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Industrial Communication

Solar power as the basis of life

Siemens supports Hamburg school project in Nicaragua

A school project in Hamburg is looking at the specific application of photovoltaics in agriculture. The main focus is on the development and sizing of solar-powered groundwater irrigation systems. This is a learning process in which SIMATIC S7 and the Siemens expertise also play a role.

Robert Heiden, a physics teacher at a school in Blankenese, a suburb of Hamburg, has recognized the signs of the times. "Renewable energy will become a major issue for the generation growing up now." Together with Clemens Krühler, his colleague from the technology department, and Kirsten Ahrncke who teaches social studies, Robert Heiden is supporting the EduaRD (Education and Renewable Energy and Development) project at his school.

It is offered as a series of electives and looks not only at the interactions between economic productivity and how societies develop. It also wants to offer practical insights into the interaction between physical and biological processes. And it looks at the growing importance of future technologies to make use of renewable energy.

A partnership between the city of Hamburg, Germany, and the city of Léon in Nicaragua is helpful in this respect. The three dedicated teachers realized that they could use this connection for a practical photovoltaic project as part of EduaRD. And so the first project group traveled to Nicaragua in 2003 to demonstrate the practical use of solar power in agriculture on-site. A solution that was so successful that the project still exists today and 20 additional plants have been implemented since then.

Topic of a Hamburg school project with its partner city León in Nicaragua is the practical application of solar powered groundwater irrigation systems in agriculture.

Shortage despite abundance

There are a few things you have to know about Nicaragua: The country is rich in natural resources and has a huge potential to produce agricultural products. But local farmers have to live under climatic conditions that are defined by extreme rainfall on the one hand and several months of drought on the other. The existence of an entire family could easily be in danger if one of the two rainy seasons were to fail.

During the drought period, farmers have a hard time to supply their fields and plantations with water. In rural areas without any electricity, they can only pump the groundwater manually to water the parched soil. This means productivity is low; so low that Nicaragua cannot support its own population sufficiently despite its huge areas of arable land.

The problem is not water which is available in abundance even during the drought period. The problem is simply to bring this water to the surface.

Solar power as solution

This is where EduaRD comes into play. Robert Heiden and Clemens Krühler discovered rather quickly that there was a crucial connection. The same sun that dried out the soil and made plants wither also supplied energy in abundance. This means it makes sense to use exactly this energy to provide plants with the water that is available in large quantities underground.

At the start of the project, students were asked to calculate the biological and physical correlations of a project and to use these insights to determine the technical key figures of a solar powered irrigation plant. More specifically, the question is how much water specific plants need to grow, how much of it evaporates and how much water must be supplied to adequately irrigate a field of a specific size.

From theory to practice

Because they had to cover a lot of new ground, the two teachers hired outside experts to assist them with the project. For example, an electrical engineer from Nicaragua who lived in Hamburg and quickly seized the opportunity to build a company which uses solar power in his native country. Since then solar powered irrigation plants have been implemented with his support on-site; these plants are a big step forward for the farmers in Nicaragua and offer important insights here in Germany.

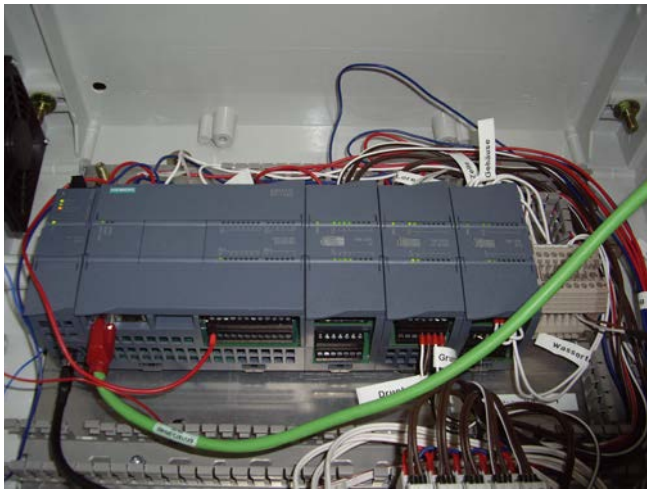
“Such a project takes about two years from the first calculations until we install the plant on-site,” explains Clemens Krühler. “The students learn a lot from these practical objects. They gain decisive insights into the use of one of the most important energy sources of the future. And they learn first-hand about the potential of photovoltaics to sustainably change the economic and social conditions in many regions around the globe.”

“It is interesting to see that about half of the students stay in touch with this topic as they move on,” adds Robert Heiden.

And the last project went even a step further: “We wanted to compare the efficiency of different pumps. And we wanted to know exactly how much water is needed for how many hours of sunshine,” explains Krühler. “This means we are constantly measuring all decisive parameters with our latest project, such as sun exposure, voltage and current flow of the electrical system as well as quantity and pressure of the groundwater pumped from the well.”

Daten im transatlantischen Dialog

Siemens was consulted to help with the realization of this job. The company has more than just a consulting role in the project today. Siemens donated the TeleControl Basic telecontrol system to control and monitor remote substations using wireless GPRS technology. TeleControl Basic uses the TeleControl Server Basic control center software to connect the control center with two substations that each consist of one SIMATIC S7-1200 controller with CP1242-7 communication processor. A SIMATIC HMI operator panel of the type KP300 is used for operation on-site.



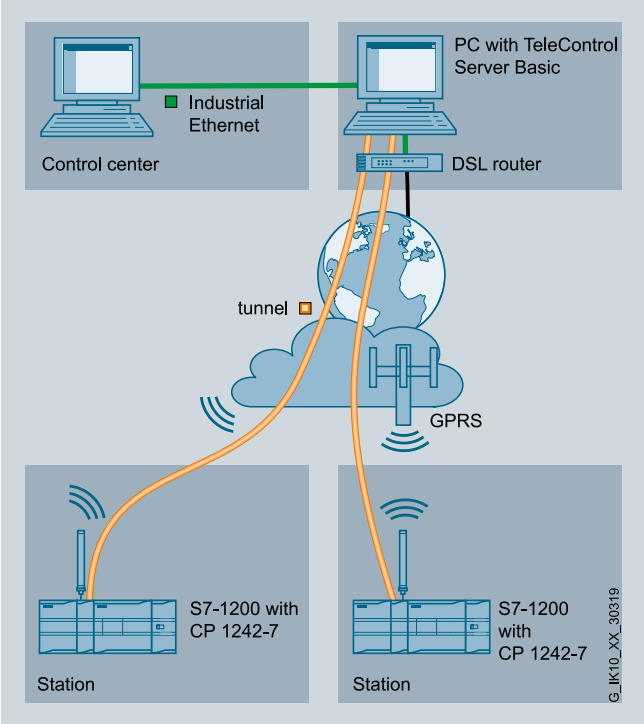
TeleControl Basic telecontrol technology from Siemens is used to monitor and control the remote systems in Nicaragua.

The system, including sensors and back-up battery, was installed by students during their project trip in the summer of 2013 in a research area used by the agricultural institute of the university in Léon, Nicaragua. The system is installed in a control cabinet right next to the groundwater pump and is supplied with power by its own photovoltaic system. It currently records the performance data of two pumps from different manufacturers which are directly transmitted to Blankenese via GPRS. A server is installed there to collect the constantly transmitted data and store it in a database.

The two RTUs (Remote Terminal Units) in Nicaragua each consist of a SIMATIC S7-1200 controller with CP 1242-7 communication processor. The values measured on site are directly transmitted to the "control center" at the school in Hamburg via GPRS.

The benefits of the telecontrol system are the cost-efficient connection of the substations by means of the public GPRS network and the encrypted data transmission. Several thousand data values can be buffered in the communication processor to bypass any downtimes of the transmission path. Fully automatic time stamps are used to correctly archive the process data in the control system later.

"We not only want to collect practical data about the performance of the different pump models. We also want to use the data for a variety of calculations and for more insights into the amount of water required depending on the weather," describes Kühler the system and adds: "Someday we should be able to determine, based on the size of a field and the fruit grown there, how much groundwater is required for irrigation and what size pump is needed for the job."



Schematic representation of the TeleControl Basic solution in use. The students in Hamburg can use the measured values from Nicaragua for different calculations and to gain insight into the amount of water required depending on the weather.

Then the farmers in Nicaragua will not only grow the fruits and vegetables as permitted by Mother Nature. For the first time, they will not be impacted by weather-related uncertainties. And they will be able to actively market their products and produce exactly when it fetches the highest prices in the market.

Local farmers who are already using solar powered irrigation systems as part of the EduaRD project are experiencing the benefits associated with it even today. Lost harvests which almost destroyed their families are now a thing of the past. Even during the dry season, they are now able to bring in additional harvests. This situation has a tremendous impact on economic prosperity and the living situation of the people in Nicaragua.

It is no wonder that photovoltaics are on the verge of a breakthrough in Nicaragua. It all started with two dedicated teachers and a handful of inquisitive students in Hamburg-Blankenese.

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