		Sol Tank

Ghaddar Trade and Industry ★★★		
Contact Person: Sahar Ghaddar	Contact Number: 07 221956	Address: Ghazieh
Item	**Qualified System**	**Passing System**
System Name	Aelios★★★	Sunfire★★
Collector	Aelios CUS	Aelios CUS
Tank	Aelios	Txxx

Green Essence ★★				
Contact Person: Francois Farage	Contact Number: 03 748702			Address: Zahle
Item	**Qualified System**			**Passing System**
System Name	FPC 1200D ★★ TZ58/1800-xxR★★ TZ18CPC ★★ TZ58/1800-xxR5★★ TZ58/1800-xxT★★	TZ58/1800-xxE/C ★★★	YYJ-C01-xx	YYJ-R-5818-xx
Collector				
Tank	HE2V		HE2V	

Houssam Rifai and Partner for General Trading (Future Technologies) ★				
Contact Person: Houssam Rifai	Contact Number: 08 375876			Address: Douris
Item	**Qualified System**			**Passing System**
System Name	Forced Circula-tion ET SS	Vacuum tube thermosiphon	Pressurized vacuum tube thermosiphon	
Collector	KFP 1800*58-30	KFP 1800*58-24 KFP 1800*58-30	KFP 1800*58-18 KFP 1800*58-20 KFP 1800*58-24 KFP 1800*58-30 KFP 1800*58-36	
Tank				

Il Bagno			
Contact Person: Edgard Elias	Contact Number: 03 688866		Address: Zouk Mosbeh
Item	**Qualified System**		**Passing System**
System Name	WOLF-0x★★★	TML-0x★★★	
Collector	CFK-1		
Tank	SE - SEM	DSFV – BMV	

Khoueiry Co.			
Contact Person: Michel Khoueiry	Contact Number: 03 723175		Address: Kornet Chahwan
Item	**Qualified System**		**Passing System**
System Name	Wunder★★		
Collector	ALS2110	ALS2512	
Tank	Solimpeks		

Khoury & Abu Rjeily (Synergy Green)					
Contact Person: Naji Khoury	Contact Number: 01 893715	Address: Hadath			
Item	**Qualified System**	**Passing System**			
System Name		SIDITE SD-T	SIDITE SP-C	SIDITE SC-H ★	SICC
Collector		1800X58			
Tank		K&R001	K&R0040	K&R090	K&R090

Mawared & Construction Company (Kypros)★★★		
Contact Person: Hanna Akar	Contact Number: 01 255400	Address: Dora
Item	**Qualified System**	**Passing System**
System Name	KPT xxxL★	KGT xxxL
Collector	KCT	KCT
Tank	KBP	KBG

Mecha Basic Industries S.A.R.L.★			
Contact Person: Mounir Daknach	Contact Number: 71 402238		Address: Beirut
Item	**Qualified System**		**Passing System**
System Name	PRO+xxxA/B★★★ ECO xxxA/B★★★	FORxxxA/B★★★	
Collector	SundwarePro	SundwarePro	
Tank	Thermosiphon SS/ ECO	Forced xxx/ 2 Coils	

Mereco		
Contact Person: Ahmad Noureddine	Contact Number: 03 191413	Address: Arabsalim
Item	**Qualified System**	**Passing System**
System Name		MRGNP-V MRGHP-HT XNSSNP-V XNSSHP-HT
Collector		
Tank		

Middle East Green Energy★			
Contact Person: Philippe el Khoury	Contact Number: 03 444961		Address: Jbeil
Item	**Qualified System**		**Passing System**
System Name	Sunneo Flat Plate★★	Sunneo SS HP xx★★	Sunneo CPxxx Sunneo HCxx Sunneo CNPxxx
Collector	FP-GV2.15A,		SK-xxx-1858-xx
Tank	Schneller/ELBi BST	Schneller/ELBi BST	

Najjar Solar Systems					
Contact Person: Amal Najjar	Contact Number: 71 210663	Address: Zahle			
Item	**Qualified System**	**Passing System**			
System Name		QAL Non Pres-sure★★★	QAL Collector Tubes★★★		Panel System
Collector		QAL Evacuated Tubes			Ouraset
Tank		JXPHP SS 316	Copper	Stainless Steel 316	

NaturEnergie★		
Contact Person: Gilbert Zabbal	Contact Number: 03 322207	Address: Baabda
Item	**Qualified System**	**Passing System**
System Name	Enersol T/W 200★★ Enersol Lowe 200★★ Enersol Linuo Ritter 200-1-1518.CPC★★ Enersol Lowe P200-1-2000★★ Enersol Linuo Ritter P-G/LT★★ Eurostar TS/ECO TS★★ LPPC/LP★★ Enersol U300	Enersol LPC
Collector		
Tank		

Phoenix Group★★		
Contact Person: Rabih Osta	Contact Number: 09 855690	Address: Safra
Item	**Qualified System**	**Passing System**
System Name	Solior System★	
Collector		
Tank		

Renewable Med Energies ★★			
Contact Person: Ziad Doumit	Contact Number: 03 302203		Address: Dbayyeh
Item	**Qualified System**		**Passing System**
System Name	Thermosiphon★★	Forced Draft★★	
Collector	Apollo SX/SXL		
Tank	Baymak	Baymak Double Coil	

RJR Trading and Contracting				
Contact Person: Rony Rihany	Contact Number: 79 123431			Address: Sin El Fil
Item	**Qualified System**			**Passing System**
System Name	FHP200★★	FHP300A★★	FHP300B★★	THPxxx
Collector	Aelios Cus 2000	Aelios Cus 2600	Aelios Cus 2000	
Tank	SHSD 20	SHSD 30	SHSD 30	

Sabra General Trading and Contracting							
Contact Person: Mohammad Sabra	Contact Number: 03 709756				Address: Sin El Fil		
Item	**Qualified System**				**Passing System**		
System Name	SBA-x00-I ★★★	SBA-x00-B ★★	SBA-x00-J ★★	SBA-xx	SBA-24-HP	SBA-24-PH	SBA-x0-SC
Collector	Energy +Evo 2x	HPxx0	JDL-PG2.x-xx0	JDL-xx-58/1.8	JDL-HP25-58/1.8	JDL-CC24-58/1.8	JDL-PM-x0-58/1.8
Tank	SHS-DH-20x	KDx00	KDx00	JDL-xx-58/1.8	JDL-HP25-58/1.8	JDL-CC24-58/1.8	JDL-PM-x0-58/1.8

Salem International Group ★			
Contact Person: Toufic Salem	Contact Number: 03 133409		Address: Barbara
Item	**Qualified System**		**Passing System**
System Name	SP Series ★★★	SPB Series ★★★	
Collector			
Tank			

Sawan Solar Systems ★★				
Contact Person: Elie Sawan	Contact Number: 01 681421			Address: Tripoli
Item	**Qualified System**			**Passing System**
System Name	BLx ★★	SPxxx (Megasun xxx) ★★	Sawan Heat Pipe	
Collector	STxxxx		Sunrain Heat Pipes	
Tank	BL	Megasun		

Smart Age ★				
Contact Person: Saad Khoury	Contact Number: 70 008818			Address: Zalka
Item	**Qualified System**			**Passing System**
System Name	U-ET-A/B ★★★	M-ET-A/B ★★★	Z-TS-A/B ★★★	
Collector	T20US	T20MS	TZ 58-1800 R	
Tank	ATE	ATE	SST	

Solar King ★			
Contact Person: August Malak	Contact Number: 04 910494		Address: Zekrit
Item	**Qualified System**		**Passing System**
System Name	CS-UBBS ★ CS-UBAS ★	CM-UBBS ★ CM-UBAS ★	
Collector	CS-UBBS CS-UBAS	CM-UBBS CM-UBAS	
Tank	GES	ABECS	

Solar Solutions S.A.L. ★★			
Contact Person: Jihad Ghorra	Contact Number: 08 806778		Address: Zahleh, Jdeideh
Item	**Qualified System**		**Passing System**
System Name	Atlantic Thermosyphon ★	ONS-IP-20/24 ★★	FUSION NP304-xxx LOSUNG NP316-xxx LOSUNG RT316-xxx LOSUNG Split C50 LOSUNG Split VC30
Collector	SP20 V SC SL		
Tank	DHW		

Solar Systems★		
Contact Person: Sam Bechalani	Contact Number: 01 878724	Address: Zalka
Item	**Qualified System**	**Passing System**
System Name	Solarrie★★	
Collector	VSH2200	
Tank	HS200 or HS300	

Solarleb		
Contact Person: Leon Kradjian	Contact Number: 01 565449	Address: Achrafieh
Item	**Qualified System**	**Passing System**
System Name		SR-HTS-xx★
Collector		1-FUJI-C
Tank		

Solarnet★★★		
Contact Person: Jean Paul Sfeir	Contact Number: 04 532927	Address: Mansourieh
Item	**Qualified System**	**Passing System**
System Name	TS-MxxxNxxS★★ TS-MxxxNxxN★★ FC-MxxxNxxS★★ FC-MxxxNxxN★★	
Collector		
Tank		

Sun Island ★★				
Contact Person: Ziad Daou	Contact Number: 03 580084			Address: Shouf
Item	**Qualified System**			**Passing System**
System Name	COMPAC VSH ★★	FPPT★★	VTLP	
Collector		DPS ECO		
Tank		Venman		

SunBelt				
Contact Person: Elie Aoun	Contact Number: 03 640660	Address: Ain Saadeh		
Item	**Qualified System**	**Passing System**		
System Name		Compact Integrated LP/HP	Split LP	Split HP
Collector		Vacuum Tubes		
Tank		SS-SUS304		Copper

Takat General Trading EST. ★			
Contact Person: Deeb Youssef	Contact Number: 03 750200		Address: Byblos
Item	**Qualified System**		**Passing System**
System Name	TSM xxx Solimpeks★★	PRO xxx Sundware★	
Collector	CLS 2510/2108	PRO 20	
Tank	Sundware		

Techno Mass			
Contact Person: Khaled Tohme	Contact Number: 01 495306		Address: Dekwaneh
Item	**Qualified System**		**Passing System**
System Name	TM-SPT-xxx★★	TSA-xxx ★★	
Collector	FK8253	A/T VPLUS 2.37	
Tank	BST	Alpha Therm xxx	

Tfaily ★★			
Contact Person: Sami Tfaily	Contact Number: 07 530330		Address: Deir El Zahrani
Item	**Qualified System**		**Passing System**
System Name	ST-xx	Heat Pipes★★	
Collector	VT 3 targets	DLL-C-P01-xx	
Tank	Stainless Steel		

WEBCO★		
Contact Person: Maher el Baba	Contact Number: 01 850068	Address: Beirut
Item	**Qualified System**	**Passing System**
System Name	KPRDC/BC ★★★ OEM Vario xx00-x0 RBC/RDC ★★★ OEM Vario HP xx00-x0 RBC/RDC ★★★	
Collector	KPS1/11 OEM Vario	
Tank	RDC/RBC R2DC/ R2BC	

White Water			
Contact Person: Gaby Mrad	Contact Number: 03 660847	Address: Sammrieh	
Item	**Qualified System**	**Passing System**	
System Name		TM-SPT-xxx★★	TSA-xxx ★★
Collector		FK8253	A/T VPLUS
Tank		BST	Alpha Therm xxx

Zmerly and Co. ★★		
Contact Person: Wael Zmerly	Contact Number: 03 751062	Address: Tripoli
Item	**Qualified System**	**Passing System**
System Name	OVpanels CK Forced★★★ Nobel/Nobel Selective forced/Black forced ★★★ OV/Nobel Selective forced/Black forced ★★★ OV-panels CS forced★★★ OV tubes forced★★★ Hyperion★★★ Aelios★★★ Apollon★★★	
Tank		
Collector		

LEBANESE REPUBLIC
MINISTRY OF ENERGY AND WATER

LCEC
LEBANESE CENTER FOR ENERGY CONSERVATION
المركز اللبناني لحفظ الطاقة

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