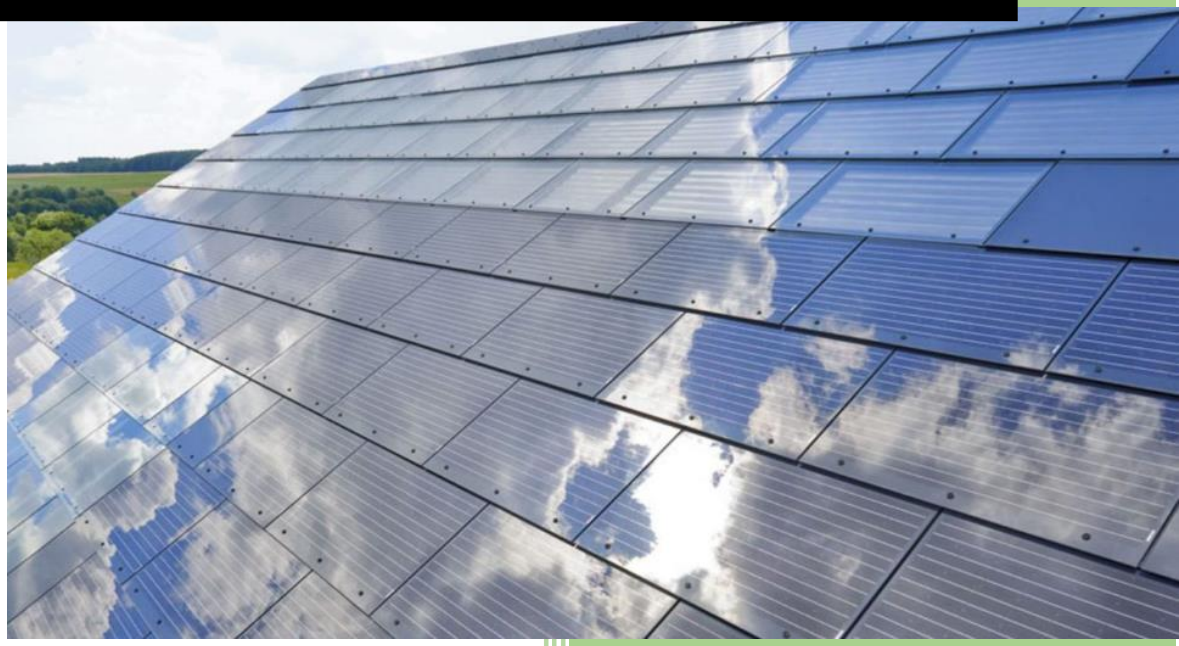
SVEN CARLIN

RESEARCH PLATFORM

2018

HOW TO INVEST IN THE SOLAR SECTOR - RESEARCH REPORT



Sven Carlin

Research platform

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Contents

Introduction - The solar displacement

We have already seen a boom and bust cycle in solar stocks but this time the actual trend might be here to stay. We'll first discuss the trends in the solar industry and then how to invest in the sector as the sector is much more than just the solar panels you see around. Digging into each component of the process of transforming solar energy, storing it and powering the device you are using to read this is the key to find the best risk reward sector investments. It is interesting to expose each portfolio to the potential the solar industry offers in not only disrupting the energy environment but actually displacing it.

The solar industry overview and outlook

The renewable sector has been constantly growing over the last 10 years and solar made 50% of the sector in 2017.

Figure 1 Investments into clean energy

Source: Bloomberg

The levelized cost of electricity (LCOE) has fallen by 77% for solar in the last 10 years and 38% for wind while it only declined marginally for fossil fuels. Further, lithium ion battery costs have declined 79% since 2010. Bloomberg New Energy states that the fossil fuel power "is facing an unprecedented challenge in all three roles it performs in the energy mix – the supply of 'bulk generation,' the supply of 'dispatchable generation,' and the provision of 'flexibility.'" As all those costs related to renewables, from generation through solar and wind to storage with batteries are continuing to decline, sooner rather than later there could come to a shift in the way we create and consume energy that will not only disrupt the current system but even displace it. Each portfolio should be

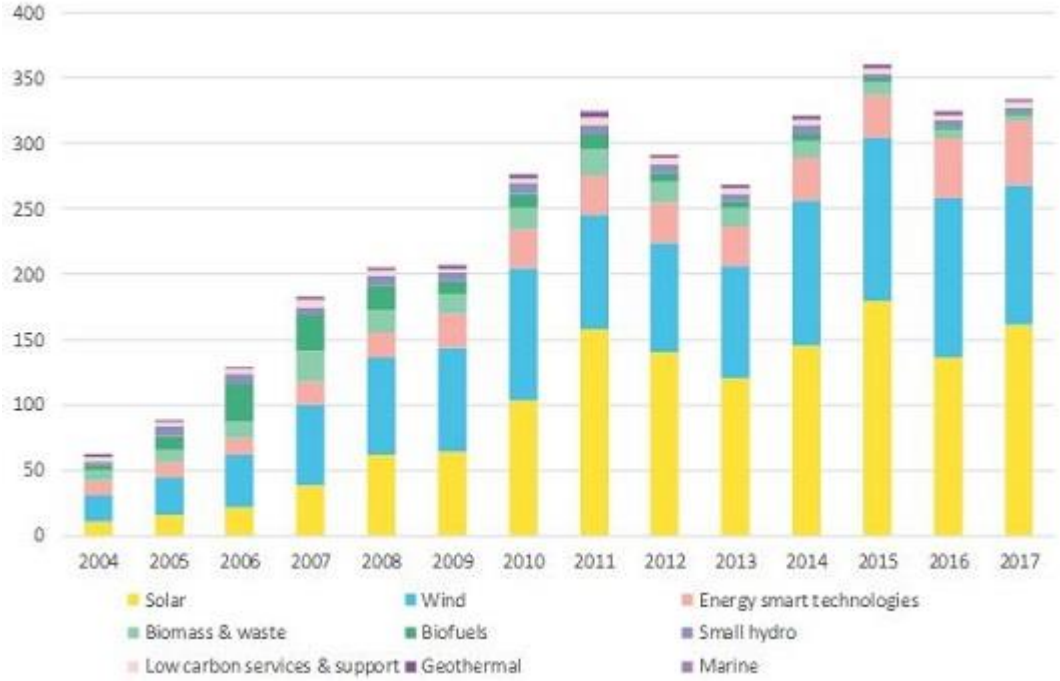
exposed to such a possibility with the best low risk high reward investment where you are rewarded extremely well if things do explode but you don't lose much or don't lose at all if things don't explode.

Market overview

"Solar investment globally amounted to $160.8 billion in 2017, up 18% on the previous year despite these cost reductions. Just over half of that world total, or $86.5 billion, was spent in China. This was 58% higher than in 2016, with an estimated 53GW of PV capacity installed – up from 30GW in 2016." SOURCE: BNEF

These numbers are huge given the constantly declining costs which can be seen in the divergence between the actual spent amount and the capacity installed. What is important is that the solar trend is growing and the lower cost will keep it attractive despite regulatory and subsidy headwinds. Higher oil prices also help.

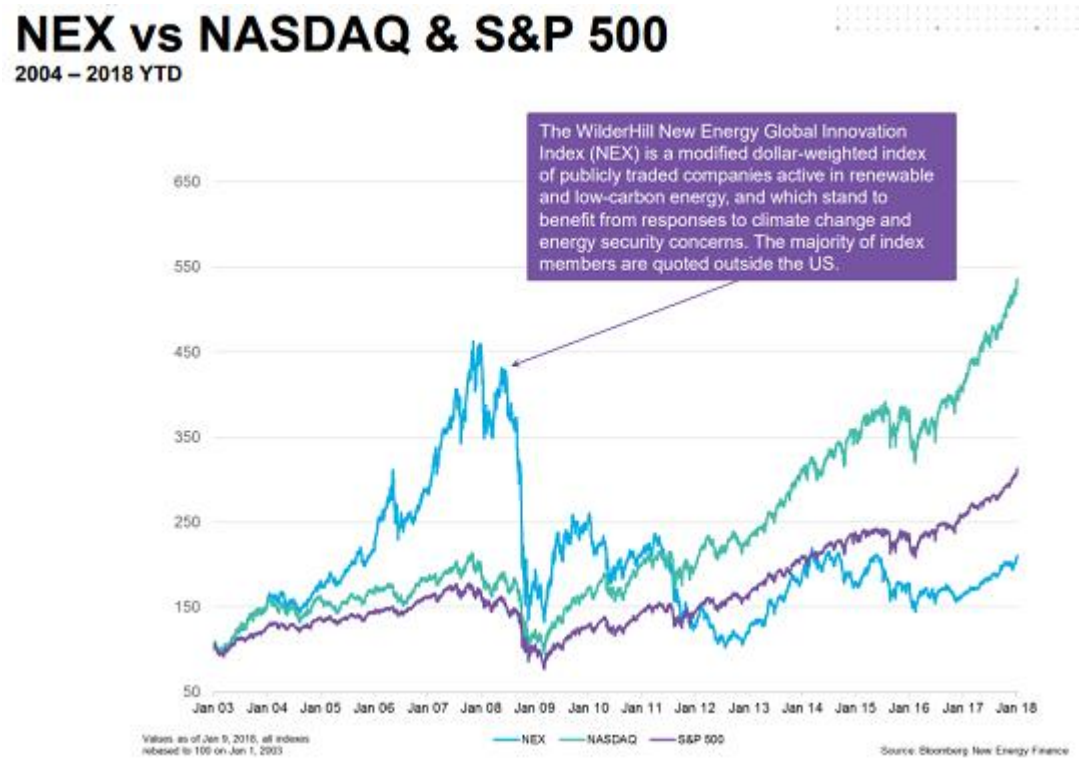
Figure 2 The solar trend is strong and getting stronger



Source: BNEF

Despite the growth, the renewable energy stock index didn't outperform, actually it underperformed the market showing that there is still potential for those who want in on the trend.

Figure 3 The NEX index vs. the S&P 500 and Nasdaq



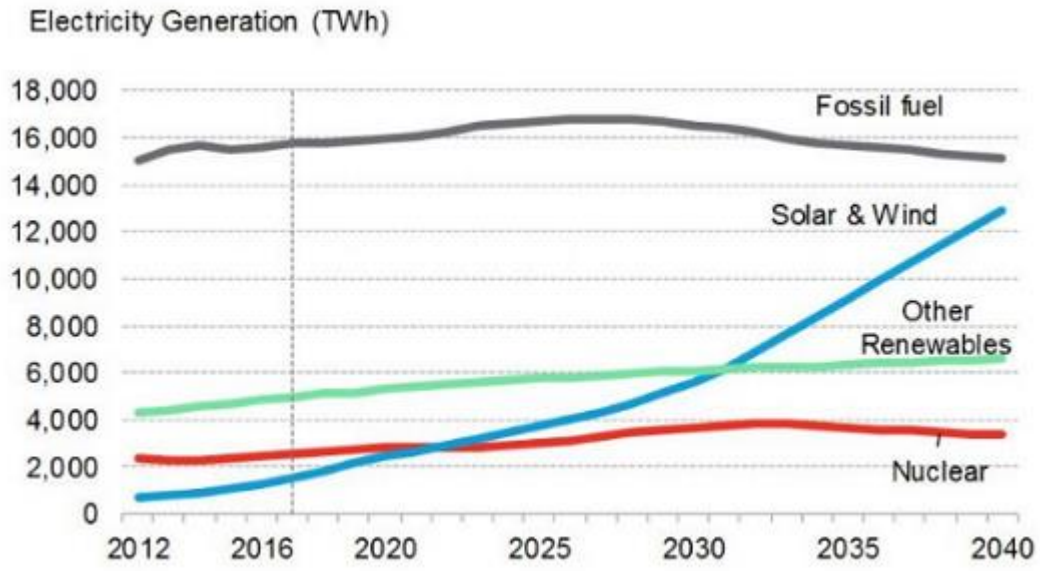
Source: BNEF

Market outlook

The positives for the sector are that the plunging costs in solar, wind and storage will continue to open market opportunities for clean energy and increase its footprint. Another positive for solar are the declining battery costs for storage as one of the weakness of the solar technology is the impossibility to store it, for now.

The negatives are as always economic shocks, tariffs and higher interest rates that burden the high capex, low opex renewable energy investments. Nevertheless, despite Trump pushing for more coal in the U.S., sooner or later clean energy will prevail simply because people will demand it more and it will have a lower cost. This creates a strong and healthy long-term trend.

Figure 4 Long term trend for solar and wind energy



Source: BNEF

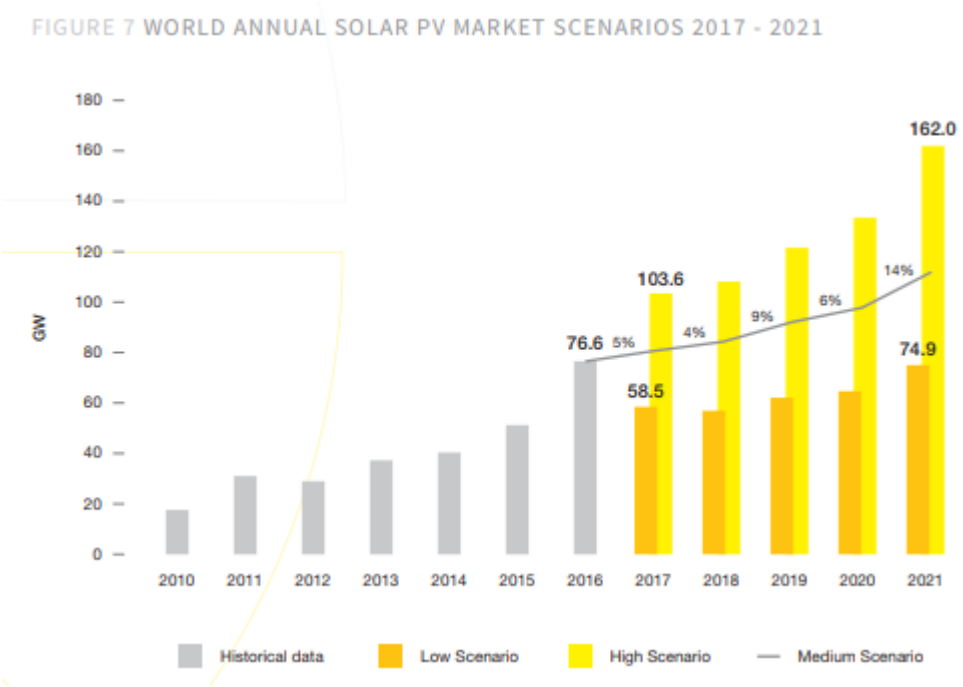
The long-term outlook is positive, BNEF says:

“Renewable energy sources are set to represent almost three quarters of the $10.2 trillion the world will invest in new power generating technology until 2040, thanks to rapidly falling costs for solar and wind power, and a growing role for batteries, including electric vehicle batteries, in balancing supply and demand.”

By 2021 solar energy will be cheaper than coal in China, India, Mexico, U.K. and it is already as cheap in Germany, U.S., Australia, Spain and Italy. Lower cost batteries will reach a market penetration of 74% in Germany by 2040. Home owned PV installations will reduce the need for large scale coal and gas plants.

So, the trend is positive with the risks of a recession and higher capital costs determining the negative scenario.

Figure 5 3 scenarios for the solar industry



Source: [Solar Power Europe]

In one scenario we see the industry more than double, in the medium scenario we see a 50% increase while in the negative scenario plagued by a recession and higher capital costs we see a flat environment. In that light we have to find investments that we can buy more in case of the negative scenario and not lose our shirt while having a significant exposure in case of the best-case scenario.

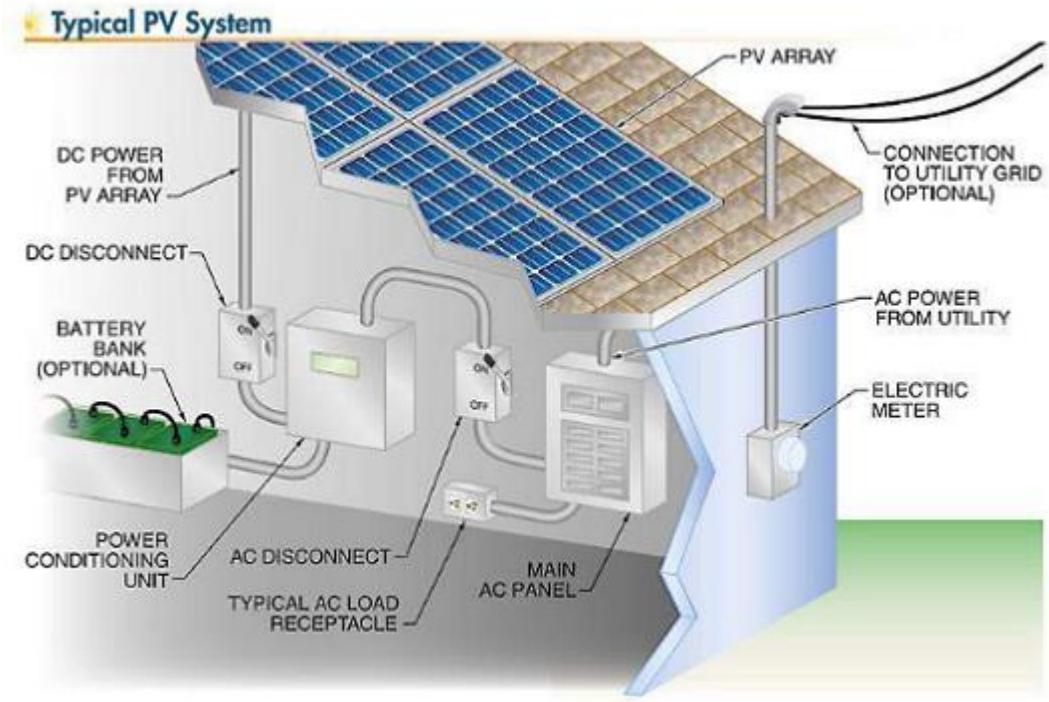
Shorter term developments see utilities investing more and more in solar based energy generation on purely economic numbers, corporations are switching to 100% renewable and sustainable and solar is expanding into other markets. Solar energy first grew in the U.S. and Europe, China followed in the last few years but now that the technology is actually economic, First Solar's CEO expects to see 22 markets install more than 1 GW in the next 5 years in comparison to the current 9 markets. The big trend that is just starting to get traction but hasn't yet exploded is storage with batteries.

Also, with more and more mandatory renewable energy solar is in a positive place.

Investing in the solar industry

Let's first take a look at what are the investing opportunities in the solar industry. The typical PV system has a lot of components that all have to be made and if the market grows, more of those have to be made.

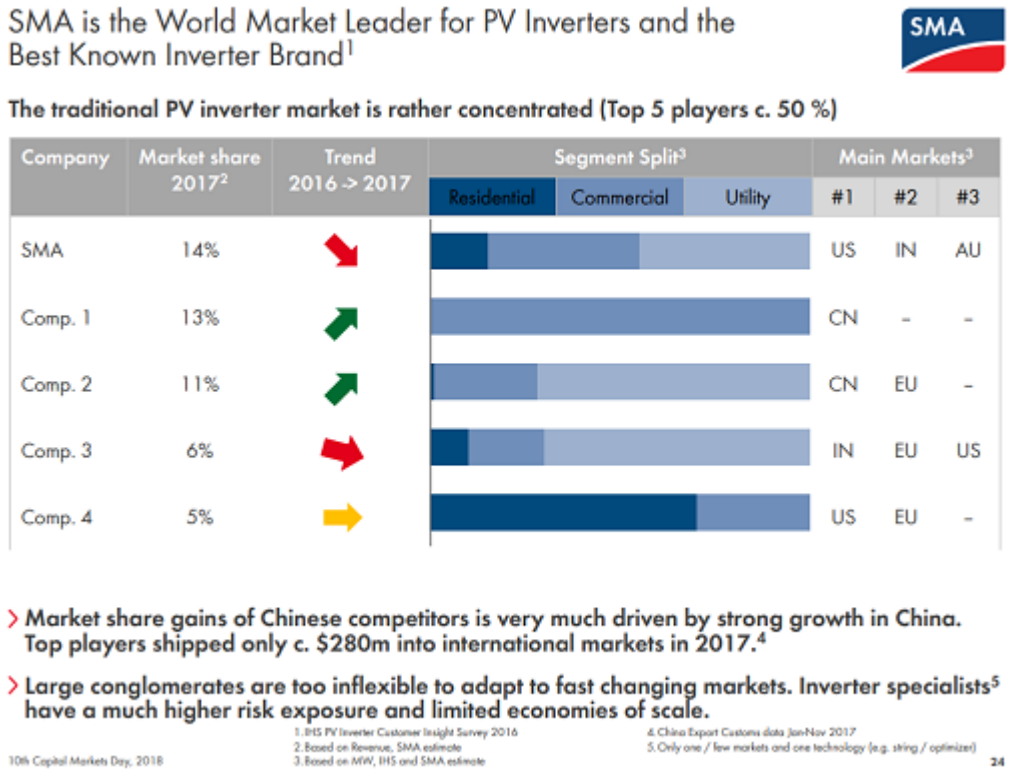
Figure 6 Components of solar system



Source: [The grid]

So, each of these components can be made in a different way and it is also important to understand the technology trends because in any growth industry there is a lot of marketing promoting strange business models. Each component from the PV wafer, glass, inverters, batteries, modules etc. has a different quality level, price and efficiency which is something important to look at.

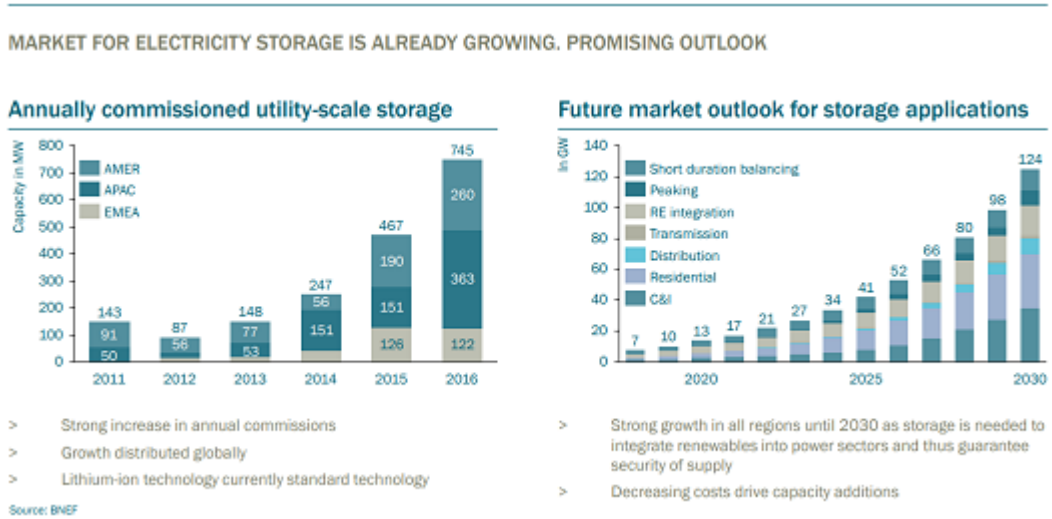
Figure 7 The inverter market is pretty competitive but differentiated



Source: SMA

Apart from the trends in the solar specific industry it is also important to look at the trends that are developing alongside solar. Energy storage and batteries are a key component for the success of the technology but there are other things too, like system integrations, digitalization, operations etc.

Figure 8 Battery storage is a trend still in infancy but with huge potential depending on technological developments

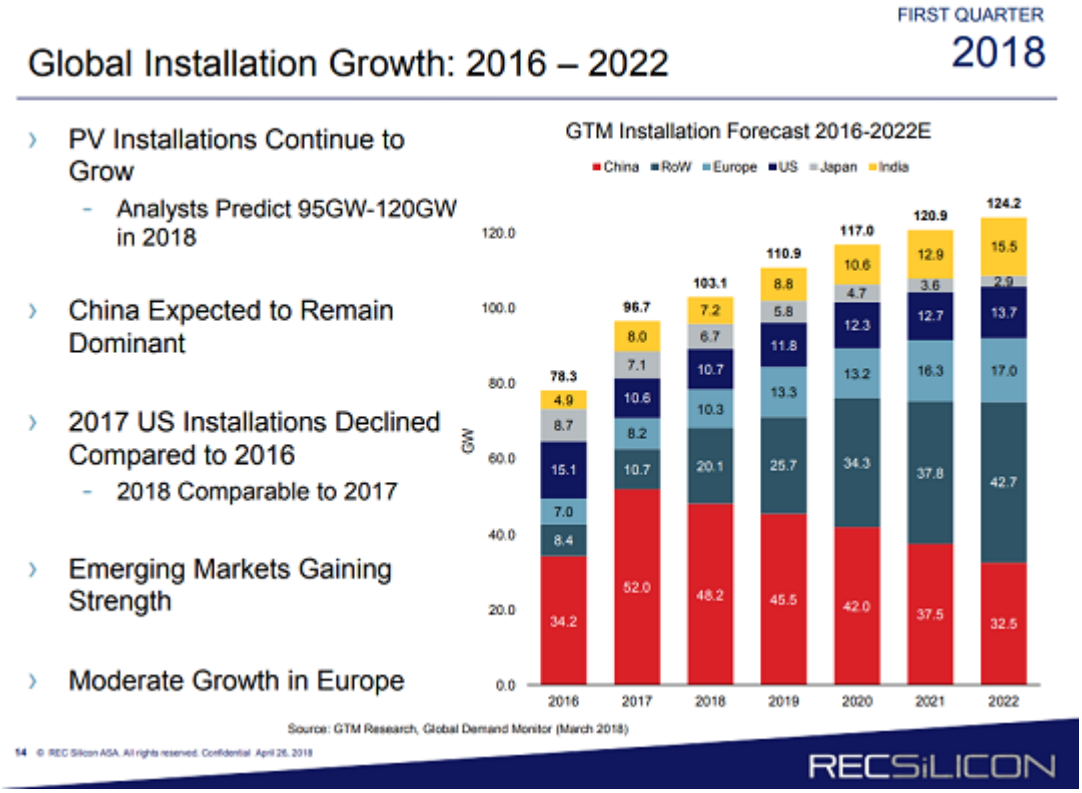


Source: SMA

However, it is important to note that the solar equipment market is extremely competitive and efficiencies, quality are constantly considered and weighted against payment terms, price etc.

Emerging markets are expected to lead the growth in demand for solar but with higher interest rates that might be postponed as most assumptions were made with lower interest rates.

Figure 9 REC ASA's market forecast



Source: REC ASA

Despite emerging market risks, things in the developed world are also changing and California has just made it mandatory to have solar roofs from Jan 1, 2020 onwards. If others follow path the solar industry is just in its infancy.

Conclusion

The long-term picture is pretty clear, solar will be a big part of our lives in the next decades. However, the question is how to take advantage of it. Here are the stocks that I found related to the sector and I will go through each one of those to find the best exposure or at least what to watch if the risk is too high as the good stocks already spiked in the last year.

Another risk is the usual cyclicality of the industry. We know solar will be the norm but any kind of delay hits solar stocks hard and we must expect volatility and play this in a cyclical way when thinking about portfolio allocation. Each individual company runs market, operational, political and fundamental risks which is important to keep in mind before investing.

Figure 10 Solar stocks to explore

STOCK	Company	Country	Business
FSRL	FIRST SOLAR	USA	PV producer
SEDG	Solar Edge	Israel	Inverters and systems
RUN	SunRun	USA	System installation, financing home
XINYI	Xinyi Solar Holdings	CHINA	Solar glass production, solar farms
REC ASA	REC Silicon ASA	Norway	polysilicon producer
DQ	Daqo New Energy	CHINA	polysilicon producer
JKS	JinkoSolar Holding	CHINA	PV producer
SNPW	Sun Pacific Holding	USA	Microcap
HASI	Hannon Armstrong	USA	Climate change, solar projects
AY	Atlantica Yield plc	UK	Renewable energy investments
CSIQ	Canadian Solar	China	PV producer
SSO	Scatec Solar	Norway	Builcing Solar power plants for equity
S92	SMA Solar Technology Ag	Germany	Solar equipment supplier
CAP	Encavis	Germany	Wind and solar parks
ENPH	Enphase Energy Inc.	USA	Inverters and systems
TERP	TerraForm Power	USA	Renewable yieldco
MBTN	Meyer Burger Technology AG	Schweiz	Solar technologies
	SOLARIA ENERGIA Y MEDIO AMBI	Spain	Solar parks
00451.HK	GCL NEW ENERGY HOLDINGS LTD	China	Solar parks
00750	CHINA SINGYES SOLAR TECH	China	Solar installations
VSLR	Vivint solar	USA	Solar leasing
SUNW	Sunworks	USA	Installation
SPI	SPI Energy	China	PV solutions
SKYS	Sky Solar Holdings	China	Solar parks
RGSE	RGS Energy	USA	Solar systems
SOL	ReneSola	China	Solar systems
JASO	JA Solar Holdings	China	Solar cells
ELLO	Ellomay Capital	Israel	Utility
ASYS	Amtech Systems	USA	Solar systems
CAFD	8poin3 Energy partners LP		Bought out
AQN	Algonquin Power & Utilities Corp	Canada	Mostly wind power
ASTI	Ascent Solar Technologies	USA	PV - microcap
PLUG	Plug Power	USA	Fuel cell
BLDP	Ballard Power Systems	Canada	Fuel cell
PEGI	Pattern Energy Group	USA	utility
BLX	Boralex	Canada	utility

Source: Author

If I missed on any, please let me know.

More about the above stocks in the next parts of the report that will lead into the detailed analysis of the best picks, earnings models, intrinsic value calculations that will show what are the best opportunities to invest in or just to keep an eye on.