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Solar Drip Irrigation Case Study – The Valle Family

Nelson and Johana Valle are small farmers from the community of Jucuapa, Matagalpa, Matagalpa, Nicaragua. They support their 5 year old daughter, Ixil and Nelson's mother, Marina. Matagalpa is located in the northern mountainous region of Nicaragua and is known for its cooler climate, rivers and coffee production. Nelson grows squash, passion fruit, and tomatoes on 2 acres of land to sell at the local market but has had trouble earning a profit due to the high cost to irrigate his crops. When we met the family, they were using a pump to water crops that was powered by grid electricity at times and by a diesel generator at times. The diesel generator was used because the electric grid goes down often, preventing them from irrigating when needed, and the grid quality is not high enough to accommodate the voltage from the pump. When the water pump is turned on, the lights and appliances in the house do not work properly. In addition to problems with grid quality, some farmers in Nicaragua are charged commercial electric rates or a fixed electric rate, making the use of electricity too expensive to irrigate his small farm. Nelson and Johana were using the pump to water crops three days a week, even though the crops needed watering daily. They were paying as much as $130 per month for electricity and diesel fuel to irrigate their farm.

Nelson is a member of a national agricultural organization called UNAG, Unión Nacional de Agricultores y Ganaderos. UNAG is one of the largest agricultural groups in Nicaragua for small and medium sized farmers, with more than 72,000 members, offering them support, training, and opportunities to improve their businesses. GRID Alternatives approached UNAG to find small organic famers that would benefit from a solar-powered drip irrigation system. The UNAG Matagalpa chapter introduced us to Nelson and Johana because they met our require-ments of having successful experience growing crops on 2.5 acres of land or less, having a clear need for a solar-powered drip irrigation

system, and having the willingness to pay for part of the irrigation system.

Over the course of nine months, GRID staff and local solar company Suni Solar worked with the Valle family to determine their irrigation needs, design the irrigation system, establish ground rules for system use, and prepare for the installation. The family was required to pay $2,000, 20% of the system cost, up front before the project was installed. They borrowed funds from the UNAG Matagalpa chapter's revolving fund since small farmers do not typically have $2,000 on hand. GRID Alternatives paid the remaining $8,000 for the system for a total system cost of $10,000

In December of 2015, GRID Alternatives volunteers helped install a 370 Watt solar-powered drip irrigation system along with the Valle family, technicians from Suni Solar and community volunteers. The group spent three days installing a pole-mount system that pumps water from a nearby river into a cement storage tank, which then waters the plants drip by drip through gravity. Water pipes were buried in a ditch that ran from the river to Nelson's storage tank to prevent cows from stepping on them and breaking the PVC pipes. The PV system is a DC-direct stand-alone system with no batteries. The PV modules power the pump during the day to move water from the river to the storage tank, and the water moves to the crops as needed by gravity. A DC-direct system means no battery purchase, replacement or maintenance is necessary.

Ten months after the project was installed, GRID staff visited the farm to see how the system was working and to better understand the impacts the system had made so far. The family mentioned the following impacts:

- Before the drip irrigation system was installed, Nelson and Johana grew only squash, passion fruit, and tomatoes because there was not enough water to irrigate other crops. Now they are able to grow squash, passion fruit, tomatoes, onions, pipian, pasturage, and raise Tilapia. He has improved the diversity of his crops and the quantity of each one.
- Before they had the drip irrigation system, their monthly earnings were $25 (income $103 - $77 costs). Now their monthly earnings are $546 (income $581 - $35 costs). They increased their monthly earnings by more than 20 times (or over 2,000%).
- Previously, the Valle family had to walk to the com-munity well to get drinking water. Now that the pump has been installed, they can get drinking water from the storage tank that runs directly to their house, saving them time each day.
- Now that they don't use electricity to run a pump, their monthly bill comes out to about $2.90 instead of $33. They also don't have to buy any diesel fuel and were able to sell their diesel generator and old water pump to recoup some of their investment.
- Previously the family had 8 cows that had to eat in another field because they did not have enough to feed them. Now, they have 12 cows that can graze in their field. The solar irrigation system allows them to keep animals on the farm.

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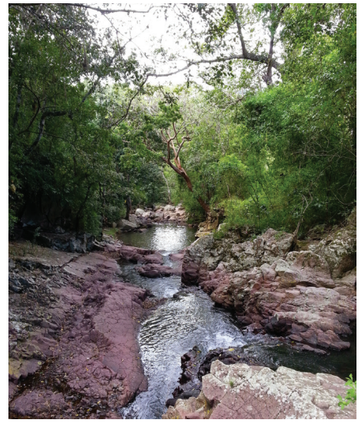

- The solar pump allows them to divert water from the river to create a pond on their property where they can raise Tilapia, a fast growing fish that can be sold at the market. Tilapia fish eat mosquito larva, reducing mosqui-to born virus exposure near the family's home.
- Nelson and Johana are able to sell their crops directly to community members, who take the produce to resell in markets in the capital city of Managua, providing their neighbors with a source of income.

In summary, impacts from the solar-powered drip irrigation system include higher earnings, more diverse crops, less time collecting drinking water, more reliable electricity for home appliances, no more trips to buy diesel fuel, more income for neighbors, more locally grown food available all year round.

Due to the increased income from more and different crops, Nelson and Johana were able to pay back the $2,000 loan in one year. Now that they are earning more income, they are thinking of opening a bank account for the first time to have emergency funds in case the new pump needs to be fixed. They will also use the funds to provide for their family, paying for food and clothing. One day Nelson hopes to buy a motorcycle so he has more transportation independence, and possibly more land to grow more crops.

Normally, they would only need to use the drip irrigation system during the dry season since there should be plenty of rain in the rainy season. However, in the last two years, Nicaragua has experienced extreme droughts which requires farmers to water their crops all year round or lose their crop entirely. Since it has been dry, the Valle family has used their drip irrigation system all but one month since it was in-stalled last December. When it does rain heavily, they roll up the irrigation tubes and remove the pump from the river to lock it up, preventing the river from covering the surface pump and avoiding the risk of theft.

Although the project was installed successfully and the system is working well, GRID will continue to visit the family twice per year to maintain a strong relationship and ensure they are part of our growing solar network in Nicaragua. Our staff will work with Nelson and Johana to ensure their system is working well and to continue gathering feedback about the project for the years to come. Nelson and Johana will continue to be invited to our annual solar conference in Nicaragua where they have the chance to meet representatives from other communities where GRID has installed solar projects, to learn more about solar energy, and to share experiences with others.

Nelson and Johana have become role models for the

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surrounding farmers who initially were skeptical about the reliability of solar energy and the system's return on investment. Many of the neighboring farmers now express strong interest in having a solar-powered irrigation system themselves. Nelson expressed that even he had doubts at first: "When GRID told us about the drip-irrigation project, I wasn't sure it would really work. Plus, I knew these types of systems are expensive, so I didn't think I would have the capacity to pay for one. But now we're happy to see how much progress we've made. I now have more varieties of food to feed my family and sell. Not only am I producing more, but there are also fewer costs both economically and environmentally."

SYSTEM SPECS:

Modules: Two 185W UD-185MF5 Mitsubishi Electric PV Modules

Motor controller: One NOV MONO Solar Motor Controller

Pump: One Surface Pump, SunRay SRX Drive Pack CP800

Combiner Box: 1 Midnite Solar Combiner Box MNPV3

Surge Protector: One Midnite MNSPD115

DC breaker: One Midnite 20 amp

Land Size: 2 acres

Water flow: 44 liters per minute (on a sunny day)

Total project cost: $10,000 USD

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