



# Project: Innovation Facility Installation of Demonstration Ram Pump

Project Timeframe: September 2020 – July 2023

## Case Study

**CAMBODIA CLIMATE CHANGE ALLIANCE**

Implemented by:



Funded by:





# PROMOTING GREEN AGRICULTURE THROUGH THE INNOVATIVE HYDRAULIC RAM PUMP IN CAMBODIA

In Cambodia, agriculture contributes to 37 percent of the workforce, accounting for around 21 percent of the nation's gross domestic product (GDP) in 2017. However, the impacts of climate change have posed several challenges to the sustainable growth of the agriculture sector and those relying on this sector for living standards. Nowadays, irrigation for the agriculture sector in Cambodia is primarily conducted using diesel pumps, which draw water from various sources, negatively resulting in significant CO<sub>2</sub> emissions from the combustion of fossil fuels. More seriously, diesel engine emissions cause ground-level ozone production, harming crops, trees, and vegetation. They also contribute to acid rain formation, damaging soil, and freshwater ecosystems, and entering the human food chain. Additionally, these emissions cause property damage and reduce visibility, impacting daily life and the environment.

To ensure the long-term sustainability of green agriculture, the Ministry of Environment, and the National Council for Sustainable Development in collaboration with international partners EU, UNDP, and Sweden have supported the Prek Leap National Institute of Agriculture (NIA) to implement a project "Innovation Facility Installation of Demonstration Ram Pump" to replace the diesel pumps with hydraulic ramps for agricultural irrigation and provide capacity building for students on hydraulic ramp pumps as an innovative approach to move Cambodia toward green agriculture, contributing to the reduction of CO<sub>2</sub> emission in agriculture.

## Sustainable Ways for Hydraulic Ram Pump:

This project was implemented in two phases. The first phase involved setting up a demonstration system at the NIA in Phnom Penh for training purposes. The small-scale demonstration system of a water tower with a ram pump and a solar pump can help students visualize and fully comprehend how the ram pump practically was operated.

In the second phase, the original plan was to establish a large-scale system for irrigating 50 hectares of plantation and aerating fishponds in Stung Chral, Obakrotes, Kampong Seila, Sihanoukville. However, because the intended project area was predominantly owned by a small number of large farm households, the project was proposed to CCCA3 to identify a more suitable new location to irrigate 17 hectares for 20 households in Village 6, Yeay Mao Pichnil, Traeng Trayueng Commune, Phnom Srouch District, Kampong Speu. The new proposed location was then approved by the CCCA3.



H.E. Dr. Vathana Thun, Former President of the NIA

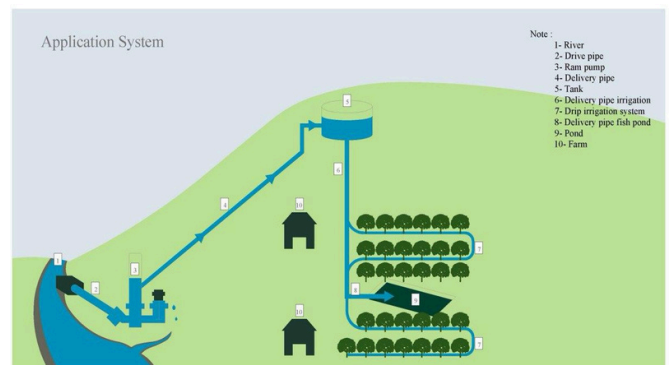
H.E. Dr. Vathana Thun, explained, “We selected the location in Kampong Speu province to build a hydraulic ram pump after studying its geography and the agricultural needs of the local community. Previously, residents in this area had to purchase water for daily use and faced water scarcity during the dry season.”

Technically speaking of the hydraulic ram pump installation, Mr Yvon Chalm, CEO of K-Box Solution, in charge of the technical process of the hydraulic ram pump explained that:



Mr Yvon Chalm, CEO of K-Box Solution

“The water flows from the dam through a pipe to reach the ram pump. The ram pump utilizes water pressure to lift some of the water to a tank on the mountain, without relying on fossil fuels, only utilizing natural pressure from differences in elevation. The water is stored in the mountain tank and can be used to irrigate all the fields and mango trees in the area, Chalm said.”



Additionally, Mr Chalm, elaborated that the hydraulic ram pump was originally invented in France and has been extensively used in Switzerland, Thailand, Indonesia, England, and the USA. It can be employed in any country that has mountainous terrain. Additionally, due to its low operational costs and minimal maintenance requirements, this system represents an innovation in Cambodia and can be implemented in regions with flowing water, particularly in mountainous provinces. Its simplicity highlights its potential for application in various other provinces such as Kampot, Mondulkiri, Ratanakiri, Koh Kong, Pursat, and Banteay Meanchey.

Transitioning to this low-tech solution, which solely relies on water energy for water lifting, will eliminate the need for burning fossil fuels for irrigation purposes, thereby mitigating CO2 emissions. The technology, known as the self-acting ram pump, is simple and requires minimal maintenance.



This initiative marks the first implementation of such technology in Cambodia and holds potential for replication in other areas with surface water sources. In addition to its mitigation benefits, the technology offers advantages for adaptation, as it eliminates fuel and running costs associated with diesel pumps, enabling the lifting of greater volumes of water.

H.E. Dr. Vathana highlighted that the hydraulic ram pump system is beneficial for the environment because it operates without electricity or fossil fuels, thereby causing no environmental pollution and contributing to the reduction of CO2 emissions in agriculture. The hydraulic ram pump effectively reduces energy expenses for irrigation and enhances crop resilience against climate change challenges such as drought.

## Cambodia Toward Green Agriculture through Hydraulic Ramp Pump:

Following the successful execution of the first and second phases of these trial initiatives, this project aims to establish strategies that enhance our capacity for project expansion and implementation throughout Cambodia. In addition to extending the system to various regions of the country, the NIA incorporated the insights gained from the project into its student training programs.

H.E. Dr. Vathana mentioned that “we focused on agriculture students specializing in water management and teachers, aiming to broaden their understanding of the ramp pump process. K-box Solutions also collaborated with NIA to develop training manuals on-ramp pumps.”

To advance Cambodia toward sustainable green agriculture, the first hydram was set up at the NIA compound for educational purposes, providing practical training to students that can be applied across the country’s agricultural sector.

Mr Chalm asserted that “we provide training to students on how to install and operate the ram pump system. As part of the training, we set up a small-scale ram pump system at the NIA”.

The training materials were developed by K-Box Consulting Firm in consultation and close coordination with the NIA. These materials include a training manual, a slide presentation on the three eco-designed models, a video on the operation of the hydraulic ram pump, and information on potential areas where a ram pump can be installed. After the project ends, teachers at the NIA will be responsible for providing any future training courses related to the Ram Pump, if such courses are offered.

The training mainly focuses on various aspects including the overall application system, the benefits of the hydraulic ram pump, how to calculate pump efficiency, the essential components for installing a ram pump system, site evaluation and necessary parameters, and the method for calculating greenhouse gas reductions with this system, which could potentially enhance environmental quality.



*Training to Students on How to Install and Operate the Ram Pump System*



## Sustainable Water Management for Irrigation System: Student Perspectives After Training

**Mr Hieng Lyhuoth**, currently a rural construction engineer and a former student at NIA, stated, “I participated in this hydraulic ram pump training for about six months. Most of the training content focuses on the impact of diesel pumps on natural resources and the installation of hydraulic ram pumps.”

Lyhuoth added that he has observed many communities in Cambodia facing challenges with water shortages, especially for agricultural purposes. He believes that studying the installation of hydraulic ram pump systems is beneficial as it helps educate the community on effective system utilization, replacing diesel pumps with hydraulic ram pumps.



*Mr Hieng Lyhuoth, currently a rural construction engineer and a former student at NIA*

*Lyhuoth explained the significance of hydraulic ram pumps by comparing them with diesel pumps: “Generally, using diesel pumps causes numerous problems for farmers and the environment, including economic, biodiversity, and temporal aspects. Economically, fuels are expensive, resulting in lower incomes and higher expenditures, making diesel pumps less profitable for users. In contrast, using hydraulic ram pumps is more convenient and financially beneficial due to avoiding gasoline purchases. Secondly, diesel pumps pose risks to biodiversity through toxic emissions and environmental impacts, contributing to climate change. Thirdly, diesel pump installation is time-consuming, whereas hydraulic ram pumps are ready for use automatically at any time.”*

**Ms Sun Dina** is majoring in Agricultural Engineering and Rural Construction at NIA. Dina participated in training on the hydraulic ram pump for nearly 5 months. The training focused mainly on its benefits, significance, technical processes, installation procedures, and case studies.



Ms Sun Dina is majoring in Agricultural Engineering and Rural Construction at NIA

*Dina shared that “typically, farmers in Cambodia use diesel pumps to irrigate their agriculture using water from rivers and ponds. However, the drawbacks of diesel pumps are primarily related to costs and environmental impact, as they burn petroleum and contribute to air pollution. Farmers face challenges due to water scarcity during the dry season, often relying on pond water. Consequently, they switch to crops that can withstand hot weather and require less water, thus sacrificing potential benefits.”*

Using hydraulic ram pumps could offer numerous advantages to farmers, lasting up to 5 years and providing water year-round, even during the dry season, ensuring consistent irrigation, Dina added.

To promote the widespread adoption of ram pumps in Cambodia, collaboration among relevant ministries—such as the Ministry of Agriculture, Ministry of Rural Development, and Ministry of Environment—is essential. These ministries directly engage with farmers and can effectively communicate and advocate the benefits of ram pumps with them.

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## The Key Milestone of the Ram Pump Project:

As a result of the project, six training sessions on the ram pump system were co-organized by NIA’s and K-Box Solution’s teams, benefiting 404 students and 10 teachers from the Agricultural Machinery Department. Among all the students who participated in the training, 81.76% of them passed the test.

Environmentally speaking, the large ram pump system in Kampong Speu province has provided water for irrigating 17 hectares of land and serving 20 households with free water access for daily use. Given its effective functioning without fossil fuel or petrol-diesel operation, the ram pump system has the potential to reduce approximately 1.22 tons of CO<sub>2</sub> emissions per month, based on the capacity of the existing ram pump. Extrapolating this figure, we can estimate a reduction of 14.64 tons of CO<sub>2</sub>eq annually.

In the scale-up plan, following the successful completion of Phases 1 and 2 of these pilot projects, the project implementer aims to enhance the capacity to expand the project across Cambodia. Besides extending the system to other parts of the country, NIA will integrate the lessons learned from the project into its student training programs.

For future ram pump projects, it is crucial to identify water sources, assess water needs, and evaluate existing infrastructure within the community before installing the system. This approach enables users to design the most effective type of ram pump for their environment. Thus, H.E. Dr. Vathana anticipates that “in the future, I would like to initiate a scale-up project for further research on ram pumps. This project aims to ensure the construction of sustainable ram pumps capable of withstanding varying water levels and flows.”

## CAMBODIA CLIMATE CHANGE ALLIANCE - PHASE 3 (CCCA 3)

The Cambodia Climate Change Alliance (CCCA)-Phase III builds on the achievements of the first and second phase (2010-2014, 2014-19) and provides a unified engagement point to pool resources for the mainstreaming of climate change in national and sub-national policies and programmes. CCCA is a joint initiative of the Royal Government of Cambodia and a partnership between UNDP, the European Union and the Swedish Government. It is implemented by the National Council for Sustainable Development (NCSd) and managed by its Department of Climate Change to address climate change in Cambodia.

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