

## CIRCULAR ECONOMY BUSINESS CASE STUDIES IN SOUTHEAST ASIA



## SOGE, Solar Green Energy (Cambodia)

-  Phnom Penh, Cambodia
-  Agriculture
-  [soge-cambodia.com](http://soge-cambodia.com)
-  (Ms) Thida Kheav, founder and CEO
-  Since 2014

## Solar Green Energy (Cambodia) Solar Solutions for Sustainable Growth

### Business Spotlight

Solar Green Energy (Cambodia) – known as SOGE – aims to expand the use of green energy in agriculture and to address challenges like energy scarcity and the high operational costs for irrigation pumps and systems. Their innovative products, including smart water pump services and solar-based irrigation systems with sun trackers, have helped to enhance irrigation efficiency and farming sustainability. In particular, SOGE's solutions in hydroponics and poultry farming have significantly reduced operational costs and cut CO<sub>2</sub> emissions substantially. The solar water pump project in Kampong Cham has increased agricultural yields and reduced greenhouse gas emissions, exemplifying efficient resource utilisation in line with circular economy principles.

The SOGE business strategy, built around sales of high-quality solar equipment and water pumping services, has created a robust customer base and prospects for expansion, despite challenges in market acceptance and the impact of the COVID-19 pandemic. Ms Thida founded SOGE with a commitment to renewable energy, sustainability, and increasing the participation of women in the green sector in Cambodia.

### Keywords

Solar energy, water pump, irrigation

### Innovation

Product/service design, Use and maintenance, Resource efficiency, Resource substitution

## Context and baseline

Agriculture in Cambodia is crucial to the nation's economy and livelihoods. As of 2021, the sector employed over 35% of the workforce, and 77% of rural households depend on agriculture, fisheries, and forestry for their sustenance. However, numerous challenges exist. These include limited access to reliable energy, inefficient irrigation during dry seasons, high operational costs due to fuel costs, inadequate rural electrification, and the impact of climate change. Solar technology offers a promising solution, potentially boosting agricultural productivity and sustainability in Cambodia by providing a dependable, cost-effective energy source, thereby reducing operational expenses for irrigation and aiding crop growth.

SOGE provides green energy solutions for rural Cambodia. Renowned for its high-quality products and dependable services, SOGE offers a diverse range of solar systems. Their product line encompasses both on- and off-grid systems, solar water pumps, solar backup systems, and smart irrigation systems. Additionally, SOGE provides water pumping services at stations for small and medium-sized enterprises (SMEs) and farmers who are unable to afford their own water pumps.

## Innovation

SOGE has innovated in the design, assembly, and optimisation of solar-powered systems for agricultural applications, using imported components such as the photovoltaic (PV) panels, Internet of Things (IoT) devices, battery balancers and smart controllers. The applications cover drip irrigation and pumping systems, along with cooling systems and mini-grids, and these products excel due to their automatic sun tracking, which adjusts the position of the panels throughout the day to maximise power generation. The resulting systems are unique for Cambodia, and allow farmers to both optimise irrigation for crop growth and reduce operational costs by avoiding the need for diesel powered pumps.

SOGE has only a small product development department, yet it has successfully optimised its systems for improved efficiency and the quality and reliability of its final products.

SOGE is also the first in its sector to have offered warranties for 6 months initially, and now the guarantees cover their products for 2 or 4 years. Furthermore, through a partnership with the SNV Netherlands Development Agency, SOGE has trained farmers in the use, repair, maintenance, and installation of its solar power systems.

## Circular Economy impact

In their applications in farming, SOGE's solar power systems contribute to resource substitution, from non-renewable grid-power and diesel to renewable solar energy, and to resource efficiency by maximising the energy efficiency of the solar systems and supporting water efficiency and reducing irrigation requirements in agriculture. However, these resource substitution and efficiency effects are specific for each system, as per their scale and intended application.

The EU-funded SWITCH TO SOLAR project in Cambodia provides two good examples of the impact of SOGE solar cooling solutions (SSCS) in farming subsectors. In hydroponics, solar energy supplying and smart irrigation cooling solution led to a notable increase in the efficiency of water use. Energy consumption in hydroponics is very limited, so energy savings, compared to the grid, do not represent much (10–15% savings). However, production time was reduced by at least 50%: depending on the crop, the time from nursery to harvest went from 60–75 days to 28–35 days when using hydroponics with SSCS, allowing more production cycles per year. Plant growth and productivity increased, and significant operational cost savings (50%–75%) were made. This transition also achieved a notable environmental benefit by reducing CO<sub>2</sub> emissions by 5.89 tons per year for the farm with a total annual power production of 10,153 kWh by solar PV. Similarly, solar cooling in one poultry farm resulted in a 70% reduction in operational expenses, due primarily to increased energy savings by maintaining optimal growth conditions, which contributed to CO<sub>2</sub> emissions reductions of 4.36 tons per year. In both cases, the excess power was stored in a battery, and sometimes in other electrical appliances, to ensure power backup for the cooling systems. These examples demonstrate a clear alignment with circular economy principles by optimising resource use and minimising waste, specifically in terms of energy consumption.

Another documented example involves solar water pumping in Kampong Cham, whose central system provides 144 smallholder farmers with solar-powered irrigation. The project proved to be cost-effective from savings on diesel fuel, associated reductions in greenhouse gas emissions, and the enablement of increased agricultural yields, potentially allowing for year-round rice production and reducing the reliance on chemical inputs for greenhouse farming. Indeed, diesel pumping is polluting and it has an impact on the quality of the production, usually requiring more chemicals.

SOGE is in the process of creating an advanced irrigation management system designed to optimise water use for farmers. This innovative system will facilitate the coordination of the scheduling of irrigation activities across multiple farms through a smartphone application. By preventing simultaneous irrigation across all farms, the system effectively eliminates bottlenecks and ensures a more equitable distribution of water resources. Additionally, it offers the capability of managing irrigation at the parcel level, further enhancing water efficiency and conservation. The system is currently in the pilot phase with 2 groups of farmers, and should be available by 2025.

These initiatives collectively contribute to the circular economy strategies of resource substitution by using renewable energy, thus reducing the wasteful use of farm chemicals and greenhouse gas emissions, along with supporting eco-friendlier farming solutions. The impact on resource usage and wastage is significant in both relative and absolute terms, with substantial energy savings and reductions in CO<sub>2</sub> emissions and operational expenses, while also positively influencing land use and nature conservation through enhanced agricultural practices and reduced dependency on agricultural chemicals.

## Business and market impact

The company has two primary sources of revenue: the sale of solar equipment, with a particular focus on water pumps, and water pumping services, which are expected to grow in the future.

SOGE places strong emphasis on client satisfaction and after-sales service. They offer high-quality products, which, while more expensive, come with maintenance and warranty services. Currently, they are seeking investors to help establish a manufacturing unit for their solar products.

Regarding services, since late 2021 SOGE has installed a total of 17 water pump stations, 7 of which are owned by SOGE, and has introduced a 'Pay-per-Use' system for farmers. This initiative serves 2500 hectares and supports 1200 smallholder farmers. These stations have been financed through loans. This service has proven very successful, achieving a payback period of three years and generating highly positive results for the farmers. While most of the water stations cover about 50 hectares of land, SOGE recently invested in a larger station in Kompong Cham capable of servicing over 1200 hectares. This expansion is expected to yield higher revenues in the future, even though the initial investment is significant.

## Stakeholders

The company has established a customer base of over 2,000 clients, with smallholder farmers making up 30–40% of this group. While smart irrigation systems, solar pumps and solar cooling may not be affordable for everyone, their clients acknowledge the high quality of these products. Significantly, SOGE makes a social impact by providing low-income farmers with access to water through their water services.

Additionally, by training farmers in the use, repair, and installation of solar products, SOGE leverages their support for broader product outreach via a commission-based model. Beyond farmers, SOGE has also garnered backing from several organisations, receiving grants and technical assistance from entities like Netherlands Development Organisation (SNV), UN Development Programme (UNDP), US Agency for International Development (USAID), and the EU Switch-to-Solar programme.

## Implementation

The challenges faced by SOGE mirror the difficulties of introducing renewable energy technologies in emerging markets. A significant obstacle is bridging the mindset and knowledge gap about solar energy among end-users and the local population at large. Many farmers, habituated to traditional energy sources, tend to compare solar solutions primarily on initial investment price rather than on operating or lifetime energy costs and quality. The challenge remains to demonstrate how the initial higher investment for the solar solution has the potential to unlock lasting savings and other benefits for the future.

Moreover, the introduction of 'Pay-per-Use' solar power systems, which replace conventional pumps and engines, initially encountered resistance. Local communities, unfamiliar with this concept, mistakenly expected these services to be free, leading to initial scepticism and opposition along with unfortunate payment defaults.

Recruitment presents another challenge for SOGE, especially to attract staff with the appropriate skills and mindset for this innovative sector. The COVID-19 pandemic exacerbated this difficulty, causing a significant decline in sales, strained resources, and a test of the company's resilience.

At the heart of the company's journey is the inspiring story of its founder, Thida, who began the business with limited financial backing. She faced considerable risks, including taking loans at high interest rates to fund initial projects. Her story underscores the financial hurdles that entrepreneurs, particularly women, encounter in the green industry.

## Takeaways

SOGE's journey highlights the complex challenges of introducing solar solutions in Cambodia, including cultural, financial, and gender-related issues. However, it also illustrates the potential for positive impact and transformation through green solar solutions. Despite hurdles, the sector is witnessing increased opportunities, fuelled by advancements in technology and a global trend towards environmental sustainability. Thida's vision transcends mere business success: she is passionate about increasing female participation in the solar energy sector and in the green industry in Cambodia. She also strongly believes that it is possible to produce renewable energy products in the country via innovative solutions. Her ambitions include fostering environmental consciousness, encouraging sustainable practices, and advancing knowledge and research in renewable energy.



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