



A growing need

Affordable irrigation with ABB's solar pump drive

FILIPPO PAGANI – It is no secret that the world's thirst for water and energy continues to rise dramatically. But did you know that half of the world's energy is used to operate pumps? With agriculture's reliance on irrigation, which depends on water pumps, it is no wonder that so much energy is dedicated to this field. But plugging into a reliable or affordable local power grid to operate a water pump is not always an

option in many parts of the world. And so, ABB has turned to the sun to develop an innovative solution that uses solar power as a reliable energy source for pumping water. The ABB solar pump drive, designed to use maximum power point tracking and conventional drive technologies, enables water pumps to run at maximum power proportional to the available solar power.



1a ACS355 general machinery drive



1b ACSM1

Solar pumping systems are increasingly being adopted for use in a variety of applications. For example, the systems are being used in community water supplies, fish farming and agriculture, forestry, and wastewater treatment engineering. These systems are also more frequently being used for municipal engineering, city parks, resorts, and even fountains in residential areas – and, of course, for irrigation.

In some countries many small- and medium-sized farms are either off-grid or receive only a few hours of electricity each day. Often, the farmers' only alternative is to run irrigation pumps with diesel generators, which are costly to operate – especially as water demand rises during the growing season, causing fuel prices to spike. Now, solar energy is playing an important role in the irrigation sector for agriculture around the world.

Solar pump drive

In 2011, ABB developed a solution that combines ABB drives with solar panels and a maximum power point tracking (MPPT) system that controls the pump through solar radiation. Pump operators, such as farmers, can then benefit from the maximum amount of pump output over the course of the day. Compared with diesel generator pumps, the ABB solar pump drive is environmentally friendly and has a long lifetime and low maintenance costs. It is independent from the grid and produces no pollution or noise.

The power range for the solar pump drive was recently extended from 0.37 to 18.5kW up to 45kW. This increased power range enables the use of the solar

The complete system consists of four components: a photovoltaic (PV) panel, a drive, a motor and a pump. The ABB solar pump drive system uses a PV panel as its power source, which is connected to the direct-current (DC) connectors of an ACS355 or an ACSM1 drive → 1. The drive is connected to the motor that runs the pump → 2.

Maximum power with dual supply

The ABB drives provide uninterrupted flow, even during drastic changes in irradiation, thanks to the MPPT algorithm. Built-in MPPT functionality is also important for reliability when the equipment is installed at remote sites where maintenance is minimal. Users can monitor the pump remotely, from anywhere. Embedded, pump-specific features such as dry-run detection and sensorless flow calculation are used to protect and monitor the pumping station. The drive is designed to automatically shut

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pump drives in larger pump applications such as high-power pumps in agriculture and solar desalination.

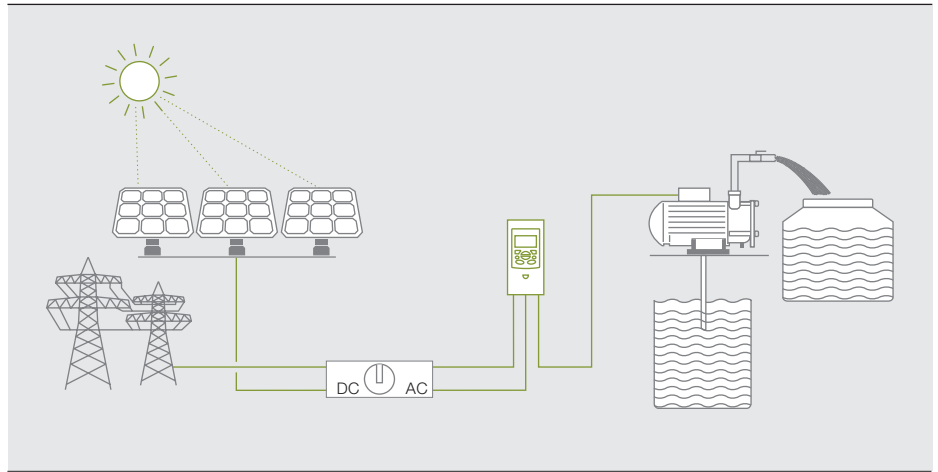
down to prevent equipment damage from running the pump dry. Sensorless flow measurement gives a direct indica-

Title picture

An Indian pump supplier has incorporated ABB's ACS355 solar pump drive into its pump technology, enabling independence from the electricity grid and from diesel fuel.

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2 The ABB solar pump drive



tion of the performance, allowing the end user to measure system performance based on flow rather than on electrical parameters.

After dawn, when the sunlight is sufficiently intense to power up the drive, the drive automatically starts the motor and runs the pump to draw water. At sunset, the drive turns off the motor and the water flow ceases. When equipped with a changeover switch, it is possible to run the drive from the grid – for example, during the night or when maximum flow is required and not enough solar power is available.

Compact and beneficial

The solar pump drive is preprogrammed for specific pump applications with minimal parameter settings required. Other benefits include: long pump life, elimination of restarting during DC voltage variations, and automatic fault-reset and auto-start. The solution is also free of other restrictions that can impact productivity, such as load shedding, electricity supply cuts and increased energy prices, as well as burnt motors often caused by voltage fluctuations.

A number of ABB's low-voltage components such as relays, terminal blocks and contactors are also used in the solution, including PV-S miniature circuit breakers, which are specially designed to safely extinguish dangerous DC arcs in PV applications.

Driving success

The ABB solar pump drive has been a success in India, where ABB already has thousands of installations.

In some Indian states the government funds as much as 86 percent of the cost of solar pumps as a long-term investment in the country's agricultural output and sustainability.

There is demand for the solution in, for example, Asia, South America and Africa as well: Only around 6 percent of cultivated land in sub-Saharan Africa is currently equipped for irrigation. Even in countries that do not subsidize renewables, a number of financing alternatives including rental programs, cooperatives with shared ownership and micro-loans are making solar water pumps economical for smaller off-grid farms.

With the world's growing demand for both water and energy, and environmental pressures showing no signs of easing, solar pumping is a viable short-term as well as long-term solution. ABB is paving the way for increased use of renewable energy sources around the world.

Filippo Pagani

ABB Discrete Automation and Motion, Solar Pumps
Sesto San Giovanni, Italy
filippo.pagani@it.abb.com