

FOLLOWING THE SUN

A commercially viable solar powered pumping solution becomes a reality *By Amr Aref*

Courtesy: KarmSolar



In 2012 *Business Today* interviewed the founders of KarmSolar, an Egyptian start-up company with a mission to develop innovative and commercially viable off-grid solar energy solutions. Their flagship product is a solar-powered water pump that can substitute the use of diesel-powered generators in pumping water from underground wells.

At the time, the company's founder and CEO, Ahmed

Zahran, had pledged to make his company's product commercially viable within a year's time. Twelve months later, *Business Today* returned to KarmSolar to catch up with their developments and found Zahran had kept his promise.

A fitting context

Off-grid agricultural farms located in the desert — away from the Nile Valley and its Delta — depend

heavily on diesel-powered generators to pump underground water for irrigation. With the inconsistent supply of diesel, a lack of uniformity in its price due to the existence of a black market and lower-than-expected efficiency rates leave farmers struggling to manage their energy needs. Additionally, the uncertainty surrounding the fate of diesel subsidies makes it clear that the context in which these farmers operate is in desperate need of change. Zahran explains that it is this economic context coupled with some technical innovation on his company's part that makes their product commercially viable.

"People usually assume that by solely developing a technical solution, their product will be economic. This is not true. In order to develop a system that is competitive in the market you also have to work on economics," says the CEO. "Economic innovation is putting the proper economic model that reflects the conditions and needs of your client."

What KarmSolar's clients need is a more consistent and sustainable source of energy that allows them to do away with diesel and its troubles. This substitute also must not cost them more than the price of diesel.

"Our aim is to have any off-grid agricultural or industrial project convert from diesel to solar energy while making sure that they achieve three things: reduced costs, better management and sustainability," Zahran says.

Varying the flow

Meeting those three targets requires a great deal of technical innovation. While conventional solar systems require expensive batteries to store the generated power, KarmSolar's system does away with these batteries altogether and therefore reduces the overall investment cost.

"Batteries fulfill two functions in a conventional solar-powered pumping solution. The first is to store the generated power and second is to act as a translator between the panels and the pump as the power cannot be consumed directly," Zahran explains.

In partnership with WorldWater & Solar Technologies — a US-based developer of solar and water technologies — KarmSolar was able to modify the pump, allowing it to operate with a varying input of power and consequently ending the need for batteries to act as an intermediary.

"Everyone in the market was under the assumption that you need a constant level of power for the pumps to operate. We contacted the manufacturer and applied some modifications that allowed the pump to work with varying power," says Zahran.

"The difference appears to be a lot, however when you look at the amount of diesel you consume in addition to efficiency and reliability issues, our system becomes more economic."

"Using energy this way is more efficient as the system is adapted to the variability of the sun," says Xavier Auclair, the company's cofounder and its chief innovation and technology officer. "Other methods wait for the intensity of the sun to reach a certain level that is high enough to start the equipment and therefore they lose the early morning and sunset hours. By allowing the pump to work at lower capacities, our system utilizes the sun's intensity throughout the entire day."

Altering the functionality of the pump and erasing the need for batteries is not the company's sole innovation. An in-house developed software and user interface allows farmers to accurately gauge every watt consumed and every cubic meter of water produced.

"At the moment, energy cost for an agriculture investor is a big black hole," says Zahran. "The amount and price of diesel varies and there are no clear parameters that can be used to help farmers better manage their energy consumption."

"Our system, however, utilizes a Solar Management Interface that lets you know exactly how many kWh

KarmSolar cofounders Xavier Auclair, Ahmed Zahran and Yumna Madi



Omair Mohsen

consumed per meter cubic of water in addition to having the system fully automated; the pumps automatically start working at sunrise and shut down by end of day.”

A Rewarding Environment

The working environment at KarmSolar is something that the employees proudly boast to be a part of it. While graduates would usually opt to work for well-established large enterprises to gain experience and acquire a sense of stability, the people at KarmSolar wouldn't trade their jobs for anything.

“I graduated last January and joined KarmSolar in mid-February,” says Farida Zaki, a business developer at the firm. “Everyone here has great passion and it's very rewarding to feel that you are helping farmers and helping your country,” she says.

The company regularly holds meetings between the different teams to share knowledge and trade experience whether in the technical or economic sides of the business. This gives the employees an exponential learning curve and makes everyone witness first hand their added value.

“We feel like we really add value to the company and we see our work being translated to growth,” says Zaki.

And growth is being achieved. What started with a paid-in capital of LE 65,000 and only four founders quickly grew to a capital of LE 13 million and employing more than 20 people.

“Working for a young company with a really good spirit and team around it really does tick all the boxes,” says Richard Barret, a UK citizen who joined KarmSolar shortly after graduating from the University of Leeds.

“What this company is doing is not just good for the market but it's also great for technology in general. Why work for a big company when you can work for a smaller one that is very promising?” he asks.

KarmSolar serves as a model for young aspiring entrepreneurs and is a beacon of hope for the small and medium enterprises sector in Egypt. The people there have shown that with a combination of young talented professionals, hard work and innovation, anything is possible.

Allowing the pump to operate with varying power means the amount of water produced throughout the day will also vary. As irrigation systems need a steady flow of water to operate, the water produced has to be stored in tanks.

“Producing a variable amount of water may not necessarily fit the irrigation needs of the farmer,” says Auclair. “This is why the water is stored in tanks and the irrigation system is fed from these tanks. We are, however, doing some research to overcome this,” he says.

By further developing their technology and allowing the system to bypass the storage tanks, the team will yet again be able to reduce the number of components and consequently cut costs.

In the money

At the onset, it might seem far-fetched that a solar powered water pump could actually be cheaper than using diesel given the stereotypes surrounding solar energy. However, when accounting for the running cost of a diesel generator over a five-year period the numbers start to make sense.

“The price of a diesel generator varies between LE 50,000 to LE 150,000 while our solar powered system will cost you around LE 900,000. The difference appears to be a lot. However, when you look at the amount of diesel you consume in addition to efficiency and reliability issues, our system becomes more economic,” says the CEO.

Being a start-up makes it difficult to sell the numbers to potential investors without backing it up with practical implementation. Luckily, KarmSolar found a like-minded investor who was willing to bankroll the testing period.

“We managed to find a client that shared our vision and was willing to take the risk to try out an innovation that has never been tried, at least in the Middle East and North Africa,” says cofounder Yumna Madi, the company's commercial manager.

“Tarek AbuBakr, owner of Al Tayebat farm in the Bahareya Oasis, provided us with the space, put down the money and converted one of his wells from diesel to solar,” Madi says.

“Our system outperformed the diesel generator as we were able to reach 163 cubic meters of water per hour compared to a diesel range of 140 to 145 cubic meters per hour,” she says.

By converting a 30 kW Grundfos pump — a leading pump manufacturer — to using solar rather than diesel, the team established that over a five-year period the farm could save up to 18% in energy costs going up to 57% over 10 years.

“It's like paying your diesel associated expenses over a five-year period up-front. Even if you are fine with just paying for diesel every month, right now finding diesel itself is an issue,” says Madi.

Paying for the system up-front doesn't have to be the only option. The people at KarmSolar are hoping to establish a scheme where the banks could finance the farmers. Money that would have been invested in a diesel generator can be paid as a down payment for the system and the monthly diesel costs could be used as installments.

“A diesel system requires an energy budget every month and so they [farmers] already have that budgeted in their income statements,” says Zahran. “All that is needed really, is for the banks to [get in on it].” *bt*



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