EXPANSION OF RENEWABLE ENERGY SOLUTIONS IN AGRICULTURE

CASE STUDY
BUSINESS: LLC GREEN TECHNOLOGIES
LOCATION: DUSHANBE, TAJIKISTAN

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Summary

LLC "Green Technologies," established in 2016, is one of the few companies in Tajikistan that specializes in green energy, with a particular focus on the agricultural sector. Although the country is rich in water resources, the mountainous terrain creates challenges, as not all types of agricultural land have access to gravity-fed water systems.

A key aspect of the company's work focuses on improving access to reliable water supplies for irrigation. Recognizing the significant hurdles faced by farmers who depend on consistent water access, "Green Technologies" has positioned itself as a leader in providing sustainable energy solutions tailored to the agricultural industry. The company's offerings include a range of solar energy and micro-hydropower systems, which are essential for solving water access problems in rural and remote areas.

The company's business model is built around providing end-to-end services, ensuring that customers have access to comprehensive support throughout their transition to renewable energy. LLC Green Technologies offers a wide range of services, including engineering design, installation, and ongoing maintenance of solar and micro-hydropower systems. By managing every step of the process, the company ensures that its clients can implement sustainable energy solutions with minimal risk and maximum efficiency. This holistic approach is particularly valuable in rural areas, where technical expertise and infrastructure support can be limited. Through its innovative solutions, the company helps address the economic and logistical barriers that prevent many agricultural businesses from accessing reliable energy, ultimately improving productivity and reducing operational costs.

Background & Challenges Addressed

The country faces significant challenges in ensuring a reliable electricity supply, particularly in rural areas where power interruption and high energy costs hold back productivity. Agriculture, being a critical part of Tajikistan's economy, is heavily impacted by these issues. With the government's growing interest in sustainable energy development and reducing reliance on imported fossil fuels, there is a pressing need for energy-efficient and eco-friendly solutions. LLC Green Technologies addresses these challenges by offering solar and hydropower solutions that are specifically tailored to meet the needs of agricultural businesses. The company's focus on renewable energy use not only contributes to the development of the green energy sector in Tajikistan but also supports the broader goals of energy independence and sustainability. Climate change is intensifying existing challenges for Tajikistan's agricultural sector: a) drought and irregular rainfall patterns are becoming more frequent, exacerbating water scarcity and increasing dependence on irrigation systems, which places further pressure on already limited water resources, b) rising temperatures lead to increased evaporation rates, reducing soil moisture and crop yield, making the need for efficient, energy-powered irrigation systems even more critical, c) soil degradation due to extreme weather events like floods and landslides not only disrupts farming activities but also diminishes the long-term fertility of agricultural lands, and d) shortened growing seasons due to fluctuating climate conditions threaten food security, pushing farmers to rely more on energy-intensive methods to sustain agricultural output.

CLIMATE CHANGE

The expansion of renewable energy use is critically important to reduce the heavy dependence on diesel generators and the often-unreliable public power grid, both of which contribute to environmental degradation and economic inefficiencies. Particularly in rural agricultural areas of Tajikistan, many lands remain unused due to lack of access to water and the power grid.

ECOLOGICAL CHALLENGE

Addressing the growing issue of water scarcity and inefficient irrigation practices is critical and can be achieved through the implementation of solar-powered irrigation systems, which offer a sustainable and energy-efficient solution to conserve water resources while improving agricultural productivity in areas heavily impacted by limited water availability.

ECONOMIC CHALLENGE

Reducing operational costs for farmers is crucial and can be achieved by cutting energy expenses by up to 70% through the adoption of innovative renewable energy solutions, such as solar power systems. These technologies not only reduce reliance on expensive traditional energy sources but also decrease irrigation and storage losses by up to 40%, improving water management, reducing waste, and ultimately enhancing agricultural efficiency, productivity, and profitability for a more sustainable and financially viable agricultural sector in the long term.

SOCIAL CHALLENGE

Supporting rural development can be significantly advanced by providing sustainable energy solutions that not only enhance agricultural productivity but also improve living standards in rural communities, thereby contributing to economic growth, better quality of life, and increased access to essential services and opportunities.

Objectives

Objective 1
Lower the amortization time of green energy applications to less than five years, making them more accessible to farmers.

Objective 2
Enable farming businesses to reduce energy costs by 70% and decrease irrigation and storage losses by 40%.

Objective 3
Create conditions for long-term sustainability by establishing a repair and testing facility for green energy equipment.

Being part of the Climate Smart Business Challenge Facility has been instrumental for Green Technologies in subsidizing solar energy solutions for rural farmers, which has significantly increased the adoption rates of these technologies. This support has allowed the company to offer more affordable renewable energy options to farmers who previously struggled with high energy costs and unreliable power supply. As a result, many rural communities have begun to experience the benefits of solar energy, such as reduced operating expenses and more stable access to electricity. Additionally, with the support of the program, the technology has been subsidized, making it more accessible for farmers. In the future, as some farmers start using solar devices and witness their effectiveness, it could create a demonstration effect, encouraging other farmers to invest in such solutions.

From an economic perspective, subsidies help lower initial investments, making the transition to solar energy more appealing. Without subsidies, farmers may have to wait longer to recoup their investments, but over time, they will still be able to see the advantages of using solar energy. Thus, even though the unsubsidized option may be less accessible, it can still become beneficial in the long run, especially as the overall trend towards renewable energy continues to grow.

1 Assessment

The site assessment involved a detailed evaluation of environmental and operational factors to inform decision-making. Technical planning was conducted to design tailored green energy solutions for the identified needs. A minimum of 12 farming businesses were selected as pilot sites to ensure the suitability and scalability of the proposed solutions.

2 Installation of systems

Solar systems, such as solar pumps and cooling rooms, were installed at the selected sites to address energy needs of the local community. A professional repair and testing workshop was also established to support ongoing system maintenance and reliability. These installations aimed to enhance energy efficiency and promote sustainable practices in the farming businesses.

3 Monitoring & Evaluation

All project sites were continuously monitored to ensure efficiency and reliability in intervention. Regular filed visits have been conducted to assess the economic impact on farming businesses and community livelihoods. Findings from the monitoring process were used to make necessary adjustments and improve the overall sustainability of the systems.

Results and Impacts

Climate change adaptation and mitigation outcome
Reduced dependence on fossil fuels by increasing the use of solar energy for irrigation, cooling, and power backup.

Economic outcomes
Lowered energy costs by 70% for participating farmers and reduced storage losses by 40%.

Environmental outcomes
Improved water use efficiency and reduced carbon emissions through the replacement of electricity and diesel generators.

Social outcomes
Increased productivity and profitability for rural farming businesses, contributing to rural development.

Key lessons learned

The financial viability of solar solutions with reduced operational costs made them highly attractive to farmers. The installation of solar panels and pumps in Tajikistan currently has a payback period of approximately 8 to 10 years, given the existing energy tariffs. However, through the project, which covers about half of the farmers' expenses, this payback period could be reduced by half for those with access to the power grid. On the other hand, farmers without grid access often do not engage in gardening or agriculture. Some farmers are using diesel generators, which significantly increases their costs and contributes to atmospheric pollution. In such cases, the installation of solar solutions could serve as an effective alternative.

The project has had a profound and transformative impact on the adoption of climate-smart practices within Tajikistan's agricultural sector. By successfully integrating renewable energy solutions, it has not only addressed critical economic, environmental, and social challenges but has also demonstrated the powerful potential of these technologies in driving sustainable business growth. The project illustrates that renewable energy can significantly reduce operational costs, enhance energy efficiency, and improve productivity while mitigating the adverse effects of climate change.

Furthermore, it underscores the vital role that such innovative solutions play in fostering long-term sustainability within the agricultural industry. Through these advancements, the project supports climate change mitigation efforts by reducing reliance on fossil fuels and lowering greenhouse gas emissions. The success of this initiative highlights the broader potential for renewable energy to support economic development, environmental stewardship, and social progress, proving that such interventions are not only beneficial but essential for building a resilient and sustainable future.

Future Steps

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The Climate Smart Business Challenge Facility (CSBCF)

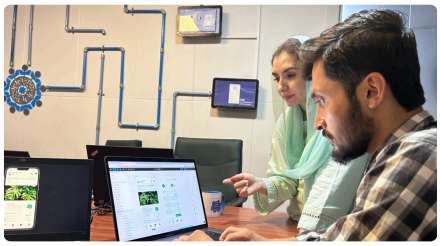
Also referred to as Facility – is a pilot project that aims to identify and support Small and Growing Businesses (SGBs) focusing on low-carbon and climate-resilient solutions in Tajikistan, Pakistan, and India.

The facility provides

Technical support
Technical support to SGBs to execute innovative climate-smart solutions

Grants
Access to much-needed grants to leverage additional private sector capital.

The Facility (CSBCF) is a pilot project implemented by Aga Khan Foundation Tajikistan in partnership with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). This project is supported by the IKI Small Grants program, which is part of the International Climate Initiative (IKI) and financed by the German Federal Ministry of Economic Affairs and Climate Action (BMWK) in close cooperation with the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) and the Federal Foreign Office (AA). Focusing on the agriculture, forestry, and other land use (AFOLU) and water nexus (both adaptation and mitigation), the facility will create incentives for SGBs to become champions of green practices and tap into the potential of the private sector to contribute to climate resilience.



Innovative climate smart solutions that are contextual, scalable, and inclusive will be prioritized.

The Facility defines innovation as developing new and/or refining/adapting existing practices, goods, services, and technologies that have potential to address issues related to the impacts of climate change in the targeted countries more effectively than existing approaches. A pre-requisite for an idea to be categorized as an innovation is that it recognizes and addresses, where possible, the sensitive needs of marginalized groups such as women, children, and senior citizens. As such, an idea that negatively impacts marginalized groups cannot be categorized as innovative based on CSBCF's criterion. The Facility focuses on supporting highly innovative climate-smart solutions and refrains from funding the replication or scaling up of existing, proven solutions. Therefore, proposed innovations must not yet be considered commercially viable, thus not qualifying for loans or repayable capital due to innovation risks, justifying the use of grant subsidies. Despite their current status, solutions should have the potential to become viable and scalable after successful pilot "" testing as evidenced by documented technical and financial results.

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