A decade of growth and innovation

Solar photovoltaic systems, once an emerging technology, are rapidly moving towards becoming a mainstream source of electricity throughout the world. However, less than a decade ago the solar industry was undergoing a difficult period of transition, with the price of PV panels decreasing globally, driven partly by an increase in competition from China. Many solar companies were struggling to survive.

It was around this time, that five friends decided to enter the market: Guy Sella, Lior Handelsman, Yoav Galin, Meir Adest and Amir Fishelov. With backgrounds in electrical engineering and research and development, the five friends recognized that there were technical difficulties holding the industry back.

While less recognizable than the solar panels, the inverter is one of the most important components within a PV system as it acts as the brain of the PV system. Inverters convert the direct current (DC) electricity generated by the solar panels into the alternating current (AC) used by the grid and in our buildings. They also manage the power output from each of the panels within a solar system.

However, each of the panels within a system typically performs at a different level from the others. As a result, an overall maximum output for each string of panels as a whole must be found, a technique known as Maximum Power Point Tracking (MPPT).

To do this, conventional string inverters find the MPPT for the entire string instead of for each individual panel, meaning lower performing panels are excluded and do not contribute to the overall output of the system. Alternatively, the lowest performing panel will cause the output of all the other panels to be dropped down to the level of the lowest performing panel. In either scenario, energy is lost.

This one-size-fits-all approach also means that individual panels cannot be shut down in the event of a problem, and limits the layout of a system, meaning all the panels have to be oriented in the same direction. It also limits the possibility for monitoring each of the panels individually.

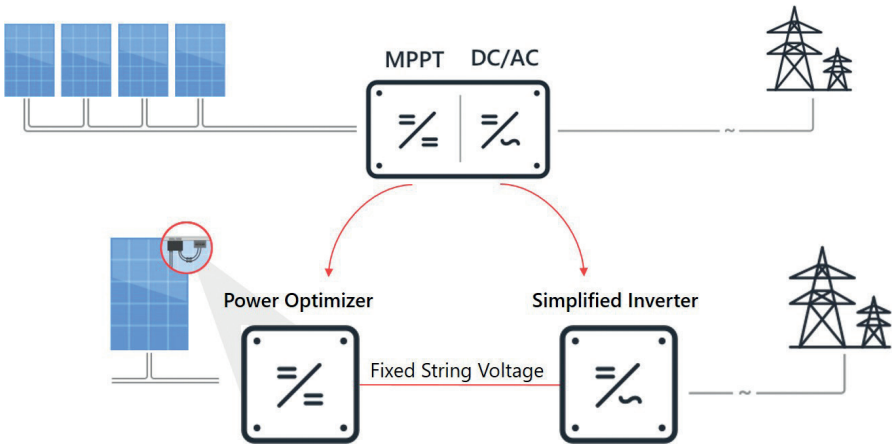
To overcome these limitations, the team developed the concept of splitting up the two functionalities of the inverter.

In this way a simplified inverter would be responsible for converting the DC output into AC electricity. Meanwhile, the MPPT function would be performed by a separate device, known as a power optimizer. These devices would be installed behind each panel, meaning that each could be managed and monitored separately.

To commercialize their idea, the team established a company, which they called

Meir Adest, Chief Information Officer, Yoav Galin, VP Research & Development, Guy Sella, CEO and Chairman, Lior Handelsman, VP Marketing and Product Strategy, Amir Fishelov, Chief Architect

A power optimizer



Distributed inverter architecture

SolarEdge. But despite their faith in the product, the founders faced scepticism from others in the industry, who claimed it would be a niche solution at best. They also went against the advice of potential financial backers, who felt they should concentrate their energies on the power optimizer, and not produce their own inverters as the founders envisioned.

In the face of this scepticism, the team pushed ahead with their plans to build their own inverter company, and very quickly the company began to grow.

In 2009 SolarEdge opened its first international office, in Germany, and in 2010 it began mass production. The first sales also began in 2010, and their DC optimised inverter solution began to receive a number of prestigious awards. The company began expanding into new geographical regions and different sectors, including commercial PV and small-utility.

As a result of this expansion and success, in 2013 the company had reached over $100 million in sales, and by 2014 it was already ranked amongst the top ten inverter manufacturers in the world.

In 2015 they undertook an Initial Public Offering (IPO), and is today considered the largest inverter company in the world, in terms of revenue, with monitored sites in over 130 countries around the world.

Despite this rapid growth, the company has not lost sight of its focus on innovation and engineering excellence. While many companies will attempt to remain competitive by cutting prices, SolarEdge believes in constantly adding more value to its products, such as embedding metering and communications capabilities into its inverters, offering longer warranties, or providing 25 years' monitoring services at no extra cost.

As part of this drive for innovation, the company has also focused on improving the design of inverters, which have remained largely unchanged for the last 25 years.

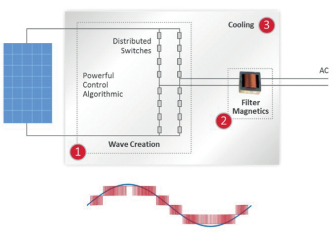
Standard inverters use switching elements, which open and close the circuit to convert DC energy into the form of an AC sine wave. However, the waveform produced is relatively crude, requiring the use of magnetics to further filter it into a clean sine wave. This is not particularly efficient, meaning a considerable amount of energy is lost in the form of heat, meaning a cooling component is needed for dissipation.

Understanding that improving the inverter design could advance PV proliferation, SolarEdge set out to overcome the technological challenges that were holding back progress. With some imagination, determination, and a lot of R&D effort, SolarEdge developed a distributed multi-level switching system, known as HD-Wave Technology, in which a powerful processor is used to control the switches, allowing the company to dramatically reduce the amount of magnetics by a factor of 16 and cooling components by a factor of 2.5 needed in the inverter.

This in turn cut the overall size and weight of the system and considerably improved its power density, while also achieving new weighted efficiency record of 99%.

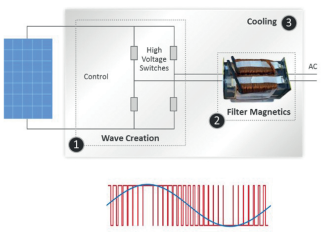
After overcoming the challenge of redesigning the conversion mechanism in the inverter, SolarEdge set its sights on tackling the difficulty of solar intermittency. Because solar energy production and usage in the home often do not match up, electricity produced by solar panels often needs to be stored for later use. To this end, the company developed a DC coupled storage solution consisting of only one inverter that manages both the solar energy supply and the battery. Unlike other storage systems, the StorEdge solution eliminates additional DC to AC conversions to improve the overall efficiency

HD-Wave Technology



1. **Distributed multi-level switching** elements creates a sine wave
   - Powerful DSP processor synthesizes a **clean** sine wave
2. Less magnetics is required for filtering
3. Highly efficient design with minimal heat loss reduces cooling requirements

Traditional Technology



1. Today, inverter switching elements create a **crude** sine wave
2. Magnetics filter a sine wave
3. Metallic enclosures, cooling systems and fans dissipate heat

EV charging solar inverter with HD-Wave Technology

of the solar plus battery system and requiring only one inverter to reduce the LCOE of solar-plus-battery systems.

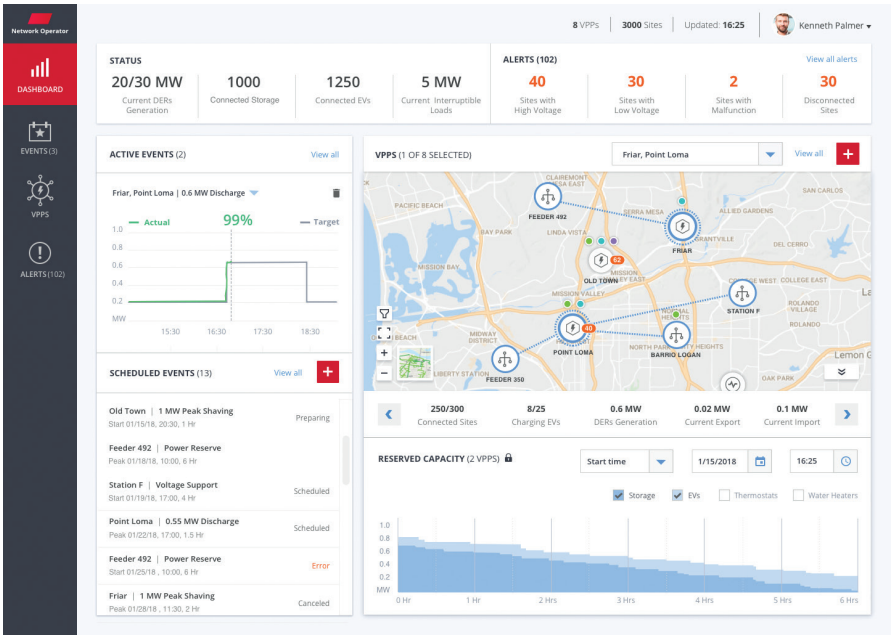
Continually trying to improve the way energy is produced and consumed, SolarEdge set its sights on EV charging as it recognized the impact that the projected increase on EV sales would have on electricity demand patterns. SolarEdge understood the opportunity of combining EV charging with solar power. This is how SolarEdge moved into the electric vehicle (EV) market, by developing the world's first solar inverter to be equipped with an embedded EV charger. Combining the two technologies into one will make it far easier for drivers to power their electric cars with solar energy, an important step towards decarbonising the transportation industry.

What's more, EV charging can be a considerable household expense, so using solar to power these vehicles can help to reduce electricity bills.

More recently, the company has been developing smart energy systems, including a device that uses excess PV to heat water, as well as smart outlets that the inverter can control to switch on particular household appliances at times of high PV production.

Ultimately, the company hopes to develop an all-in-one inverter, capable of managing not only a household's solar panels, battery storage, and EV charging, but other smart devices as well. A smartphone app allows users to seamlessly control all of these elements at the touch of a button. This is part of the company's vision for the inverter to become the complete energy manager for homes and buildings.

Most recently, SolarEdge has turned to a macro-level challenge of grid stability. Due to increasing penetration of intermittent solar energy into the grid and expected increasing in unprecedented EV charging patterns, the grid is facing difficulties balancing supply and demand. To solve this, SolarEdge has developed a virtual power plant solution, capable of aggregating and managing in the cloud a large fleet of distributed solar energy systems, batteries, and EV chargers. In this way these distributed energy resources can be used to discharge a network of batteries when the centralised power station can't meet demand. Conversely, a utility could instruct the batteries to charge their batteries, to prepare for a future demand peak, or to help with frequency variations. With this step, brought the philosophy of smart energy management to a much larger scale.



To complement these developments, SolarEdge has recently acquired three companies in the uninterrupted power supply, battery, and EV powertrain markets. The company hopes to be able to use these different energy types synergistically with its existing technologies.

In this way, in a little over a decade, SolarEdge has developed from a clever idea by a group of friends, designed to improve a single technological device, into a global smart energy company that is leading the decarbonization, decentralization, and digitalization energy transition.

www.solaredge.com