Report

Stakeholder Forum of the Sub-sector Working Group on Irrigation (SSWG-IR):

Solar-powered groundwater irrigation for climate resilience and water security: overcoming barriers for sustainable and inclusive adoption in Lao PDR

Vientiane, Lao PDR | November 21, 2025

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Abbreviations

ADB	Asian Development Bank
DLAM	Department of Land Administration and Management
DOI	Department of Irrigation
DWR	Department of Water Resources
FAO	Food and Agriculture Organisation
IWMI	International Water Management Institute
Lao PDR	Lao People's Democratic Republic
MAE	Ministry of Agriculture and Environment
NAFRI	National Agriculture and Forestry Research Institute
NDC	Nationally Determined Contribution
NUOL	National University of Lao PDR
SSWG-IR	Sub-sector Working Group on Irrigation
SWG-ARD	Sectoral Working Group on Agriculture and Rural Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
WUG	Water User Group

Summary

The report summarizes key outcomes of the second semi-annual Stakeholder Forum of 2025 of the Subsector Working Group on Irrigation (SSWG-IR), which was held on 21 November 2025 in Vientiane Capital, Lao People's Democratic Republic (Lao PDR). The event was attended by more than 60 participants from government agencies, academia, development partners, farmer organizations, civil society organizations, and the private sector. The forum was organized by the Department of Irrigation (DOI), with the technical support from the Asian Development Bank (ADB) together with the International Water Management Institute (IWMI).

The main objective of the forum is to serve as a strategic coordination platform that offers high-level support to the Sectoral Working Group on Agriculture and Rural Development (SWG-ARD) of the Ministry of Agriculture and Environment (MAE). In addition, it is to offer regular coordination among key stakeholders, who advocate for irrigation development, to discuss more effective resource utilization and synergy enhancements for different irrigation development agenda topics or issues featured in each forum. The discussion topic of this forum is *"Solar-powered groundwater irrigation for climate resilience and water security: over-coming barriers for sustainable and inclusive adoption"*, which was discussed in detail together with complimentary topics including irrigation development more broadly, groundwater governance frameworks and lessons learnt from groundwater irrigation practices in the Lao PDR and other regions.

During the discussion, participants shared insights on how solar-powered groundwater irrigation is being adopted and managed at both community and household levels, with encouraging signs of progress evident. At the same time, the adoption status is considered new and supported through development projects and private investments. Key benefits include the potential for addressing water security, for example water supply in areas without access to surface water irrigation and grid electricity for water pumps; its feasibility as an option for cash crop cultivation during the dry seasons, a low-cost technology option for group operation, and its overall contribution to climate resilience and improvements in farm productivity and livelihoods.

On the advocacy and governance efforts, public agencies adopted guiding policy frameworks, i.e., the incorporation of groundwater irrigation in the revised Law on Irrigation in 2025 and a climate-resilient groundwater irrigation model in the irrigation development strategy; collaborated with development partners and across sectors to implement groundwater assessments and consolidation of existing data to produce groundwater maps for public uses; and coordinated with the private sector to facilitate their service compliance in order to ensure the service quality to the water users and farmers. Some recommendations for sustainable, equitable, and effective adoptions are summarized as follows:

- Establishing awareness campaigns to encourage farmers to use the services of business operators or drillers who registered to comply with service protocols and have the tools to assess the groundwater potential in advance of drilling.
- Establishing public-private partnerships to harness the technical knowledge and know-how of the private companies to address the maintenance issues through facilitating their service expansions to other provinces.
- Establishing groundwater maps to provide information on water quality, quantity, and sources of availability for public services to plan the installation of groundwater wells and avoid an issue of limitation.

- Conducting further research and studies on cost-benefit analysis and sustainable utilization of groundwater about how to recharge groundwater by storing rainfall for recharging groundwater during the long extended dry spell, for instance.
- Establishment farmer groups to enhance farmers' access capacity to technology and to help guide some basic operational and maintenance services and a process for seeking further support to farmers.

Key feedback on the draft of the irrigation development plan from 2026 to 2030 and the strategy to 2030 is about aligning and reflecting its climate-resilient irrigation into MAE's new agriculture and environment development strategy and the Lao Nationally Determined Contribution (NDC) for climate adaptation. Other specific suggestions are to incorporate the fish passage-compliant irrigation and set targets for automatic and sensing systems as part of the climate-smart irrigation.

In summary, there is a need to bring the topic of solar-powered groundwater irrigation into discussion in the SSWG-IR's next stakeholder forums to inform further progress and required improvements to ensure sustainable and equitable utilization of groundwater to underpin long-term water and food security.

1. Introduction

This report documents a summary of the Stakeholder Forum of the Sub-sector Working Group on Irrigation (SSWG-IR) organized on 21 November 2025 from 8.00 am to 12.00 am in Vientiane Capital, Lao PDR. The event is the second semiannual stakeholder forum of the year 2025 of the SSWG-IR, which was hosted by the Department of Irrigation (DOI) of the Ministry of Agriculture and Environment (MAE), with technical support from the International Water Management Institute (IWMI), under the technical assistance from the Asian Development Bank (ADB) to its partner governments, including the Government of Lao PDR. It is the fourth event under this form of tripartite cooperation, from 2024. The event was co-chaired by Dr. Khamphachanh Vongsana, DOI Director General, and Ms. Shanny Campbell, ADB Country Director, featured in Photo 1. There were 60 participants, with 19 women, represented from government agencies, academia, development partners, farmer organizations, civil society organizations, and the private sector.

Photo 1: Dr. Khamphachanh Vongsana, DOI Director General, and Ms. Shanny Campbell, ADB Country Director, delivered opening remarks as the chairperson and co-chairperson of the stakeholder forum. Credit: IWMI

The overall objectives of the event are to serve as a strategic coordination platform that offers high-level support to MAE's Sectoral Working Group on Agriculture and Rural Development (SWG-ARD) and facilitate regular coordination and discussions among key stakeholders for more effective resource utilization and synergy enhancements for different irrigation development agendas or issues. This event featured the topic of the discussion on "*Solar-powered groundwater irrigation for climate resilience and water security: over-coming barriers for sustainable and inclusive adoption*". The topic was proposed in the previous stakeholder forum based on the positive discussion outcomes for the overall opportunities and potential for solar-powered irrigation in the Lao PDR. The discussion focus of this event was on the governance mechanisms for the sustainable and inclusive operations of the solar-powered groundwater irrigation at the community level.

2. Meeting process

Technical agenda items of the forum included presentation and discussion sessions on policy frameworks, operational challenges, lessons learnt, and recommendations. A detailed agenda is attached in the Annex section of this report. More details of the presentations and discussions are summarised as follows:

2.1. A presentation on DOI's policies and strategies for irrigation development and climate resilient irrigation models.

The presentation was delivered by Dr. Vongsakda Vongxay, DOI Division of Planning and Cooperation. Key contents of the presentation were about overall policies, strategic directions, and action plans for irrigation development from policy frameworks from 2025 to 2026 and further to 2030, because DOI has yet finalised its next irrigation development strategy from 2026 to 2030 and vision to 2040. Details on the overall policy directions and the climate-resilient irrigation models are as follows:

- Vision and strategies for irrigation development from 2026 to 2030:
  - Improving the water supply to ensure water security and availability.
  - Rehabilitating existing irrigation projects, which are old and deteriorated, especially to upgrade soil canals to concrete-lined canals, which are more permanent and standardised.
  - Improving the water management process and irrigation system modernization, including the modernised database improvement and management and the use of modernised technologies for monitoring.
  - Strengthening irrigation management, operations, and maintenance for the institutions, water user groups, and farmers to be able to operate and manage irrigation systems.
  - Strengthening human resources in the irrigation sector at both the central and local levels, and further improvements of the legal and regulatory framework as well as technical standards.
- Prioritized policies for irrigation development from 2025 to 2026
  - Increasing water storage of the irrigation schemes through reservoirs and ponds, and introducing water-saving distributions through concrete lining, piping, and dripping systems.
  - Introducing technical options with higher-level of water-delivering service systems to farmers, such as gravity systems, groundwater with solar power technologies, and modern delivery and application systems.
  - Improving schemed water management by using field sensors and modelling to improve scheduling to better match supply delivery with crop water needs.
  - Improving operation and maintenance capacity building of water user groups (WUGs).
  - Improving efficiencies through different water management techniques, i.e., alternative wetting and drying and intermittent irrigation.
  - Introducing a systemic-approach asset management to help have the data for maintenance requirements and the estimated costs.
  - Improving the irrigation data collection, analysis, and monitoring to enhance irrigation planning and management at the national and local levels.
  - Introducing irrigation funds for operation and maintenance purposes.

- Introducing policies to better integrate Lao irrigated farmers into agricultural value chains to improve the links between input supplies and output markets.

- Climate resilience and new irrigation models:
  - A flood embankment/dike irrigation and a groundwater irrigation using solar power are the promising climate-resilient irrigation models. They were incorporated in DOI's strategic plans in 2023.
  - Although the solar-powered groundwater irrigation for the community and commercial scales has been implemented via development projects, a pilot scheme of the flood embankment irrigation model has not been piloted.
  - DOI took the platform to present the model by demonstrating a potential project area in Pakpeung floodplain area in Bolikhamxay, as shown in Figure 1. DOI had visited the area and consulted with the village authorities about the potential use of the flooded areas for agricultural production. However, further socio-economic assessments will still need to be conducted if further progress has been made with the project, even though the initial consultation had positive support from the local authorities.

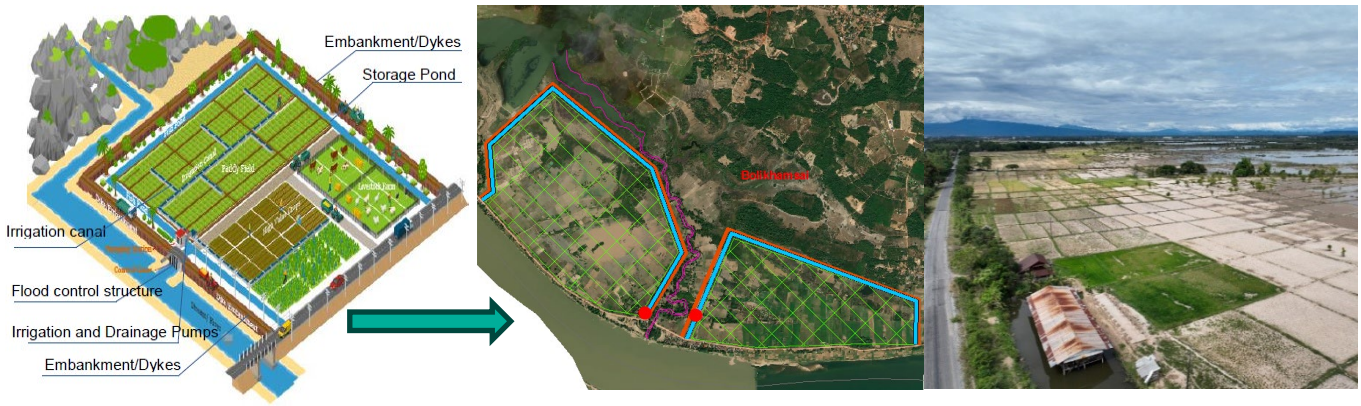

Figure1: A proposed flood embankment irrigation model in Pakpeung floodplain area in Bolikhamxay.
Source: The presentation slide by Dr Vongsakda Vongxay.

  - Background information of Pakpeung area: the area has about 360 hectares (ha), but not all of the area was arable land for wet seasonal rice cultivation due to annual floods. The areas near the rivers of Houay Hay, Houay Pueng, and Houay Songmaelouk surrounding Pakpeung area were not able to be cultivated. These rivers were tributaries of the Mekong River. However, the host authorities do not have estimated data of the unplanted area. During the dry seasons, rice cultivation can be done in 174 ha based on the supply capacity of four existing irrigation stations. A few vegetable gardens were arranged in the area, while the majority of the vegetable cultivation was arranged at the other end of the village near the Mekong River, where the soil was good and easier for weed management because the soil was not tough/stringent.

2.2. A presentation on a project proposal on solar-powered irrigation implementation.

The presentation was delivered by Mr. Khamphone Bounnavong, DOI Division of Planning and Co-operation. The presentation was to introduce DOI's project proposal on "*Increased climate resilience of traditionally rainfed agriculture in remote areas of Lao PDR*" to seek support for its implementation because the project proposal has not been processed for either the government budget or funding proposal since its inception in September 2025. Key points of the presentation include the project background, objectives, and expected outcomes. Details are as follows:

- Project proposal background: the proposal was developed with support from the United Nations Environment Programme (UNEP), with the aim of providing preparedness support for the Government of Lao PDR to implement its commitments in the Nationally Determined Contribution (NDC), because solar-powered irrigation was outlined in its priorities.
- Objectives: this three-year project has the primary objective to reduce the risk of climate change on water availability in traditionally rainfed agriculture in remote areas of Lao PDR.
- Expected outcomes: the project has two expected outcomes: i) solar-powered irrigation systems are demonstrated as a superior alternative system in remote rural areas without grid connection and ii) an enabling political and economic environment is built to further scaling in remote rural communities.

2.3. A presentation on groundwater policy.

The presentation was delivered by Mr. Ounakone Xayviliya, Groundwater Management Division, Department of Water Resources. The presentation features the current groundwater situation, management policies, challenges, and opportunities for groundwater development. Details of the contents are as follows:

- Groundwater situation: groundwater serves as a critical resource for socio-economic development sectors in the Lao PDR, such as agricultural production, domestic utilization, and industrial production. Despite a lack of comprehensive data, previous explorations showed that the country has abundant groundwater sources. The current monitoring system is not efficient for checking groundwater in terms of water levels, quality, and quantity.
- Policies and regulations: groundwater management policies and regulations have been formulated and reflected in different levels of policy frameworks, such as the Law on National Water and Water Resources, groundwater management policies and regulations, and provincial groundwater management plans. However, policy enforcement remains challenging, which affects sustainable utilization and quality of groundwater.
- Challenges: key challenges in groundwater management in Lao PDR include a lack of sufficient capacity for groundwater monitoring, contributing to limited databases on water quality, quantity, and levels, in addition to other challenges in effective policy implementation and water scarcity in some areas due to uneven distribution of rainfall while water demand is increasing to meet population growth and economic development.
- Opportunities and recommendations: the government's efforts in the adoption of groundwater management policies to ensure coherence in the designs and implementation, i.e., vertical coherence between the national and provincial policy implementations, are seen as a strong foundation for sustainable groundwater management, in addition to abundant water resources.

However, implementing effective policies and strategies may require more collaboration, capacity building, and investments in technologies and infrastructure.

- In terms of the technologies, the areas of focus shall be on remote sensing, geographic information system mapping, and groundwater modelling tools to enhance monitoring and management capabilities.
- For the capacity development, comprehensive interventions through training courses, knowledge exchange programmes, and technical support are recommended for effective groundwater management.
- As part of cross-sectoral collaboration, community engagement is key for sustainable groundwater management. Involving local communities in decision-making processes, raising awareness about water conservation, and promoting sustainable practices should be strengthened.
- Another key recommendation is that of the need to have sufficient financial resources secured for enabling sustainable management, such as research, infrastructure development, and policy enforcement and implementation.

2.4. A presentation on an overview of groundwater resources for irrigation in Lao PDR.

The presentation was delivered by Dr. Mathieu Viossanges, IWMI. The presentation is to share lessons learnt on groundwater irrigation from technical, environmental, and policy perspectives. Key features of the presentation include key considerations on groundwater irrigation development from the resource aspects, an overview of the groundwater resource in Lao PDR, and IWMI's experiences and lessons learnt from Lao PDR and other regions. Key messages of these aspects are as follows:

- Key considerations on resource requirements for groundwater irrigation development: the development shall be based on the two axes of demand and supply sides.
  - It is crucial to consider the availability, sustainability, and quality of groundwater towards the reliable and suitable supply aspects.
  - Hydrological assessments and monitoring networks are required to address the availability, suitability, and quality concepts.
  - The hydrological assessments may cover surveys to understand aquifer characteristics, recharging, and associated risks; their assessments; and modelling.
  - On the monitoring networks, necessary datasets often include water levels and abstractions in relation to the number of wells, ecosystem impacts, and routine water quality monitoring on salinity levels, for instance.
- Groundwater resources in Lao PDR: the country has a contrasting situation of aquifers, in which each of those has set characteristics that often affect irrigation development, including the three potential characteristics: alluvial deposits, volcanic rocks, and sandstones, as shown in Figure 2below.
  - An alluvial aquifer consists of gravels and pebbles, which is often found close to river channels or paleo-channels and valleys. It provides high productivity of 0.3 to more than 6 litres per second.
  - A sandstone aquifer consists of fractured sandstones, with water stored in both the pores and fractures. The aquifer is found across Lao PDR, especially in the southern

region. It provides low productivity of 0.1 to 1.5 litres per second, which is still sufficient for small-scale needs and cash crop production.

- Volcanic (basaltic) aquifer consists of basalt lava flow with weathered vesicular rocks. It also provides high productivity of 0.3 to more than 3 litres per second.

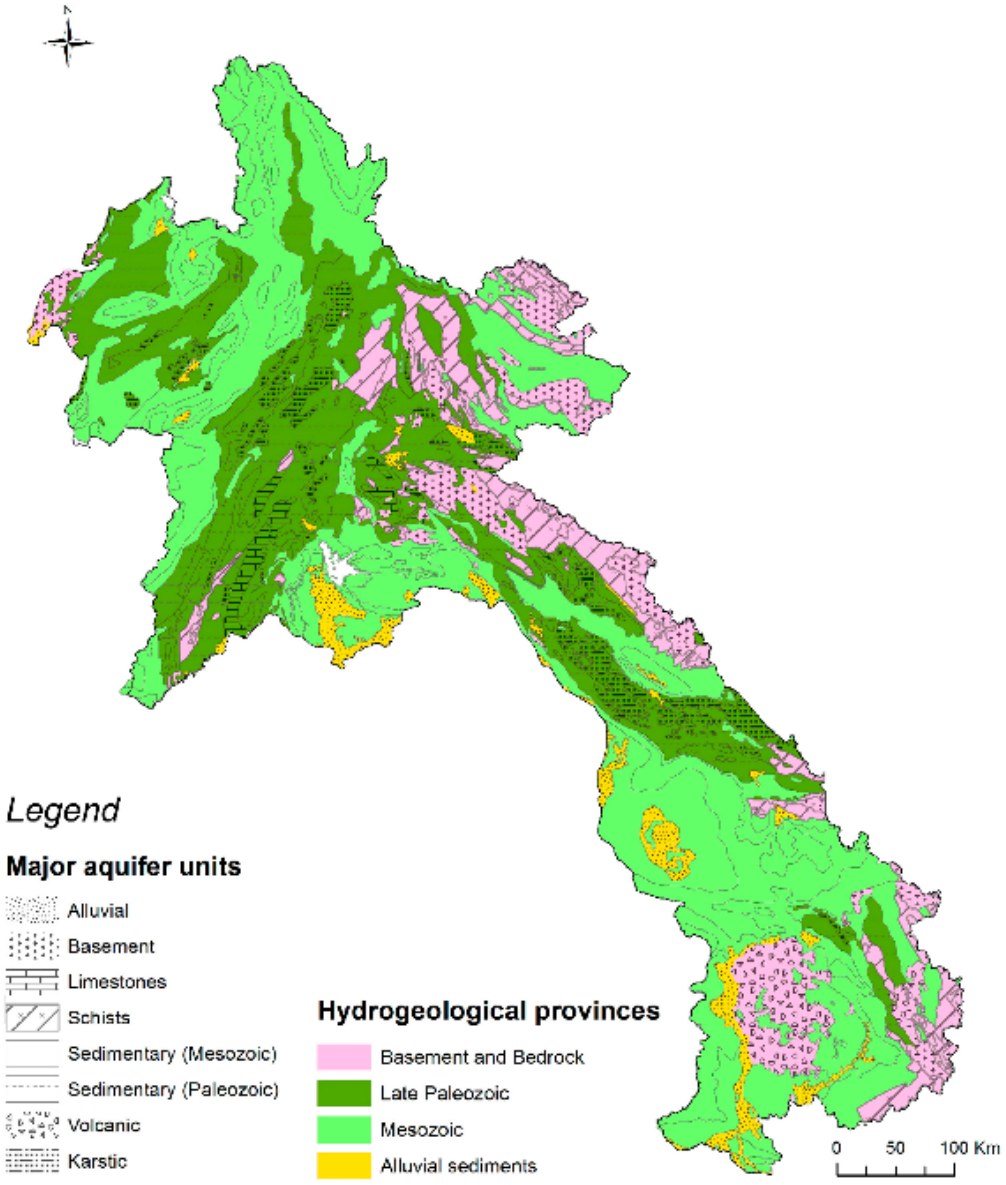

Figure 2: Groundwater map in Lao PDR, Source: The presentation slide delivered by Dr. Mathieu Viossanges, IWMI

- Experiences and lessons learnt from Southeast Asia and Africa: some key lessons learnt that may well be applicable for the Lao context are listed as follows:
  - A comprehensive baseline study on hydrological status is required as a key process for the promotion of solar-powered irrigation expansion, because concerns for an overuse of groundwater have emerged.

    - Policy and regulatory frameworks may pose opportunities and obstacles to promote large-scale uptake of the technology. Regular monitoring of the policy implementation and reflections may help effective scaling. Besides, strong governance, effective assessments, and monitoring are needed when recalling that the water use is contested.
    - Harnessing the public-private partnerships can offer scaling solutions, especially in the context where either found technical and financial constraints to operate the introduced technologies.
    - More accessible financing is needed to facilitate investments among the farmers. Additional support to link the farmers to the finance is also needed to enable the access.
- Experiences and lessons learnt from Lao PDR: the lessons learnt were from two research projects conducted by IWMI in cooperation with DOI and local partners. These include a community-based groundwater irrigation with solar pumping systems in Ekxang Village, Vientiane Province, and a review of 10 cases from the southern part of the country. Key lessons learnt from these projects are as follows:
    - The scope of the availability, quality, and sustainability of the groundwater is promising for the solar-powered groundwater irrigation in Lao PDR.
    - Hydrogeological studies and monitoring are required for proper project designs and operations.
    - Knowledge learning and synthesis are made in an active manner, as the solar-groundwater sector is growing, offering more opportunities for the exchanging of lessons learnt and strengthening the public-private partnerships.
    - Strengthening evidence-based policy reflections and enforcement for more effective promotion and governance of comprehensive water use aspects, i.e., a sustainable abstraction to avoid overexploitation and negative consequences.

2.5. Discussion session:

The discussion session was facilitated by Mr. Mark Dubois, IWMI Representative in Lao PDR and Southeast Asia. An overall concept of the session is to offer the floor to all participants to share comments, feedback, and questions around the topic of the forum on "*Solar-powered groundwater irrigation for climate resilience and water security: overcoming barriers for sustainable and inclusive adoption*". Key points of the discussions are summarized as follows:

Irrigation policy frameworks:

- A participant from the Faculty of Water Resources of the National University of Laos (NUOL) suggested that clear objectives and indicators for irrigation development should be considered if the DOI's irrigation development strategy (2026-2030) and vision to 2040 is still on its development process. The participant added that articulating the fish passage compliance for dam and overflow constructions, outlined in Article 47 of the revised Law on Irrigation in 2025, should be part of the indicators, for instance. He continued that the smart irrigation goals within the next five to 10 years may have more focus on promoting automatic and sensing systems.
    - The suggestions were acknowledged by the DOI formulation secretariat team because the formulation of DOI strategy and vision is still in the process of consolidating feedback and suggestions from the local level. He added that feedback and suggestions from

today's forum will also be reflected in the feedback consolidation process, in addition to further discussions with relevant sectors, for example, the Department of Water Resources (DWR) on the construction of irrigation headwork in the watersheds with fish passage compliance.

- A participant from the United Nations Children's Fund (UNICEF) suggested that DOI should link its five-year strategic plan from 2026 to 2030 and vision to 2040 to climate change adaptions as part of the Lao Nationally Determined Contribution (NDC), which is on its third version. He elaborated that the irrigation sector can be well fit for water management for climate change adaptation and the section on greenhouse emission reduction. Having these in the DOI's strategy can be good for further fundraising from the Green Climate Fund, for instance.
- A participant from the Food and Agriculture Organization (FAO) shared an update on the consultation process of MAE's new agricultural and environmental development strategy, with support from FAO. He added that the development of the document is almost completed, which is under its validation consultations in the northern, central, and southern parts. He urged the sectors to participate in the consultation workshop in December in Vientiane Capital to reflect their priorities in the document.

Extension support and business services:

- The co-chairperson from ADB raised a set of questions on the majority of supply, whether i) there is an existing process for a farmer to seek support from a service centre to come for a suitability test of the land, arrange the installation of the solar-powered power irrigation, and provide support for maintenance, ii) there is existing business service for installation and maintenance service, or iii) they are relying on DOI's extension support to provide information on a range of possibilities for the technology adoptions.
    - A participant from DWR clarified that the adoption of the solar-powered technology for groundwater use is relatively new with limited numbers of wells, which were operated by farmers' investments and with some emerging support from development projects. Key consideration to promote further adoptions is about the access to the technology, maintenance, and management. For the service system, there are a number of limitations preventing sufficient services and supplies to farmers, such as a lack of groundwater assessments and automatic monitoring tools for assessing water quantity, quality, and water sources at the provincial and district levels.
    - A participant from IWMI added the overall service system is on positive trends, although there are some challenges in the technology adoption in terms of the land assessment and maintenance services. He added that although the availability of the service providers at the district is still challenging, the situation at the provincial level is better, with at least one store selling solar parts and water pumps. He suggested that further efforts to improve the maintenance may focus on harnessing the public-private partnerships to set up a service network with some business operators in Vientiane Capital who can handle installation of the water pumps and solar power systems. He also shared that IWMI, DOI, and DWR will also work in cooperation to address the challenge in groundwater assessment and create groundwater maps through a new Australian-funded project on "*Enhancing sustainable groundwater management*".

Groundwater mapping establishment:

- The participant from FAO suggested the relevant public agencies establish groundwater maps demonstrating information on groundwater quality and quantity in different areas across the country to avoid the risk of drilling groundwater wells into saline water, causing unnecessary loss of investments by smallholder farmers.
    - The participant from DWR acknowledged the suggestion and clarified that establishing groundwater maps is a priority of the sector, which is under a data collection process. He explained that the establishment requires different data sets, such as geological data, which can be collected by proper studies with high technology. An alternative option, which is currently being implemented, is that DWR collected secondary data from the Department of Ecology and IWMI to establish the maps with some information on water discharge and quantity. DWR will continue developing the groundwater mapping, which can be started with a pilot project in Vientiane Capital through a joint development project with IWMI, for instance, to collect data on groundwater quality.
    - Another participant from IWMI shared a feasible solution to avoid breaking into saline water, which can be done by using physical measurements with electrical conductivity. He added that medium to large service providers often have the tool to measure the salinity before drilling. He suggested using a drilling service of drillers who registered compliant service with relevant public agencies to avoid the risk of breaking into salinity lines. He added that the relevant public agencies have issued policies and regulations for companies to register their drilling services.
- In addition, a participant from the Department of Land Administration and Management (DLAM) raised the need for groundwater maps, which can be integrated into DLAM's plan on a groundwater survey around agricultural land of 4.5 million hectares across the country. He added that the information on water supply capacity during the dry seasons and water quality is useful for identifying different types of crops for cultivation promotion in the agricultural lands.

Effectiveness and sustainability of solar-powered groundwater irrigation:

- The participant from NUOL shared that groundwater irrigation with solar power systems has been adopted successfully in many parts of Lao PDR. He suggested that further discussion areas on how to recharge groundwater for sustainable use should be emphasised. He added that finding ways to store rainfall for recharging groundwater may be feasible for the context of Lao PDR, where they encounter frequent floods in rainy seasons and dry spells in dry seasons.
- A participant from the United Nations Development Programme (UNDP) also raised the success of the use of solar-powered irrigation and groundwater wells to improve farm productivity and villagers' capacity. However, long-term research on the cost-benefit analysis of the intervention is required, he added. Besides, he suggested applying a holistic approach of using nature-based systems and its subset ecological system to improve farm productivity and farmers' livelihood, based on lessons learnt from UNDP's joint project with DWR to address climate change and adaptation issues in Savannakhet and Louangprabang.

- A participant from the National Agriculture and Forestry Research Institute (NAFRI) shared his thoughts that solar-powered groundwater irrigation is considered relatively new even though it has widespread adoption across the country. However, he suggested that we may need to think of other options to supplement the use of solar power to ensure the effectiveness of the introduced renewable energy. He also suggested having a cost-benefit analysis concerning the costs of installation and maintenance, operational duration, and other factors, concerning the cost for the access to technology among farmers, which is still a challenging issue. In addition, the governance and operational systems should be implemented by qualified personnel to provide clear guidance for farmers to follow the systems.
- The participant from UNICEF suggested that groundwater irrigation schemes shall be also allocated for household utilizations for hygiene and sanitation in order to enhance the effectiveness of the investment, in addition to the agricultural production.
- The participant from FAO shared that FAO also promoted the use of the groundwater with solar power technology to help farmers access low-cost technology for water supply to improve their production through group establishment in 13 villages in Samakhyxay District, in Attapeu. He shared his concern for the high cost of the technology for individual farmers to purchase without support from development projects. He suggested that establishing farmer groups could be a better option to address the challenge. He added that it could be a viable option to establish solar-powered groundwater groups to address the operational and technical challenges that farmer households cannot handle by themselves due to constraints in knowledge, replaceable parts, and costs.
- The participant from DLAM shared his support for the investment effectiveness of solar-powered groundwater irrigation in a small agricultural land, which is not cost-effective to invest in other irrigation types. He raised the case of a northern district in Aed as an example, which is suitable for the installation of groundwater irrigation, but a limitation in relation to inadequate sunshine is seen as a challenge for the solar power technology, so its possible solutions need to be discussed.

3. Summary and recommendations

The adoption of solar-powered groundwater irrigation at the community level has been emerging across the country through development projects and some private investments. Progressive governance mechanisms are shared in the forum, in addition to key benefits on water supply in non-irrigated areas, feasible options for cost reduction for the pumping system with grid electricity, and the contribution to improvements of farm productivity and livelihoods of the farmer community. Institutional support and governance mechanisms to guide the practices are also well progressed, in terms of the adoption of guiding policy frameworks and collaboration with development partners. Although the overall adoption status has been increasing, the stage of adoption is still considered new in the Lao context, requiring ongoing improvements to address technical and operational challenges in relation to maintenance services and capacity, business environment, and groundwater data on water quality, quantity, and sources. Further plans and recommendations to overcome the challenges are as follows:

- Extension support and business services: there is no comprehensive extension support from an initial land assessment to find quality groundwater through post installation maintenance services. One of the key challenges preventing the adequate services to farmers included a lack of assessment data on water quantity, water quality, and water sources at the local level. Another challenge is that there is still a limited number of the business operators who supply the replacement parts and maintenance services at the district level. Discussed recommendations and priorities are as follows:
    - Increasing awareness campaigns to encourage farmers to use the services of drillers who registered the service and have the tools to assess the groundwater quality.
    - Harnessing the public-private partnerships is another practical solution to address the maintenance issues, as some business operators in Vientiane Capital have the capacity and may be interested in collaboration with the government to expand their services to other provinces.
    - A priority action plan to address the groundwater data issue is that DWR will also work in cooperation with other development partners to have more technical assistance, for example, an Australian-funded project on “Enhancing sustainable groundwater management”.
- Groundwater mapping establishment is another priority action for the relevant public agencies, which is also raised in the forum as a knowledge product to help farmers and implementers to plan their interventions. An issue of groundwater quality due to the salinity contamination was raised and discussed to support the need to have the groundwater maps, in addition to the need to understand about overall water quantity and sources for agricultural production planning.
    - Establishing groundwater maps is another DWR priority, which is under a process of collecting secondary data from relevant sectors and stakeholders, such as the Department of Ecology and IWMI, prior to collecting additional data from the target local areas.
- Overall effectiveness and sustainability of solar-powered groundwater irrigation: although different benefits of the technological adoption are known and acknowledged, concerns for sustainability and effectiveness are raised and discussed in the forum. Key discussion points are summarised as follows:

- There is a need for further discussion in detail on how to recharge groundwater for sustainability, for example, how to store rainfall for recharging groundwater during the long extended dry spell and address flooding in the rainy seasons.
- Long-term research on the cost-benefit analysis is also suggested. This is to understand the effectiveness of solar power in comparison with other renewable energy sources, recalling that the maintenance cost and personnel capacity development are still an issue.
- Establishing farmer groups for the solar-powered system's operation and maintenance may help guide some operational and maintenance services and a process for seeking further support for farmers.
- Finding practical solutions to address technical constraints for the installation of the solar-powered groundwater irrigation in the areas where adequate sunshine is challenging.

Reflections on the irrigation development plan and strategy:
Key feedback on the presented draft of the irrigation development strategy (2026-2030) is about aligning its priorities to MAE's new agriculture and environment development strategy and the Lao Nationally Determined Contribution (NDC) for climate adaptation. Other suggestions are about setting clear objectives and indicators, especially the application of automatic and sensing systems as part of the smart irrigation, to be achieved within the next five to 10 years, and an incorporation of the fish passage compliance to construction of irrigation headwork, which is outlined in the revised Law on Irrigation.

In summary, there is a need to bring the topic around the solar-powered groundwater irrigation into discussion in the next stakeholder forums of the Sub-sector Working Group on Irrigation and other forums to understand the progress and further improvements to ensure sustainable and equitable utilization of groundwater to underpin long-term water and food security.

Annex: Agenda

Time	Description	Facilitator
8.00 - 8.25	Registration	All
8.25 - 8.30	Stating the purposes and introducing the agenda	MC from DOI
8.30 - 8.50	Opening remarks by the chairperson and the co-chairperson	• Dr. Khamphachanh Vongsana, DOI DG • Ms. Shanny Campbell, ADB Country Director
8.50 - 9.00	Group photo session and setting the presentation floor	All
9.00 - 9.20 (20 Minutes)	A presentation on i) Irrigation Development Strategic Plan from 2026-2030 and Vision to 2040, ii) floodplains irrigation embankment model, and iii) irrigation with groundwater solar pump in drought area model.	Dr. Vongsakda Vongxay, Division of Planning and Cooperation, DOI
9.20 - 9.40 (20 Minutes)	A presentation on DOI's project proposal on solar-powered irrigation model	Mr. Khamphone Bounnavong, Division of Planning and Cooperation, DOI
9.40 - 10.00 (20 Minutes)	A presentation on groundwater policy	Mr. Ounakone Xayviliya, Groundwater Management Division, Department of Water Resources
10.00-10.20	Coffee break	All participants
10.20 - 10.40 (20 Minutes)	A presentation on lessons learnt on groundwater irrigation on technical/environmental and policy perspectives	Dr. Mathieu Viossanges, IWMI
10.40 -11.40 (60 Minutes)	Q & A session for the presentations and other discussions	Mr. Mark Dubois, IWMI representative
11.40 - 12.00	Closing remark	• Dr. Khamphachanh Vongsana, DOI DG • Ms. Shanny Campbell, ADB Country Director
12.00-13.00	Lunch	All participants are cordially invited

Authors

The report was jointly written by the International Water Management Institute (IWMI) and the Department of Irrigation (DOI). Key contributing authors of the report are as follows:

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