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For the Asian Development Bank

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TA-9736 CAM: National Solar Park Project - Capacity Development in the Electric Utility Industry

Final Report

June 2022



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Executive summary

Thai MM Limited has been appointed by the Asian Development Bank (ADB) to help strengthen the capacity of EDC in solar power plant construction and operation, project design and supervision, grid integration, battery energy storage and energy regulatory issues. Thai MM Limited is also acting as resident expert to EDC providing ad-hoc advice and support on solar PV, battery energy storage, and energy regulatory issues.

The capacity building program combines training workshops with continuous advisory, facilitating EDC and EAC personnel participation in specialized training courses on solar photovoltaics (PV), battery energy storage systems and regulatory development.

Thai MM Limited has adopted a demand-driven capacity building approach for the formulation of the targeted training sessions. A capacity building needs assessment was conducted to understand stakeholders' needs and identify their key priorities for the development of renewable energy in Cambodia. This was done through a series of interviews with key stakeholders identified, as well as reviews of existing documentation on the current situation of the sector. We also evaluated the background, knowledge, experience, and expectations of the trainees proposed to attend the training courses. Based on the results of this preliminary assessment, we formulated the training program, giving priority to issues identified as the most relevant for the development of the solar PV sector and its integration in the national grid.

On 24 and 25 May 2021, the first workshop of the training programme was delivered. The scope of the workshop was *Solar PV and Grid Integration*, covering solar PV technologies and its applications, as well as an introduction to integration issues and solutions related to solar PV and renewable generation. On 12 and 13 July 2021, the second workshop of the training programme was conducted. The topic of the workshop was *Battery Energy Storage Systems* (BESS) and covered energy storage systems, with a strong focus on battery energy storage and its applications in utility scale renewable generation and stand-alone applications in power systems. Lastly, on 2 and 3 December 2021, the third workshop was organized for the topic *Energy Regulation aspects for Solar PV development*, covering aspects of the regulatory development that enable an appropriate environment for renewable energy, showcasing regulatory support, policies, and financing innovations that have enabled solar PV and market growth in reference countries. The three workshops were delivered fully online, through videoconferencing, supported by online tools for further interaction with the attendees. An e-learning video has been produced for each of the workshops and was made available to the attendees at least two weeks before the actual workshop delivery. These main workshops have been complemented with twelve dedicated webinars covering specific topics requested by EDC, including *testing and commissioning of solar PV plants*, *model PPA assessment*, *solar PV plant design*, *economic aspects of BESS*, *Operation and Maintenance of PV plants*, *Operation of BESS*, *4 PVSyst modelling sessions*, and *3 HOMER Pro modelling sessions*.

Due to international travel restrictions during the COVID-19 pandemic, Thai MM Limited was unable to implement the workshops in-person in Cambodia. The switch to a fully online delivery mode of the workshops resulted in travel cost savings that allowed for further expanding the training program implementation. An extension to 30 June 2022 was approved by ADB. The schedule is given in section 2.1 of this report.

The scope of the project extension continued to focus on strengthening the capacity of EDC, for integration of renewable energy into the national grid in Cambodia covering all

aspects of large-scale solar energy deployment, including siting, design, storage technologies, dispatch and grid management techniques. In addition, capacity building on Environmental and Social (E&S) safeguards reporting was delivered by reviewing EDC's previous reports submitted and providing comments and recommendations for improvements. A meeting was organized to explain the key recommendations.

To assess the progress achieved, an evaluation was conducted on 9 December 2021, where most participants reflected a good perceived level of improvement in the three main components of the training program. In addition, surveys were conducted for all the training workshops, where most participants showed a high interest and improvement after the session.

This Final Report presents the progress achieved during the program, including activities organized, assessments conducted, preliminary conclusions, and proposes potential future activities. It also summarises the final schedule and team composition, as delivered.

1 Introduction

1.1 Background

The Government of Cambodia, with ADB support, is currently developing a solar park with a capacity of 100 MW. Construction of the first power plant in the solar park was tendered to private developers in February 2019. The government formally requested financing for the National Solar Park Project from ADB and requested ADB's assistance to access co-financing for the project through a combination of concessional loan and grant resources from the Strategic Climate Fund.

ADB has also been assisting EDC to develop a solar generation master plan. In 2017, ADB developed a preliminary national solar PV grid integration study and roadmap for EDC. In this study, low, medium and high solar penetration scenarios were considered. The plan has identified additional solar park locations that could replace fossil fuel generation capacity that would be needed through 2030. Cambodia is also developing regulations for rooftop solar and contemplating the development of floating solar power plants.

The integration of variable renewable energy into the power system requires knowledge of a wide range of technical issues and new technologies. In association with the loan-funded National Solar Park Project, the government has requested ADB to support a transaction technical assistance program to build capacity and knowledge regarding the development of solar PV technology, solar park planning, distributed energy systems, energy storage systems, grid codes for solar energy integration, and management of corresponding challenges in the deployment of renewable energy, in order to manage the sharp increase in solar power generation capacity anticipated in the country.

Significantly increased deployment of solar PV generation capacity will also require the use of forecasting techniques, changes in the power system dispatch rules, advanced inverters, and expanded information and communication technology applications. Further, to support large-scale integration of renewable energy into its grid, EDC would need to have access to the latest knowledge on energy storage technologies, which can help improve electricity grid stability, flexibility, reliability and resilience. Ultimately, this knowledge will help Cambodia bolster its energy security while also addressing its climate change goals.

This Technical Assistance (TA) aims at strengthening the capacity of EDC for the integration of renewable energy into the national grid, and more specifically their knowledge on solar PV technology development, solar park planning, distributed energy systems, energy storage systems, grid codes for solar energy integration, and management of corresponding challenges in the deployment of renewable energy, to manage the sharp increase in solar power generation capacity anticipated in the country. This is being done through the implementation of a medium-term training program over 24 months.

The Republic of Korea e-Asia and Knowledge Partnership Fund (EAKPF) is supporting the National Solar Park implementation by providing funding for the capacity building component of the project. This fund was established in June 2006 by the Republic of Korea and aims to bridge the digital divide and promote improved access to information and creating and sharing of knowledge through information and communications technology (ICT) in the Asia and Pacific region. The fund aims to contribute to poverty reduction and the economic and social development of ADB's developing member countries (DMCs) through its two windows: the e-Asia program and the knowledge partnership program.

Thai MM Limited, a Mott MacDonald group company, was appointed by the Asian Development Bank (ADB) to help strengthen the capacity of EDC in solar power plant construction and operation, project design and supervision, grid integration, battery energy storage and energy regulatory issues. Thai MM Limited has also acted as resident expert to EDC providing advice and support on solar PV, battery energy storage, and energy regulatory issues.

Mott MacDonald draws on a wide variety of capabilities and resources available within the organization to produce relevant and targeted teaching materials. All training materials are primarily developed by the experts conducting the training, while being supported and reviewed by our wider teams working in the relevant fields, to ensure all materials are aligned with current engineering, professional and practice standards.

Thai MM Limited's engagement was from 1 June 2020 to 30 June 2022 (extended from 15 November 2021). On a first online meeting between Mott MacDonald and ADB on 18 June 2020, it was clarified that due to restrictions associated with the Covid-19 pandemic, it was not possible to travel to Cambodia, and since then, several changes were introduced in the implementation of the project, most notably the shift to online delivery.

The project started with a Kick-off meeting held on 12 August 2020, with participants from ADB, Mott MacDonald, Ministry of Mines and Energy (MME), Electricity Authority of Cambodia (EAC), Institute of Electrical Science, and NEWJEC. One of the key issues discussed was the challenges facing the project delivery, due to the impossibility to implement on-site advisory until further notice, and the need to find alternative ways to provide advisory online.

A Review Mission was conducted on 15 December 2020, where the challenges to implement the project during the pandemic were discussed. Subsequently, a first variation order (VO1) was approved on 18 December 2020, which included adjustments on the team composition and schedule to reflect the actual situation caused by the irruption of the pandemic. Subsequently, three additional variations (VO2, VO3, and VO4) were approved, mainly to shift budget from onsite work to home office work, as well as to replace one of the experts. Lastly, the fifth and sixth variations (VO5 and VO6) were approved, extending the contract to 30 June 2022, and defining the additional budget, staff and scope.

This report, presents the progress achieved particularly since the previous report "Third Progress Report", which was submitted on 15 December 2021, including activities organized, assessments conducted, preliminary conclusions, and next steps. It also presents the changes in schedule and team composition to reflect the actual situation.

1.2 Scope of work

The capacity building program combines training sessions with continuous on-site advisory, to facilitate EDC and EAC personnel participation in specialized training courses on solar photovoltaics (PV), battery energy storage systems (BESS) and regulatory development.

Our methodology for preparing and conducting the capacity building plan is schematically depicted in Figure 1.1 and follows the steps listed below:

- Capacity Building Needs Assessment
 - Key stakeholder mapping and engagement followed by interviews
 - Review of existing documentation on existing policies
 - Assessment of the stakeholders needs
 - Development of the demand-driven training plan

- Training Program (implemented for each of the three key topics: PV, BESS, and Regulation)
 - Delivery of the manuals
 - Delivery of the training workshops
 - Evaluate and provide feedback
- Continuous advisory
 - Resident Advisor (complemented with multi-disciplinary specialists)
 - Remote support (hotline)

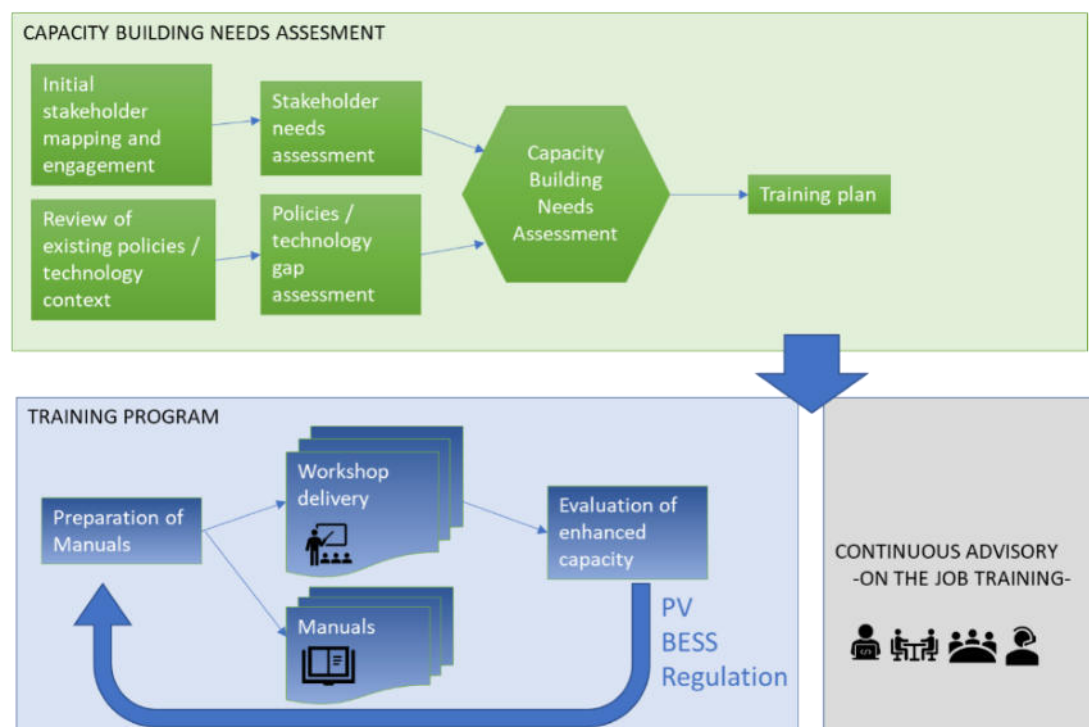


Figure 1.1: Capacity building needs approach scheme

1.2.1 Needs Assessment

We have adopted a demand-driven capacity building approach for the formulation of the targeted training sessions. A needs assessment was conducted to understand stakeholders' needs and identify their key priorities for the development of renewable energy in Cambodia. This was done through a series of interviews and meetings with the identified key stakeholders, as well as reviews of existing documentation on the current situation of the sector. We also evaluated the background, knowledge, experience, and expectations of the trainees proposed to attend the training courses by circulating an online questionnaire. Based on the results of this preliminary assessment, we formulated the training program, giving priority to issues identified as the most relevant for the development of the solar PV sector and its integration in the national grid.

The Capacity Building Needs Assessment is an iterative process originating from stakeholder consultations, and the formulation of a training program. Subsequently, we kept continuously revisiting the needs and priorities of EDC, which were adjusted as participants progressed with the trainings, and realized specific issues of interest that weren't considered before. This was particularly relevant for a flexible formulation of new topics elaborated in dedicated webinars.

1.2.2 Training Workshops

The training sessions are structured in three main workshops which due to the travel restrictions during the Covid19 pandemic, were delivered on-line.

We have split the topics to be taught in the following manner:

- Session 1: Solar PV – design, engineering, grid integration and deployment
- Session 2: Energy Storage – applications for energy storage, battery technologies and siting & sizing of energy storage systems
- Session 3: Regulatory development – enabling an appropriate regulatory environment for renewable energy, grid access and sustainable incentive programs for renewable energy development

The lectures were presented in English, with a Cambodian interpreter, throughout all the sessions.

The workshops' approach combined lectures on the relevant topics identified in the Capacity Building Needs Assessment, with Q&A sessions, case study analyses, lessons learnt, and practical exercises. In order to improve the quality of the online delivery, EDC requested for a series of e-learning videos containing the lectures that are subsequently presented in the live workshops.

The training materials, including manuals and e-learning videos for each of the three sessions, were delivered at least 2 weeks prior to the corresponding workshops, so that participants could review it in advance for better understanding. These included all the presentation's slides, with complementary explanatory text when required, case studies, practical exercises, additional references and a bibliography. Materials were provided in English.

During the training sessions, participants were asked to answer quiz questions based on the content presented. These aimed to capture the level of attention participants were paying during each lecture, without requiring them a high level of knowledge. In general, the results showed that participants had a good understanding of the contents presented. Once the correct answer is disclosed, the lecturer spends a few minutes further elaborating the reason why that solution was the best one, giving some examples. Additional questions and practical exercises using PVSyst and HOMER Pro modelling software were assigned to participants after the workshops and followed up by the trainers.

At the end of each workshop, a satisfaction survey was conducted among the participants.

Once the main workshops were completed, an evaluation has been conducted to assess the level of knowledge and understanding that the trainees have gained from the training sessions. The findings are reflected in section 2.3.

The topics covered in the training sessions are described in section 2.2.

The detailed program for each of the three workshops was prepared by the corresponding specialist, and agreed with the stakeholders, ahead of preparing each workshop.

1.2.3 Advisory

Due to the covid-19 travel restrictions, the advisory component was covered through online communication, coordinated by the Team Leader and supported by a multi-disciplinary team of experts on PV utility scale plant design, grid integration, regulatory development, BESS, roof-top and building integrated PV (BIPV), geotechnics and energy yield assessments (EYA), among other disciplines.

From the start of the project implementation, a direct channel was established by setting up a Telegram group that stakeholders use to directly request for advisory and discuss related issues as and when required. In addition, time for a bi-weekly follow up meetings with EDC is arranged and held at EDC's discretion.

The main requests for advisory raised include:

- Testing and Commissioning of solar PV plants: This advisory was delivered as an online webinar in October 2020, and the IEC related documents were purchased to provide guidance to EDC.
- Information on simulation software and meteorological data providers: This was a follow up request from the Testing and Commissioning workshop, and it was delivered as a brief document including the providers, and details of each product for reference.
- Model PPAs: This advisory was delivered as a webinar in January 2021, together with a comparison between a local model PPA and international models prepared by IFC or IRENA, providing comments and recommendations.
- Examples of grid codes in countries where renewable energy has reached a high share in the energy mix: this was incorporated to the Solar PV and grid integration workshop delivered in May 2021.
- Solar PV plant design, economic aspects of BESS, PVSyst software, and HOMER Pro software: These topics were the most demanded on the surveys conducted during the Solar PV and BESS workshops, in which several topics to be further elaborated were presented, for which the participants could vote. These topics were presented in dedicated webinars held between September 2021 and June 2022.
- Operation and maintenance of PV plants.
- Design, specifications, and operation BESS.
- E&S Safeguards reporting.

1.3 Team Composition

Originally, the project team comprised a Team Leader and Solar Deployment specialist, a Solar PV specialist, an Energy Storage specialist, and a Regulatory specialist. In addition to these, a Senior Solar PV and EYA specialist and a Regional Regulatory specialist were subsequently added to the team through a Variation Order (VO1) on 17 December 2020, and an Energy Regulatory specialist was replaced through VO3 on 9 September 2021. Lastly, an Environmental specialist, a Social specialist, and a Biodiversity specialist were included in the team through VO6 on 23 March 2022.

1.3.1 Team changes through Variation Order - 1

A variation order approved on 17 December 2020, incorporated two additional team members, Nonthi Cherdsanguan, and Siri Previn, to support the original team.

In addition, it was acknowledged that a portion of the field work originally planned had to be delivered online due to the travel restrictions, and it was reflected by shifting time from the field work budget line to the home office.

In total, a transfer of 1.5 person*months from field work to home office was approved, which represents 10% of the total project work. While it was a reasonable estimate at the time of the variation order in December 2020, the subsequent development of the pandemic during 2021, with increasing restrictions in Cambodia and Thailand, led to a fully online implementation of all the activities to date, including those originally planned on-site.

1.3.2 Team changes through Variation Order - 2

Through a variation approved on 23 July 2021, it was acknowledged that the majority of the remaining field work budget had to be re-allocated as home office budget, to further support the ongoing remote implementation of the training programme online. In total, a transfer of 3.5 person*months of field work is proposed, and a total of 4.8 person*months is re-distributed across team members. A small field-work budget remained for key members of the project team, to allow for a potential in-person visit in November 2021, but due to COVID-19 restrictions, it was eventually not possible, and the remaining budget was also later shifted to home office (under Variation Order - 4).

1.3.3 Team changes through Variation Order - 3

A variation order approved on 9 September 2021, and effective on 20 September 2021 2021, incorporated an additional team member, Stephen Hinchliffe to replace Andreas Klees as the regulatory expert for the workshop and manual on regulatory issues for renewable generation.

1.3.4 Team changes through Variation Order - 4

All remaining field work budget was shifted to home office for all the team members through a variation approved on 26 October 2021, given that travel restrictions still prevented in-person visits at that time.

1.3.5 Team changes through Variation Order - 6

Additional budget was allocated to the three E&S added team members through the variation approved on 23 March 2022. The E&S task was led by the Social specialist, Sokphea Young, a Cambodian national based in UK who can interact with EDC in Khmer, and coordinated the work internally. Also, an Environment specialist, Ben Lim, based in Taiwan, was included in the team to provide comments on the Environmental part of the reports. In addition, a Biodiversity specialist, SayLin Ong, based in Singapore, was originally proposed to support the Environmental specialist on some specific issues. This however was finally not necessary, as all aspects were covered between the Social and Environmental specialists, and no inputs from SayLin were required. Therefore, he did not effectively become a team member for this project.

1.3.6 Revised Organogram

The organogram shown in Figure 1.2 shows the team structure, including the original four staff existing at the project proposal stage, as well as the additional specialist, and the replacement included until Variation Order VO6 became effective.

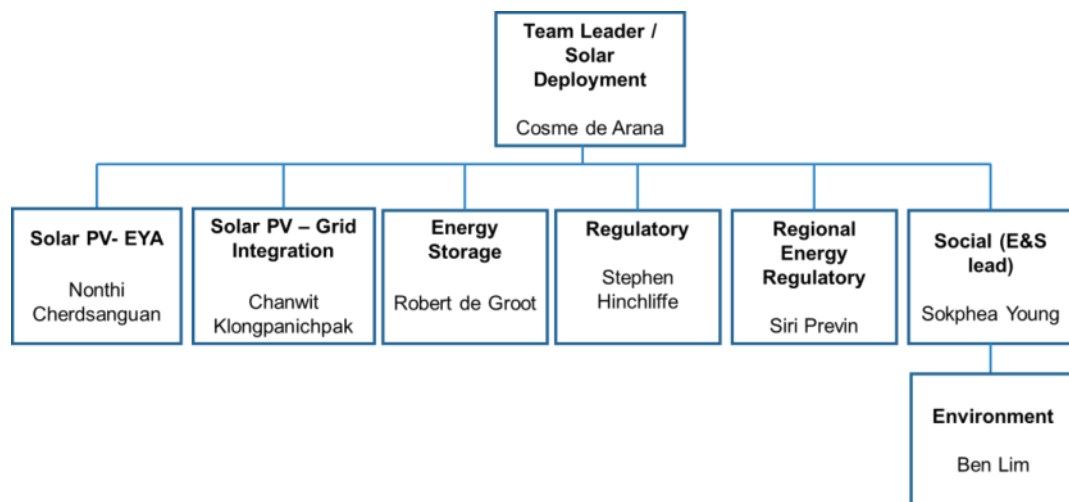


Figure 1.2: Team organogram

The team was supported by a wide pool of multi-disciplinary engineers including specialists on PV utility scale-plant design, grid integration, roof-top and Building Integrated PV, geotechnics, and Energy Yield Assessment (EYA). The key experts have been available throughout the project duration to date for advice and inputs from the supporting staff, and thus, their experience and knowledge will complement the capabilities of the team.

Additional supporting staff were generally be engaged as a “resource person” when required for specific trainings and activities.

1.3.7 Revised project staff

Further information on the team members is presented below:



Team Leader / PV deployment expert

The team leader, Cosme de Arana, is responsible for the delivery of the project. He is also acting as the focal point for all the stakeholders, coordinating the implementation of the activities, and the production deliverables, managing the time, quality and budget of the work.

Cosme de Arana is a Senior Renewable Energy Specialist with over 15 years of experience providing advisory services to public and private sector clients worldwide. Based in Asia for over 10 years has worked in a wide variety of Renewable Energy projects in the region. His experience covers capacity building, feasibility studies, due diligence, owner’s engineer, and clean energy finance.

Specific experience in Cambodia includes a capacity building program on renewable energy for the EEP (a 5-year programme funded by the Government of Finland, in cooperation with the Ministry of Mines and Energy of Cambodia) in addition to the development of grid connected Solar PV rooftops, and other renewable energy grid connected plants, as well as energy solutions in the country.

After VO6, his total time allocation is 10.54 person*months, which was fully utilized by the end of June 2022.



Energy storage expert

Our energy storage expert, Robert de Groot, is a renewable energy engineer, responsible for technical analysis, research & development, pre-feasibility studies of hybrid solar-diesel-battery projects, battery energy storage projects

and optimal grid integration of renewables and smart grid technologies. Familiar with RE and battery energy storage project development through all project phases, including pre-feasibility studies, due diligence, energy yield analysis, contract negotiations, project design and optimization, construction supervision, commissioning and testing and operational performance monitoring. Experienced in modelling and simulation of battery energy storage systems, development of control algorithms for battery storage systems and sizing and siting of renewable energy resources, battery storage and related smart grid technologies.

Together with the supporting staff, he is responsible for preparing the materials and deliver the workshop on BESS, in addition to potential BESS related dedicated webinars.

After VO6, the remaining time allocated to the BESS expert was 5.15 person*months, which was fully utilized by the end of June 2022.



Energy regulatory expert

The regulatory expert, Stephen Hinchliffe, replaced Andreas Klees since 20 September 2021.

Stephen has a PhD in power inverter technologies, Masters' degrees in Electrical and Electronic Engineering, Business Administration and in Commercial Law and over twenty-five years' energy sector experience spanning the UK, Europe, North Africa, Indonesia, Chile, PNG, Australia and New Zealand. Stephen has a background in developing renewable energy and co-generation projects and on advising on energy policy and mechanisms to remove barriers to renewable energy project development.

Stephen has advised governments and market operators on energy policy and transition to net zero in Australia, New Zealand, Indonesia, UK, India, Northern Mariana Islands amongst others. His CV is attached as Appendix A.32.

He has covered the training workshop and development of the manual on Energy Regulation, with a time allocation of 1 person*month, which was fully utilized by the end of October 2021.



Solar photovoltaic technology expert

The Solar PV technology expert for this project is Chanwit Klongpanichpal, an electrical engineer with extensive experience in solar PV plants and interconnection standards, as well as in variable renewable energy grid integration studies, and other technical issues related to connecting solar PV and distributed energy systems to the grid. His background covers power system analysis, transmission system planning and analysing, special protection scheme design and detail design for power plants on a diverse range of thermal and renewable energy projects including solar PV projects. Experience includes owner's engineer and lender's engineer for thermal and renewable power projects in Southeast Asia.

Chanwit Klongpanichpal played a key role during the preparation of the materials and delivery of the workshop on Solar PV and grid integration, particularly sections related to technology, grid integration, grid codes, commissioning, operation, and safety. In addition, he has delivered dedicated webinars on Commissioning of solar PV plants in October 2020, Solar PV plant Design in September 2021, and O&M for PV plants in May 2022,

which was part of the continuous advisory sessions organized on topics demanded by EDC.

He has supported on EDC's particular interest to be trained in practical issues related to grid integration, grid codes, commissioning, operation and safety, he has gained a more relevant role for the demanded capacity building activities, and therefore his time allocation was increased at no additional cost, through a time transfer from the Team Leader.

After VO6, the remaining time allocated to this specialist was 2.36 person*months, which was fully utilized by the end of May 2022.



Senior Solar PV and EYA specialist

Nonthi Cherdsanguan was incorporated to the team as Solar PV and EYA Specialist through the variation order of 17 December 2020, with the purpose to contribute to the preparation of the Solar PV and grid integration manuals

He is a MEng qualified renewable energy engineer responsible for project management of solar PV projects with a particular focus on PV plant performance, technology and financial assessment. He is familiar with solar PV Project development including feasibility study assessment, due diligence, energy yield analysis, plant commissioning and performance test, and operating performance analysis. He has experience in international utility scale renewable energy projects including projects in Thailand, Japan, Myanmar, Philippines, Malaysia, China and Pacific Ocean regions.

He has delivered key parts of the first main workshop on Solar PV and grid integration on 24-25 May 2021, as well as webinars on Testing of solar PV plants in October 2020, Solar Plant Design, O&M of PV plants in May 2022, and PVSyst in September 2021, April 2022, and June 2022, which was part of the continuous advisory sessions organized on topics demanded by EDC.

He has supported on some of the key requests from EDC for dedicated follow up webinars, which include areas of his specific expertise, including PVSyst software.

After VO6, the remaining time allocated to this specialist is 4.37 person*months, which was fully utilized by the end of June 2022. This will be updated once the extension details are finalized.



Regional Energy specialist

Siri Previn was included as an additional team member (Regional Energy Regulatory Specialist) by the variation order of 17 December 2020, with 1 person-month allocation, particularly to support in the preparation of the regulatory framework assessment.

Siri is an Energy engineer with 20 years of experience in renewable energy, energy efficiency, energy policy and rural electrification in 17 countries in the Asia and Pacific region. She has experience solar PV, including technical due diligence and feasibility. She has experience in over 10 energy projects for international development agencies and has designed and conducted training courses on solar energy for power utilities, private companies and government agencies.

She supported the team with the assessment of the capacity building needs, and the preparation of the materials for the webinar on model PPAs on 25 January 2021.



Social safeguard specialist

Sokphea Young joined the team through VO6 on 23 March 2022 and he has led the E&S component of the project.

He is a Senior Social Development Specialist with over 15 years of experience. He is a Cambodian national, and can communicate directly with the E&S team of EDC.

He undertook a review of the semi-annual environmental monitoring report with a focus on the social issues, then issue a single round of comments in terms of areas of improvement, and recommendations to be followed up by the Project to improve the reporting.

His time allocation was 0.55 person*month, which was fully utilized by the end of June 2022.



Environmental safeguard specialist

Ben (Boon Mo) Lim joined the team through VO6 on 23 March 2022.

He is an Environmental engineer with 12 years of international experience.

He undertook a review of the semi-annual environmental monitoring report with a focus on the environmental issue, then issue a single round of comments in terms of areas of improvement, and recommendations to be followed up by the Project to improve the reporting.

His time allocation was 0.47, which was fully utilized by the end of June 2022.

1.3.8 Resource person experts

In addition to the above key experts, and new staff additions proposed, other qualified senior experts have been invited as resource persons to provide advisory to the stakeholders, mainly as panellists in webinars and workshops.

The following experts have contributed to the previous training organized as resource people:



Utility-scale Solar PV plants design expert

Phil Napier-Moore leads Mott MacDonald's technical advisory work for solar and wind power in the Asia Pacific region. Supporting plant investors and lenders from the sector's infancy in 2008, has overseen the regional teams' technical inputs to more than 9000 MW of projects in Asia, including 250 plants now in operation. Additionally, since January 2018, is undertaking the global practice leader role for Mott MacDonald's work in renewable energy, to coordinate the company's global strategy, systems, tools and research work in this area. Complementary experience includes technical advisory support to a wide range of other power generation technologies including energy policy and techno-economic studies.

He has directed and managed projects for a range of multilateral agencies, national governments and numerous leading power sector companies, working internationally on low-carbon power projects in 30 countries around the world particularly Asia and Europe.

He is engaged in the project as a "Utility-scale solar plants design expert". He has provided advisory on a webinar on testing and commissioning of PV plants held on 8 October 2020. He also presented as a "Southeast Asia Region Model PPA Expert" for the webinar on

model PPAs in January 2021, which is part of the advisory demanded by EDC during the consultations. His contribution to the webinar included the following tasks:

- Review documentation on model PPAs applicable for renewable energy in Cambodia
- Analyse and compare the models with a focus on applicability given project experience in the Southeast Asian region
- Coordinate with the International Model PPA Expert to prepare a brief report/table, compiling comments and recommendations for the Cambodian context, and an explanatory presentation for an online workshop
- Present the findings on an online workshop, including a Q&A session



International PPA Expert

Derek Mackay has over 15 years of international experience in renewable energy, including Lender's Engineer and Owner's Engineer. He has experience in the development, financing, construction, commissioning, O&M, sale and acquisition of many large and complex international Renewable Energy projects. He possesses a strong understanding of technical, project-financing, commercial, risk, regulatory and QHSE issues. He successfully executed projects including those for utilities, developers, international financial institutions, legal firms and government agencies. He has completed a wide range of projects in established and emerging markets including Europe, Africa, Asia, the Middle East and the Americas. His relevant experience includes analysing PPA contracts for renewable energy projects.

He was engaged as a resource person for the workshop on Model PPA, which included the following tasks:

- Review documentation on models PPA applicable for renewable energy in Cambodia
- Identify and compile international model PPAs both for rooftop and ground mounted solar plants
- Analyse and compare the models, and prepare a brief report/table, compiling comments and recommendations for the Cambodian context
- Prepare an agenda and an explanatory presentation on PPAs for an online workshop to present the findings, including a Q&A session



BESS Expert - Korean specialist

Yoon Yeo-Jun has over 15 years of international experience in the energy sector, including BESS. He has experience with conducting research project related to ESS in Korea. His CV is included in the Midterm report.

He was engaged as a resource person for the workshop on BESS, including the following tasks:

- Review the training program prepared for the workshop by the project team.
- Prepare a suitable case study, related to the workshop program, reflecting Korean expertise in the ESS field. The preparation includes the slide deck to be presented.
- Present the case study on the online BESS workshop, including allocated time to a Q&A session.

1.3.9 Additional specialists

As originally proposed, the project team has been supported by multi-disciplinary specialists providing inputs as required. This has given us the flexibility needed to optimize the resources, in order to effectively target the specific advisory topics demanded.

Other non-key experts that have supported the team as needed included:

- Chisanupong Thawanyavitchajit: Solar PV specialist
- Paul Tuson: Grid integration expert
- Inaki Perez: Utility-scale solar plant design expert
- Dominic Simpson: Geotechnics specialist
- Chinnawat Pama: EYA specialist
- Benjamin Roa: E&S specialist

1.4 Communication plan

The communication plan aims at keeping stakeholders informed of the project progress, as well as receiving their feedback.

Stakeholders

Based on the stakeholders mapping presented in the Interim Report, direct stakeholders of the project include:

- Electricité du Cambodge (EDC): Programme direct beneficiary and focal point
- Electricity Authority of Cambodia (EAC): Programme direct beneficiary
- Department of Rural Electrification Fund (REF): Programme direct beneficiary
- Thai MM Limited: Consultant
- Asian Development Bank (ADB): Lender
- Republic of Korea e-Asia and Knowledge Partnership Fund (EAKPF): Donor

Other indirect stakeholders include:

- Ministry of Economic and Finance (MEF)
- Rural Electricity Enterprises (REEs)
- Independent Power Producers (IPPs)
- Public Electricity Utility (PEU)
- Ministry of Mines and Energy (MME)

Communication channels

The focal point from the project beneficiary side is EDC. In order to provide continuous advisory on issues that direct stakeholders identify during their day-to-day work, it was particularly relevant to keep a permanent communication channel with EDC to receive their inquiries both formally and informally.

In the kick-off meeting it was agreed to use the Telegram application as a quick way to interact for informal communication. A chat group was established in which all direct stakeholders can discuss in real-time. In addition, private chat rooms were used to quickly exchange information, either by short text messages or voice calls, between Thai MM and EDC, as well as the ADB focal point. As such, the current established channels are:

- The Thai MM focal point was regularly in communication with the EDC focal point via e-mail, phone, conference calls, and instant messages through Telegram. The primary

contact person from EDC is Ms. Lysornng Oeng. Between November 2021 and April 2022, Mr Tong Menghour was acting as the primary contact person.

- The Thai MM focal point was regularly in communication with the ADB focal point via e-mail, conference calls, and instant messages through Telegram. In August 2021, the ADB Project management team changed from the Thailand office to the Cambodia office, therefore, the current primary contact persons from ADB are Mr Mao Ouk and Ms Tharath Lun, with the supervision of Mr Anthony Robert Gill.
- All direct stakeholders were able to communicate directly with Thai MM and the rest of the stakeholders via text message on Telegram.
- Formal communication channels were established between Thai MM and EDC, as well as between Thai MM and ADB via Email. ADB focal point was copied in any relevant correspondence between Thai MM and EDC.
- Any formal communication Thai MM aimed to establish with indirect stakeholders was communicated through the EDC focal point, who advises and redirected to the most suitable information sources.
- Primary contact from Thai MM is the Team Leader, Cosme de Arana.

In addition, other communication platforms were used, including: ZOOM and MS Teams for webinars, and MS Forms for surveys.

Republic of Korea e-Asia and Knowledge Partnership Fund (EAKPF) Visibility

In order to communicate the Fund's contributions and achievements to beneficiaries and general audiences, EAKPF's full name and/or logo was placed on all visibility materials for events such as workshops, seminars, training and site visits, as well as on publications such reports and event materials.

2 Activities Completion Review

This section summarises the activities completed. Due to the ongoing COVID-19 pandemic situation and resulting travel restrictions, project activities could not be performed in-country. As a result, all activities were performed remotely.

Thai MM Limited's engagement was originally from 1 June 2020 to 15 November 2021. However, the project was subsequently extended to 30 June 2022 through VO5.

The kick-off meeting was held on 12 August 2020, and the last activity was completed on 30 June 2022.

2.1 Work Plan

The original workplan, as presented in the ADB form TECH-3, was structured in three main components:

1. Capacity Building Needs Assessment / Training plan: The project started with the compilation of the necessary information and preparation of the tailored training plan.
2. Training program delivery (workshops and manuals): Subsequently, materials were prepared, and three multi-day workshops were organized for the three main topics (PV, BESS, and Regulation). The workshops were delivered consecutively. This was the most labour-intensive component requiring approximately half of all the assigned resources.
3. Advisory: Implemented along the whole project duration. Experts were engaged as resource persons to provide training when needed.

2.1.1 Schedule

There were originally three main reports planned: Interim report, Mid-Term report and Final Report, however, since the project was extended to 30 June 2022, the following reports were added as milestones of the extension period: "Third Progress Report", "Consultation Report", "Activity Report-1", and "Activity Report-2".

Schedule revision

The original work plan was prepared during the proposal stage for a tentative start of the project on 13 April 2020. Due to the Covid-19 pandemic disruption, and the subsequent delay on the start of the project, some changes were introduced in the schedule to reflect the actual situation.

The revised schedule after the sixth Variation Order was:

- Milestone 1 (Mobilization) – 21 July 2020
- Milestone 2 (Interim report) – 18 December 2020
- Milestone 3 (Manual for Solar PV workshop) – 10 February 2021
- Milestone 4 (Manual for BESS workshop) – 31 May 2021
- Milestone 5 (Manual for Regulation workshop) – 31 August 2021
- Milestone 6 (Mid-term report) – 28 July 2021
- Milestone 7 (Third progress report, formerly "Final Report") – 15 December 2021
- Milestone 8 (Consultation report) – 4 March 2022
- Milestone 9 (First Activity report) – 9 May 2022

- Milestone 10 (Second Activity report) – 31 May 2022
- Milestone 11 (Final report) – 30 June 2022
- Milestone 12 (Statement of eligible costs) – 30 June 2022

Since the project was extended until 30 June 2022, the complete project has been implemented in approximately 23 months.

2.1.2 Project extension

The scope of the project continued to focus on strengthening the capacity of EDC, for integration of renewable energy into the national grid in Cambodia. In addition, capacity building on Environmental and Social (E&S) safeguards reporting was added.

The extension was carried out from 16 November 2021 to 30 June 2022. The number of person-months (PM) added for the extension period was 8.02 PM, increasing the total from 17.69 PM to 25.71 PM.

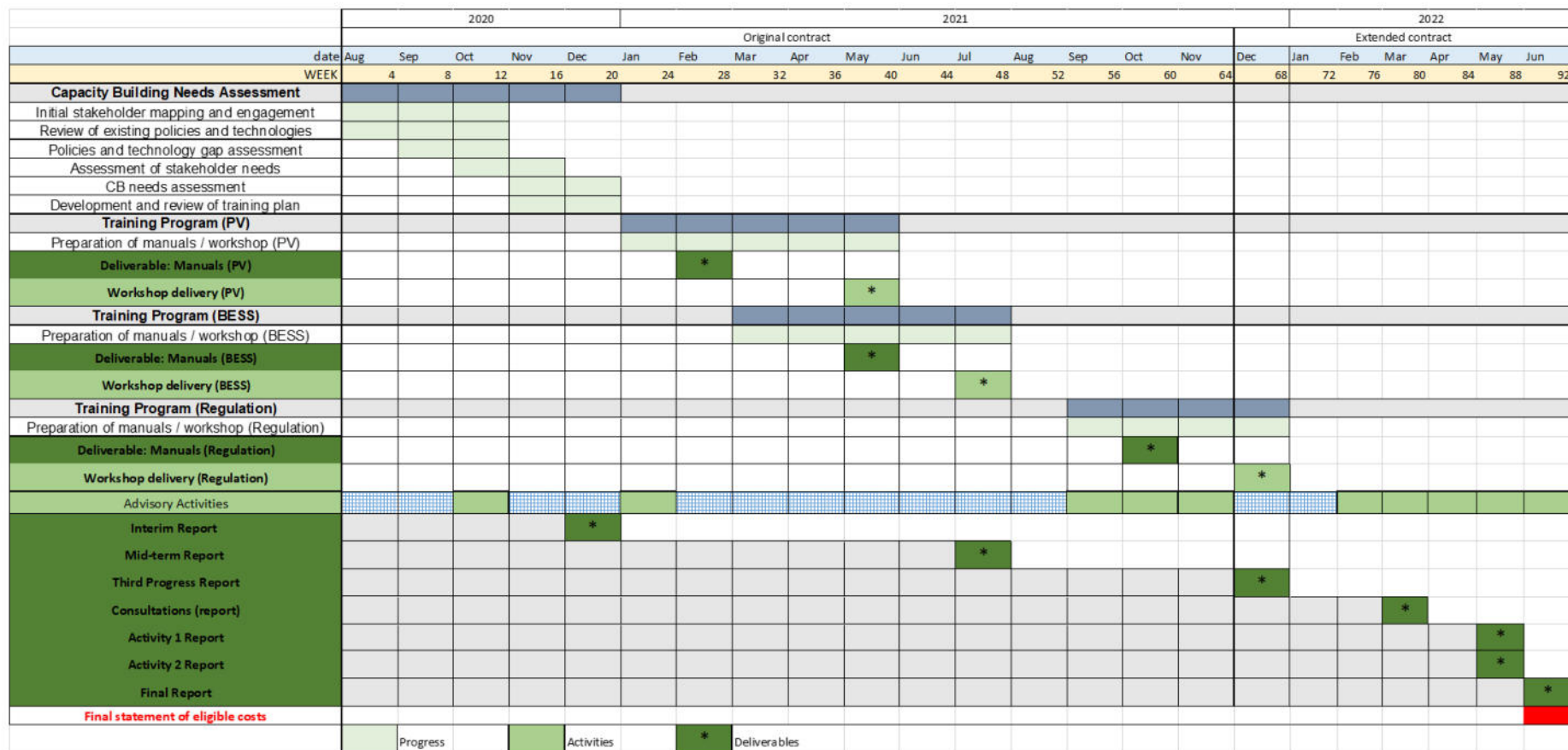
The topics to be addressed during the extension period were agreed on a consultation with EDC on 22 February 2022. The details of the consultation are included in the “Consultation report”, submitted on 4 March 2022. The following topics were agreed for further training and will be proposed to EDC:

- Advanced training on PVSyst modelling software
- Advanced training on HOMER pro modelling software
- Operation and maintenance of PV plants
- BESS Operation, design and specification, Incl. case studies.
- E&S Safeguards reporting (report review, with comments and recommendations for improvements of further reporting periods)

The team of international experts continued to be the previously approved one, with the addition of the E&S team members.

Figure 2.1 shows the revised schedule setting out the above-mentioned changes.

Figure 2.1: Schedule



2.2 Activities Completed

All planned activities have been completed and deliverables submitted, including the following:

- Kick off Meeting: 12 August 2020
- Capacity Building Needs assessment. Consultations and formulation of training program: 5 October 2020
- Main manuals
 1. Solar PV and Grid Integration: 10 February 2021
 2. Battery Energy Storage (BESS): 31 May 2021
 3. Energy Regulation: 26 October 2021
- Main E-learning videos
 1. Solar PV and Grid Integration: 7 May 2021
 2. Battery Energy Storage (BESS): 25 June 2021
 3. Energy Regulation: 2 November 2021
- Main Workshops
 1. Solar PV and Grid Integration Workshop (2 half days): 24-25 May 2021 (Appendix A.1.5)
 2. Battery Energy Storage (BESS) Workshop (2 half days): 12-13 July 2021 (Appendix A.1.6)
 3. Energy Regulation (2 half days): 2-3 December 2021 (Appendix A.1.7)
- Ad-hoc training sessions:
 1. Testing and Commissioning: 8 October 2020 (Appendix A.1.4.1)
 2. Model PPA. Incl. Report on PPA assessment: 25 January 2021 (Appendix A.1.4.2)
 3. Solar PV plant design: 13 September 2021 (Appendix A.1.4.3)
 4. Solar PV modelling with PVSyst software – Introduction: 14 September 2021 (Appendix A.1.4.4)
 5. Economic aspects of BESS: 27 September 2021 (Appendix A.1.4.5)
 6. BESS system integration modelling with HOMER Pro: 27 September 2021 (Appendix A.1.4.6)
 7. Solar PV modelling with PVSyst software – Advanced session I: 7 April 2022 (Appendix A.1.4.4)
 8. HOMER Pro: – Advanced session I: 25 April 2022 (Appendix A.1.4.6)
 9. Operation and Maintenance of PV plants: 11 May 2022 (Appendix A.1.4.7)
 10. PVSyst software – Advanced session II: 7 June 2022 (Appendix A.1.4.4)
 11. HOMER Pro – Advanced session II: 13 June 2022 (Appendix A.1.4.6)
 12. Advanced BESS topics: 27 June 2022 (Appendix A.1.4.8)
 13. PVSyst– Advanced session III: 30 June 2022 (Appendix A.1.4.4)
 14. E&S Progress reports review: 30 June 2022 (Appendix A.1.8)
- Practical exercises with PVSyst and HOMER Pro: April-June 2022
- Continuous advisory on inquiries raised by EDC
- Progress reports:
 1. Interim report: 18 December 2020
 2. Mid-Term report: 28 July 2021
 3. Third progress report: 15 December 2021
 4. Consultation report (Extension): 4 March 2022
 5. Activity report -1: 9 May 2022
 6. Activity report -2: 31 May 2022
 7. Final report: 30 June 2022
- Review missions: 15 December 2020 and 14 July 2021

More details of all these activities and deliverables are presented in appendix A.1

The corresponding start and end dates are summarized in below.

Table 2.1: Tasks

#	Activity	Status	Start date	End date	Remarks / updates
1	Kick-off meeting	Completed	12-08-2020	12-08-2020	The kick-off meeting was conducted on August 12 and attended by representatives from Mott MacDonald, ADB and all relevant stakeholders of the project.
2	Initial stakeholder mapping and engagement	Completed	12-08-2020	18-09-2020	See details below.
2a	Stakeholder mapping	Completed	12-08-2020	31-08-2020	Results are presented in the Interim report
2b	Identification of key policy documentation	Completed	12-08-2020	31-08-2020	Key documents were identified. EDC provided requested documents. Reference of the documents reviewed are given in the Interim report.
2c	Stakeholder consultations	Completed	28-08-2020	18-09-2020	Initial stakeholder consultations have been conducted. Further details are presented in the Interim Report.
3	Review of existing policies and regulations	Completed	07-09-2020	05-10-2020	A preliminary review of existing policies and regulations has been conducted. Further information is presented in the Interim Report.
4	Capacity Building Needs Assessment	Completed	07-09-2020	05-10-2020	Initial consultations have been completed. Further information is presented in the Interim Report.
5	Development and review of training plan	Completed	12-08-2020	7-06-2021	The development of the training plan has started after the project kick-off and will be ongoing until all workshop (manuals) have been delivered.
6	Training Program (PV)	Completed	18-12-2020	15-02-2021	See (5)
6a	Preparation of manuals (PV)	Completed	18-12-2020	10-02-2021	The solar PV workshop manual was submitted in February 2021
6b	Workshop delivery (PV)	Completed	24-05-2021	25-05-2021	Workshop was delivered in May 2021.
6c	Activity report (PV)	Completed	11-02-2021	15-02-2021	An activity report was delivered after (and as part of the outcomes of) the training program.
7	Training Program (BESS)	Completed	15-02-2021	12-04-2021	See (5)
7a	Preparation of manuals (BESS)	Completed	15-02-2021	31-05-2021	The BESS workshop manual was submitted on 31 May 2021
7b	Workshop delivery (BESS)	Completed	12-07-2021	13-07-2021	Workshop was delivered on 12 and 13 July 2021.
7c	Activity report (BESS)	Completed	28-07-2021	28-07-2021	An activity report is included as a part of the Midterm report
8	Training Program (Regulation)	Completed	20-09-2021	03-12-2021	See (5)

#	Activity	Status	Start date	End date	Remarks / updates
8a	Preparation of manuals (Regulation)	Completed	20-09-2021	26-10-2021	The Regulation workshop manual was submitted on 26 October 2021
8b	Workshop delivery (Regulation)	Completed	02-12-2021	03-12-2021	Workshop is expected to be delivered in September 2021. More detailed planning will be done closer to the date.
8c	Activity report (Regulation)	Completed	17-12-2021	17-12-2021	An activity report is included as a part of the third progress report
9	Continuous Advisory	Ongoing	12-08-2020	1-11-2021	Continuous advisory is on an ongoing and as-needed basis. We provided ad-hoc advisory in the form of online workshops on demanded topics.
9a	Webinar on Testing and Commissioning Standards (Solar PV)	Completed	08-10-2020	08-10-2020	A webinar on testing and commissioning standards for solar PV installations was delivered together with supporting IEC documents. This was organized as a response to an inquiry from EDC. A follow up and survey were conducted subsequently.
9b	Webinar on model PPA	Completed	11-01-2021	11-01-2021	A webinar on Models PPA was prepared as a response to an inquiry from EDC. An evaluation survey was conducted once completed.
9c	Workshop follow up Webinars (Incl. Solar PV, BESS and regulation)	Completed	01-08-2021	30-06-2022	Following the main workshops, dedicated webinars on specific topics were organized. All the activities implemented during the extension period were part of this task
10	Interim Report	Completed	05-10-2020	18-12-2020	
11	Mid-term Report	Completed	28-07-2021	28-07-2021	Submitted one month after the evaluation of the three main workshops.
12	Third Progress Report (former Final Report)	Completed	15-12-2021	17-12-2021	Submitted at the end of the original schedule.
13	Consultation Report (Capacity Building re-assessment)	Completed	22-02-2022	04-03-2022	This consultation was conducted to determine the detailed scope of work for the extension period
14	Activity 1 - Report	Completed	09-05-2022	09-05-2022	Submitted reporting activities from the previous report until 30 April 2022
15	Activity 2 - Report	Not started	31-05-2022	15-05-2022	Submitted reporting activities from the previous report until 31 May 2022
16	Final report	Not started	30-06-2022	30-06-2022	Submitted at the end of the project reporting all activities until 30 June 2022

2.3

2.3 Progress Evaluation

An evaluation was conducted on 9 December 2021, after the completion of the original workplan, by circulating a self-evaluation questionnaire among the participants of the training. The questionnaire was prepared with the purpose to understand the background of the potential participants of the training program and identify the priorities for future training sessions.

The complete list of the questionnaire recipients is attached as Appendix A.25. Through their responses, the participants reflected their perceived level of improvement in specific topics of the three main components of the training program: Solar PV, BESS, and Regulation. The level of knowledge improvement for each topic was categorized as: "None", "Have heard of it", "I have become somewhat familiar with the topic", "I have acquired some general knowledge on the topic at professional level", and the highest level corresponded to "I have acquired knowledge that I can apply to my work".

Prior to completing the questionnaire, participants were asked for permission to collect and process the data. A large number of the addressees declined to participate or provide permission to process their data. This limits the accuracy of the analysis as the results from a smaller sample of 10 people must be extrapolated.

An overview of the answers provided by the respondents of the questionnaire is given in appendix A.32

The results show the perceived knowledge improvement in various topics related to Solar PV. It can be seen that the majority considers that they have acquired significant knowledge on these topics at a professional level, and are generally able to apply this to their work.

3 Conclusions

The project has been successfully implemented despite the significant challenges of adjusting the methodology to the disruption of the Covid-19 pandemic.

While the project was originally envisaged as a 16-month capacity building program, with significant time spent on-site, it was finally implemented as a 23-month online program. The resources saved on traveling were used to increase the number of training activities and support provided on-line.

The knowledge areas covered by the program followed the original training plan, including Solar PV, Battery Energy Storage Systems, and Energy Regulation. The specific topics to be addressed were discussed and agreed with EDC through continuous consultations. While for most of the participants these were relatively new topics, according to the survey conducted, the majority consider they have acquired significant knowledge on these topics at professional level and are now able to apply this to their work.

This capacity building program has provided the participants tools and resources to better understand the technologies and regulatory implications of the ongoing solar PV development in Cambodia. Which was confirmed through self-evaluation questionnaires held among the participants, reinforcing that they had acquired valuable knowledge applicable to their day-to-day work.

3.1 Lessons learnt

- Online training poses significant communication barriers compared to conventional presentational training. To overcome this challenge, we made additional efforts to keep participants engaged, including the use of an interactive platform (“kahoot!”) which allows participants to individually provide feedback on quizzes and surveys.
- The level of interest in the training topics, and the impact on the daily work of the participants, varies significantly between individuals. While a small group of participants need knowledge and experience in Solar PV for their day-to-day work, for others just some background information is enough to understand the implications of Solar PV development in their areas of work. Therefore, we structured the trainings in a way that a small group of around 10 selected participants received advanced training, including practical exercises, while a wider group of around 50-70 participants receive more general information, not demanding previous knowledge to participate.
- The number of women currently working in this specific area of expertise in Cambodia is significantly lower than the number of men. However, EDC made an effort to identify and invite potential female participants from other departments to increase the awareness of Solar PV and BESS technologies among women.

3.2 Next steps

Considering the challenges EDC will face in the coming years during the implementation of the Solar PV Park and the scale-up of Renewable Energy sources connected to grid, further capacity building programs for more specific areas will be needed, particularly to address issues arising during the operation of the plants. In addition, trainers would be allowed to travel to Cambodia and potential additional on-site trainings would be possible.

A. Appendices

A.1 Activities Description

In the following subsections a description of the key activities and milestones completed so far is given.

A.1.1 Kick off meeting

The kick-off meeting was conducted on August 12 and attended by representatives from ADB, Mott MacDonald, Electricité du Cambodge (EDC), Ministry of Mines and Energy (MME), Electricity Authority of Cambodia (EAC), Institute of Electrical Science, and NEWJEC. One of the main issues discussed was the challenge to adapt the project to the current situation under the COVID-19 pandemic. More details are available in the minutes of meeting attached to the Interim Report.

A.1.2 Capacity Building Needs Assessment

An assessment of the stakeholder's needs was conducted in parallel to the policy review and was completed on 5 October. It included the following actions (the findings are presented in detail in the Interim Report):

- **Policy and regulatory review:** An initial review of the policy and regulatory framework of Cambodia was completed on 5 October 2020. The team reviewed existing documentation on energy policy and regulation provided by EDC and publicly available. This review served as a basis for the specialists to have a preliminary overview of the existing policy and regulatory framework in Cambodia. Further information was provided in the Interim Report.
- Stakeholders mapping and engagement: Presented in the Interim Report.
- Consultations with stakeholders: Interviews were conducted to stakeholders on the following dates (further details were presented in the Interim Report).
 - **REF:** 4 September 2020
 - **MME:** 8 September 2020
 - **EDC:** 25 September 2020
 - **EAC:** 25 September 2020
- **Capacity Building Needs Survey among training participants:** A survey was conducted between 28 October and 3 November 2020 to compile the needs and preferences of a wider group of potential participants for the training. The list of survey participants, including their positions and organization is presented in The Interim Report.

A.1.3 Review Mission

Review missions were conducted on 15 December 2020, and 14 July 2021. Virtual meetings were organized by ADB with participants from EDC, EAC, Ministry of Mines and Energy. The work progress, and the plan for next activities was presented by Thai MM. The impossibility to travel and the options to continue implementing the project online were again the key points for discussion.

A.1.4 Advisory on demand from EDC

The team keeps an open communication channel with EDC focal point through e-mail, and Telegram instant messenger, as well as scheduled conference calls. Any inquiry received from EDC is analyzed, and the team proposes an action to give response to it. Inquiries raised

through email were related to “testing and commissioning”, “model PPA”, and “grid codes”. The first inquiry was addressed on a webinar on “testing and commissioning” organized on 8 October 2020. For the second one, a specific report was submitted on 20 January 2021, providing a comparison between local and international model PPAs and an analysis from Mott MacDonald experience. A webinar presenting the findings from the Model PPAs assessment was organized on 25 January 2021. For the inquiry on “grid codes”, a full section of the Solar PV and Grid Integration workshop we dedicated to this topic, including references from countries with a high renewable energy penetration.

Subsequently, the team conducted surveys among the workshop participants to prioritize topics to be addressed in further dedicated training sessions. Following the outcome, in September 2021, the team organized webinars on Solar PV Design, PVSyst modelling, Economic Aspects of BESS, and HOMER Pro modelling. In addition, practical exercises were assigned to the participants in December 2021.

Another consultation was conducted in March 2022 to agree further topics to be addressed until the end of June 2022. The topics selected include Operation and maintenance of PV plants, BESS Operation and Economic aspects, as well as advanced practical training on PVSyst HOMER pro modelling software.

Below is a summary of the dedicated webinars delivered, in chronological order:

A.1.4.1 Training on Testing and Commissioning

A webinar on testing and commissioning standards for solar PV installations was delivered together with supporting IEC documents. This was organized as a response to an inquiry from EDC. A follow up and an evaluation survey were subsequently conducted among the participants.

- **Materials provided:** IEC 61724 on solar PV plant performance test, and IEC 62446-1 on commissioning of solar PV plants, were sourced from the International Electrotechnical Commission and licensed for the internal use of EDC. These documents were explained during the online workshop. In addition, a copy of the PPT presented was provided to the participants in advance.
- **Webinar:** The workshop was presented online via ZOOM. Participants were however all sitting in the same venue, which was provided by EAC. The training agenda is provided in Appendix A.2. Below are the details of the activity:
 - Date: 8 October 2020
 - Duration: It was originally planned to last for 2 hours, however, due to the high active participation from the attendees and the number of questions raised, the session was extended for additional 30 minutes
 - Participants: 29 participants joined the meeting from EDC, EAC, MME, REF, IES, as well as two officers from ADB. The list of participants is provided in Appendix A.3.
 - Resources: 4 experts delivered the webinar including:
 - Project solar PV specialist, Chanwit Klongpanichpal: Presented the commissioning part of the training.
 - Solar PV Specialist, Nonthi Cherdsanguan: Presented the plant performance test component. He was invited as a resource person specifically for this activity.
 - Solar PV design expert, Phil Napier-Moore: Participated as a panelist guiding the Q&A session. He was invited as a resource person specifically for this activity.
 - Team Leader, Cosme de Arana: Organized and coordinated the activity.

- **Follow up:** By request of one of the participants, the team prepared and overview of PV simulation software and meteorological data providers which was provided on 9 October 2020.
- **Evaluation survey:** The feedback received from the participants was generally very positive and encouraging to organize additional sessions. Results of the evaluation survey are attached as Appendix A.6.

A.1.4.2 Training on Model PPA:

This activity originated for an inquiry from EDC on model PPA, as part of the continuous advisory provided. In response to this EDC's inquiry we organized a webinar, including a comparison between the local model PPA provided by EDC, and international references. The deliverables comprised a report comparing key issues, with our comments and recommendations to apply in the Cambodian context, as well as a webinar in which these findings were presented and discussed on a Q&A session.

- **Documents provided:** Report in table format comparing the Model PPAs, and providing comments and recommendations. In addition, a copy of the PPT to be presented was provided in advance.
- **Webinar:** The workshop was presented online via ZOOM. Participants joined from a venue provided by EDC. The presentation was split into two sessions, covering commercial and technical aspects. The agenda is provided in Appendix A.4. Below are the details of the activity:
 - Date for the webinar: 25 January 2021
 - Duration: 2 hours and 20 minutes, including 20 minutes for Q&A, however, it was finally extended for additional 40 minutes.
 - Participants: 30 participants joined the meeting from EDC, EAC, MME, REF, IES, as well as two officers from ADB. 14 of them (47%) were women. The list of attendance is provided in Appendix A.5.
 - Resources: Three experts delivered the webinar including two experts on model PPA associated to renewable energy, with a complementary role in the workshop:
 - Derek Mackay: He provided a comparison table from an international perspective, providing recommendations. He has experience is in more established markets and provided a reference on how PPAs are usually done there. He was invited as a resource person for this specific activity.
 - Phil Napier-Moore: He contributed with an analysis, based on his regional experience, on how international practices can be better applied in Cambodia. His experience is mainly in developing countries, particularly in Southeast Asia. He was invited as a resource person.
- **Follow up:** We keep an open channel through Telegram to clarify questions and elaborate specific aspects of PPA that stakeholders request.
- **Evaluation survey:** A survey was conducted after the training session and the results are presented in Appendix A.7.

A.1.4.3 Solar PV plant Design:

The topic for this session was chosen by EDC participants through a survey, in which a number of related topics were proposed. Participants gave a score to each of the topics proposed, and the ones with higher scores were selected. The complete survey is presented in Appendix A.12

- **Documents provided:** A copy of the PPT presented was provided in advance, and a video recording of the session was circulated.
- **Webinar:** The workshop was presented online via ZOOM. Participants joined from home and offices. The presentation was split into two parts, covering Design of a PV plant layout, key considerations, for PV configuration design, and plant design for bifacial and tracker systems, and Design of Balance of Plant (BoP). The agenda is provided in Appendix A.18. Below are the details of the activity:
 - Date for the webinar: 13 September 2021
 - Duration: 3 hours, including 20 minutes for Q&A
 - Participants: 42 participants joined the meeting from EDC, EAC, MME, REF, and IES. 21 of them (50%) were women. The list of attendance is provided in Appendix A.23
 - Resources: Two experts delivered the webinar:
 - Nonthi Cherdsanguan: He delivered a session on Design of a PV plant layout, key considerations, for PV configuration design, and plant design for bifacial and tracker systems
 - Chanwit Klongpanichpal: He contributed with the Design of Balance of Plant (BoP)
- **Follow up:** We keep an open channel through Telegram to clarify questions and elaborate related aspects that stakeholders request.
- **Evaluation survey:** A survey was conducted after the training session and the results are presented in Appendix A.15

A.1.4.4 PVSyst software modelling (4 sessions):

A series of training sessions on PVSyst software started with an introductory session during the first phase of the project. However, during the consultation conducted for the extension period, EDC requested to further expand the training on this topic so that a selected number of participants could develop advanced skills on the use of this software. A total of 4 sessions were delivered on this topic, including the introductory one and 3 on advanced features. These sessions were followed by practical exercises proposed by the trainers.

- **Documents provided:** The data files to be used in the practical exercises were provided in advance, together with instructions on how to run this data in PVSyst. Video recording of the 4 sessions was circulated.
- **Webinar:** The workshops were presented online via videoconference. Participants joined from home and offices. The first webinar was split into two parts, covering a review of Energy Yield Assessment (EYA), and the introduction and demonstration of the software. The agendas of the sessions are provided in appendix A.30. Below are the details of the activity:
 - Dates of the sessions:
 - Introductory session: 14 September 2021
 - Advanced session I: 7 April 2022
 - Advanced session II: 7 June 2022
 - Advanced session III: 30 June 2022
 - Duration: 2 hours per session.
 - Participants:
 - Introductory session: 42 participants joined the meeting from EDC, EAC, MME, REF, and IES. 21 of them (50%) were women. The list of attendance is provided in Appendix A.23

- Advanced session: 9 selected participants. 2 of them (22%) were women. The list of attendance is provided in Appendix A.31.
 - Resources: A PVSyst expert, Nonthi Cherdsanguan, delivered the sessions and followed up with the practical exercises.
- **Follow up:** Several practical exercises using Pvsyst were assigned to the participants, starting on 30 November 2021, with 2 weeks to complete it, followed by similar assignments after each of the advanced sessions. Trainers kept an open channel through Telegram to clarify questions and elaborate related aspects that stakeholders request.
- **Evaluation survey:** Two surveys were conducted, first after the introductory (results presented in Appendix A.15) and then a final one after the second advanced session (results presented in Appendix A.34A.33).

A.1.4.5 Economic Aspects of BESS:

The topic for this session was chosen by EDC participants through a survey conducted during the BESS main workshop, in which a number of related topics were proposed. Participants gave a score to each of the topics proposed, and the ones with higher scores were selected.

- **Documents provided:** A copy of the PPT presented was provided in advance, and a video recording of the session was circulated.
- **Webinar:** The workshop was presented online via ZOOM. Participants joined from home and offices. The presentation was split into two parts, covering Revenue streams for Energy Storage and Techno-economics of a BESS project. The agenda is provided in Appendix A.20. Below are the details of the activity:
 - Date for the webinar: 27 September 2021
 - Duration: 3 hours, including 20 minutes for Q&A.
 - Participants: 42 participants joined the meeting from EDC, EAC, MME, REF, and IES. 21 of them (50%) were women. The list of attendance is provided in Appendix A.24
 - Resources: A BESS expert, Robert de Groot, delivered the webinar.
- **Follow up:** keep an open channel through Telegram to clarify questions and elaborate related aspects that stakeholders request.
- **Evaluation survey:** A survey was conducted after the training session and the results are presented in Appendix A.16.

A.1.4.6 HOMER Pro software modelling (3 sessions):

A series of training sessions on Homer Pro software started with an introductory session during the first phase of the project. However, during the consultation conducted for the extension period, EDC requested to further expand the training on this topic so that a selected number of participants could develop advanced skills on the use of this software. A total of 3 sessions were delivered on this topic, including the introductory one and 2 on advanced features. These sessions were followed by practical exercises proposed by the trainers.

- **Documents provided:** The data files to be used in the practical exercises were provided in advance, together with instructions on how to run this data in HOMER Pro. Video recording of the 3 sessions was circulated.
- **Webinar:** The workshops were presented online via videoconference. Participants joined from home and offices. The agendas of the sessions are provided in appendix A.30. Below are the details of the activity:

- Dates of the sessions:
 - Introductory session: 27 September 2021
 - Advanced session I: 25 April 2022
 - Advanced session II: 13 June 2022
- Duration: 2 hours per session.
- Participants:
 - Introductory session: 42 participants joined the meeting from EDC, EAC, MME, REF, and IES. 21 of them (50%) were women. The list of attendance is provided in Appendix A.24.
 - Advanced session: 9 selected participants. 2 of them (22%) were women. The list of attendance is provided in Appendix A.31.
- Resources: The BESS expert, Robert de Groot, delivered the sessions and followed up with the practical exercises.
- **Follow up:** Several practical exercises using Homer Pro were assigned to the participants, starting on 30 November 2021, with 2 weeks to complete it, followed by similar assignments after each of the advanced sessions. Trainers kept an open channel through Telegram to clarify questions and elaborate related aspects that stakeholders request.
- **Evaluation survey:** Two surveys were conducted, first after the introductory (results presented in Appendix A.16.) and then a final one after the second advanced session (results presented in Appendix A.34).

A.1.4.7 Operation and Maintenance of PV Plants:

The topic for this session was proposed and agreed with EDC on the consultation conducted for the extension period.

- **Documents provided:** A copy of the PPT presented was provided in advance, and a video recording of the session was circulated.
- **Webinar:** The workshop was presented online via MS Teams. Participants joined from home and offices. The presentation was split into two parts, covering Operation and Maintenance of Solar PV plants, as well as safety and Plant Performance during operation. The agenda is provided in Appendix A.26. Below are the details of the activity:
 - Date for the webinar: 11 May 2022
 - Duration: 3 hours, including 20 minutes for Q&A.
 - Participants: 54 participants joined the meeting from EDC, EAC, MME, REF, and IES. 20 of them (37%) were women. The list of attendance is provided in Appendix A.27
 - Resources: Two experts delivered the webinar:
 - Nonthi Cherdsanguan: He delivered a session on Design of a PV plant layout, key considerations, for PV configuration design, and plant design for bifacial and tracker systems
 - Chanwit Klongpanichpal: He contributed with the Design of Balance of Plant (BoP)
- **Evaluation survey:** A survey was conducted after the training session and the results are presented in Appendix A.33.

A.1.4.8 Advanced BESS topics:

The topic for this session was requested by EDC on the consultation conducted for the extension period.

- **Documents provided:** A copy of the PPT presented was provided in advance, and a video recording of the session was circulated.
- **Webinar:** The workshop was presented online via MS Teams. Participants joined from home and offices. The presentation was split into three parts covering Typical BESS costs and related financial modelling inputs, BESS design and specifications, and BESS O&M aspects. The agenda is provided in Appendix A.28. Below are the details of the activity:
 - Date of the webinar: 27 June 2022
 - Duration: 3 hours, including 20 minutes for Q&A.
 - Participants: 58 participants joined the meeting from EDC, EAC, MME, REF, and IES. 21 of them (36%) were women. The list of attendance is provided in Appendix A.29
 - Resources: The BESS expert, Robert de Groot, delivered the webinar.
- **Evaluation survey:** A survey was conducted after the training session and the results are presented in Appendix A.33.

A.1.5 Solar PV and Grid Integration Workshop

This was the first of the three main workshops planned for the training program.

The aim of this workshop and its associated manual was to introduce Solar PV technologies and its applications, in a way that participants with very different background levels could acquire an adequate level of knowledge, either as an introduction to these technologies for those who do not have previous experience, or to get a more in-depth understanding for those with some basic knowledge.

The project team prepared a training program on Solar PV and Grid Integration covering the topics identified as a priority for EDC and previously presented in the workshop manual.

A.1.5.1 Scope of work

This activity comprised two main deliverables:

- The workshop manual, which was delivered on schedule on 10 February 2021. This deliverable corresponds to a project milestone.
- The workshop presentation, which was originally planned to be delivered in February 2021 in a hotel venue in Phnom Penh, with the lectures delivered online. However, due to the covid-19 pandemic situation in Cambodia, with outbreaks increasing since February, EDC requested the activity to be postponed. After several attempts to re-schedule the workshop, we agreed with EDC to change to a fully online modality to avoid further delays, including the following deliverables:
 - An “e-learning” video covering the program presented in the manual, and following the same structure: We submitted on 7 May 2021 a 3.5 hours video compiling the core lectures in English. EDC requested two weeks to allow participants study the video prior the workshop.
 - A live workshop: We delivered a 2-half-days training on 24-25 May 2021. The slide deck and a recording of the live video were also provided to the participants.
 - A follow up through Q&A online through the Email and chat, and shorter session covering specific topics in more detail.

A.1.5.2 Workshop Format

The activity combined lectures translated to Khmer, case studies, Q&A sessions, and interactive exercises on a 2-half-days training on 24-25 May 2021. The slide deck and a recording of the live video were also provided to the participants. The agenda of the workshop, and e-learning video is attached as appendix A.8.

The exercises were delivered through “Kahoot!”, an interactive software that allows participants to give answers to quiz questions in real time, using their smart phones or laptops. The results are compiled and shown to participant on the screen.

The quiz questions were prepared for each section, based on the content presented. These were aiming to capture the level of attention they were paying during each lecture, without requiring them a high level of knowledge. In general, the results showed that participants had a good understanding of the contents presented. Once the correct answer was disclosed, the lecturer spent a few minutes further elaborating the reason why that solution was the best one, giving some examples.

A.1.5.3 Resources

The team members involved in this activity were, in order of appearance in the workshop:

- **Team Leader / PV deployment expert:** Cosme de Arana coordinated the workshop and presented Solar PV applications.
- **Senior Solar PV and EYA expert:** Nonthi Cherdsanguan presented topics related with Solar resources, plant design, and economic aspects.
- **Solar PV technology and grid connection expert:** Chanwit Klongpanichpal presented topics related with Solar PV and grid connection technology, as well as safety and commissioning related issues.
- **Energy storage expert:** Robert de Groot presented topics related to grid management.

In addition, the following experts joined the training session:

- **Solar PV expert / Project Principal:** Phil Napier-Moore, participated in the Q&A sessions.
- **Solar PV engineer:** Chisanupong Thawanyavitchajit provided support during the exercises conducted through an interactive app.

A.1.5.4 Translation

Since a significant number of participants don't have a high level of English, we were requested to present the live workshop with consecutive translation to Khmer.

A Khmer translator, Mr. Seng Seiha, was hired to assist in this and future workshops organized.

The time consumed for translation extended the presentation time more than originally estimated (noting that Khmer-language speaking time was significantly longer than English speaking time for the same content), for which the team had to adjust the presentation time, and which has been taken into account when preparing the following workshops.

A.1.5.5 Participants and gender balance

A total of 69 participants joined the workshop via Zoom.

The organisations represented included: MME, EDC, EAC, and IES, with staff from Planning, Generation, Transmission, and Distribution departments joining from the following provinces: Svay Reang, Kompong Cham, Siem Reap, Kompong Speu, Prey Veng, Battambang, Kratie,

Steung Treng, Rattanakiry, Tboung Khmum, Mondolkiry, Kompot, Sihanouville, Banteaymeanchey, and Takeo.

EDC invited the participants and made special emphasis in including women to maximize the number of female participants. A total of 25 women joined the workshop, which represents 36% of the total.

The attendance list is attached in Appendix A.10. A screenshot, attached in Appendix A.14, was taken as a group photo.

A.1.5.6 Discussion on topics to be further elaborated

In order to identify EDC priorities for further dedicated sessions, we proposed a number of potential topics to be elaborated. We then conducted an online consultation among the participants, allowing them to give a score to the proposed topics, and found that the most demanded was to further elaborate the “Solar PV Design section” followed by “Introduction to PVSyst”.

The results are presented to EDC as an evidence for further discussion, but don’t automatically predetermine selection of the next topics to be addressed. The topics will be decided and ultimately proposed by EDC as a part of the on-demand advisory service.

The complete results of the consultation are attached in appendix A.12

A.1.5.7 Satisfaction Survey

Following the training, a satisfaction survey was conducted online, which returned the following average results:

Table 2. Summary results from the satisfaction survey

Question	Average answer
Did you find the information delivered in the webinar useful?	Very useful
How would you rate your knowledge on the topics presented before the webinar?	Good background knowledge
How much do you consider the workshop helped you to improve your knowledge in the topics presented?	Significantly improved
How do you evaluate the quality of the presentations	At or above expectations

The complete results of the survey are attached in appendix A.13.

A.1.6 Battery Energy Storage Workshop (BESS)

This was the second of the three main workshops planned for the training program.

The aim of this workshop and its associated manual was to introduce BESS technologies and its applications, in a way that participants with very different background levels could acquire an adequate level of knowledge, either as an introduction to battery technologies for those who do not have previous experience, or to get a more in-depth understanding for those with some basic knowledge.

The Energy Storage expert led the preparation of the training program on BESS covering the topics identified as a priority for EDC and in-line with the materials previously presented in the associated workshop manual.

A.1.6.1 Scope of work

This activity comprised two main deliverables:

- The workshop manual, which was delivered on schedule on 31 May 2021. This deliverable corresponds to the fourth project milestone.
- The workshop presentation, which was originally planned to be delivered in April 2021 in a hotel venue in Phnom Penh, with the lectures delivered online. However, due to the delay dragged from the previous workshop, it was finally postponed to July 12 and 13. Following the request from EDC, it has been fully implemented online, including the following deliverables:
 - An “e-learning” video covering the program presented in the manual and following the same structure: We submitted on 25 June 2021 a video compiling the core lectures in English. EDC requested two weeks to allow participants to study the video prior the workshop.
 - A live workshop: We delivered a 2-half-days training on 12-13 July 2021. The slide deck and a recording of the live video were also provided to the participants.
 - A follow up through Q&A online via e-mail and chat.

Shorter sessions covering more specific and in-depth topics will still be organized, based on the attendees' preferences as indicated during and after the BESS workshop.

A.1.6.2 Workshop Format

The activity combined lectures translated to Khmer, case studies, Q&A sessions, and interactive exercises on a 2-half-days training on 12-13 July 2021. The slide deck and a recording of the live video were also provided to the participants. The agenda of the workshop and e-learning video is attached in appendix A.9

The exercises were delivered through “Kahoot!”, an interactive software that allows participants to give answers to quiz questions in real time, using their smart phones or laptops. The results are compiled and shown to the participants on the screen.

The quiz questions were prepared for each section, based on the content presented. These were aiming to capture the level of attention they were paying during each lecture, without requiring them a high level of knowledge. In general, the results showed that participants had a good understanding of the contents presented. Once the correct answer was disclosed, the lecturer spent a few minutes further elaborating the reason why that solution was the best one, giving some examples.

A.1.6.3 Resources

The team members involved in this activity were, in order of appearance in the workshop:

- **Energy storage expert:** Robert de Groot presented the workshop.
- **Team Leader / PV deployment expert:** Cosme de Arana coordinated the session.
- **Energy Storage expert/ Korean National:** Following indications from the donor The Republic of Korea e-Asia and Knowledge Partnership Fund (EAKPF), Mr Yoon Yeo-Jun was invited as a guest speaker. He presented a case study from Korean BESS applications, giving visibility to Korean expertise, and providing a networking opportunity for the participants.

In addition, the following expert joined the training session:

- **Solar PV engineer:** Chisanupong Thawanyavitchajit provided support during the exercises conducted through an interactive app.

A.1.6.4 Translation

Since a significant number of participants do not have a high level of English, we were requested to present the live workshop with consecutive translation to Khmer.

A Khmer translator, Mr. Seng Seiha, was hired to assist in this and future workshops organized.

A.1.6.5 Participants and gender balance

A total of 77 participants joined the workshop via Zoom.

The organisations represented included: MME, EDC, EAC, and IES, with staff from Planning, Generation, Transmission, and Distribution departments joining from the following provinces: Svay Reang, Kompong Cham, Siem Reap, Kompong Speu, Prey Veng, Battambang, Kratie, Steung Treng, Rattanakiry, Tboung Khmum, Mondolkiry, Kompot, Sihanouville, Banteaymeanchey, and Takeo.

EDC invited the participants and made special emphasis in including women to maximize the number of female participants. A total of 32 women joined the workshop, which represents 41.6% of the total.

The attendance list is attached in Appendix A.11.

A screenshot, attached in Appendix A.14, was taken as a group photo.

A.1.6.6 Discussion on topics to be further elaborated

In order to identify EDC priorities for further dedicated sessions, we proposed a number of potential topics to be elaborated. We then conducted an online consultation among the participants, allowing them to give a score to the proposed topics, and found that the most demanded was to further elaborate on the topic of “Modelling exercise with Homer Pro”, although this topic was closely followed by “Economic aspects of solar PV and energy storage”, with just one vote less for the “interested” or “very interested” scoring.

The results are presented to EDC as evidence for further discussion but do not automatically predetermine selection of the next topics to be addressed. The topics will be decided and ultimately proposed by EDC as a part of the on-demand advisory service.

The complete results of the consultation are attached in Appendix A.11.

A.1.6.7 Satisfaction Survey

Following the training, a satisfaction survey was conducted online, which returned the following average results:

Table 3. Summary results from the satisfaction survey

Question	Average answer
Did you find the information delivered in the webinar useful?	Very useful
How would you rate your knowledge on the topics presented before the webinar?	Good background knowledge
How much do you consider the workshop helped you to improve your knowledge in the topics presented?	Significantly improved
How do you evaluate the quality of the presentations	At or above expectations

The complete results of the consultation are attached in appendix A.13.

A.1.7 Energy Regulatory Workshop

This was the third and last of the three main workshops originally planned for the training program.

The aim of this workshop and its associated manual was to introduce aspects of the regulatory development that enable an appropriate environment for renewable energy development, showcasing regulatory support, policies, and financing innovations that have enabled solar PV and market growth in reference countries.

The Energy Regulatory expert led the preparation of the training program, covering the topics identified as a priority for EDC and in-line with the materials previously presented in the associated workshop manual.

A.1.7.1 Scope of work

This activity comprised two main deliverables:

- The workshop manual, which was delivered on 26 October 2021. This deliverable corresponded to the fifth project milestone.
- The workshop presentation was originally planned to be delivered in November 2021, however, by request of EDC, it was delayed to 2 and 3 December 2021, and fully implemented online, including the following deliverables:
 - An “e-learning” video covering the program presented in the manual and following the same structure: Submitted on 2 November 2021, the video compiled the core lectures in English. EDC requested at least two weeks to allow participants to study the video prior the workshop.
 - A live workshop: We delivered a 2-half-days training on 2-3 December 2021. The slide deck and a recording of the live video were also provided to the participants.
 - A follow up through Q&A online via e-mail and chat.

Shorter sessions covering more specific and in-depth topics will still be organized, based on the attendees’ preferences as indicated during and after the workshop.

A.1.7.2 Workshop Format

The activity combined lectures translated to Khmer, case studies, Q&A sessions, and interactive exercises on a 2-half-days training on 2-3 December 2021. The slide deck and a recording of the live video were also provided to the participants. The agenda of the workshop and e-learning video are attached in appendix A.22.

The exercises were delivered through “Kahoot!”, an interactive software that allows participants to give answers to quiz questions in real time, using their smart phones or laptops. The results are compiled and shown to the participants on the screen.

The quiz questions were prepared for each section, based on the content presented. These were aiming to capture the level of attention they were paying during each lecture, without requiring them a high level of knowledge. In general, the results showed that participants had a good understanding of the contents presented. Once the correct answer was disclosed, the lecturer spent a few minutes further elaborating the reason why that solution was the best one, giving some examples.

A.1.7.3 Resources

The team members involved in this activity were, in order of appearance in the workshop:

- **Energy Regulatory expert:** Stephen Hinchliffe presented the workshop.

- **Team Leader / PV deployment expert:** Cosme de Arana coordinated the session.
- **Solar PV engineer:** Chisanupong Thawanyavitchajit provided support during the exercises conducted through an interactive app.

A.1.7.4 Translation

Since a significant number of participants do not have a high level of English, we were requested to present the live workshop with consecutive translation to Khmer.

A Khmer translator, Mr. Seng Seiha, was hired to assist in this and future workshops organized.

A.1.7.5 Participants and gender balance

A total of 42 participants joined the workshop via Zoom.

The organisations represented included: MME, EDC, EAC, and IES, with staff from Planning, Generation, Transmission, and Distribution departments joining from the following provinces: Svay Reang, Kompong Cham, Siem Reap, Kompong Speu, Prey Veng, Battambang, Kratie, Steung Treng, Rattanakiry, Tboung Khmum, Mondolkiry, Kompot, Sihanouville, Banteaymeanchey, and Takeo.

EDC invited the participants and made special emphasis in including women to maximize the number of female participants. A total of 21 women joined the workshop, which represents 50% of the total.

The attendance list is attached in Appendix A.25

A screenshot, attached in Appendix A.14, was taken as a group photo.

A.1.7.6 Discussion on topics to be further elaborated

In order to identify EDC priorities for further dedicated sessions, we proposed a number of potential topics to be elaborated. We then conducted an online consultation among the participants, allowing them to give a score to the proposed topics, and found that the most demanded was to further elaborate on the topic of “Safety regulations for Solar PV and BESS”, followed by “Assessing appropriate level of renewables in the Cambodia”

The results are presented to EDC as an evidence for further discussion but do not automatically predetermine selection of the next topics to be addressed. The topics will be decided and ultimately proposed by EDC as a part of the on-demand advisory service.

The complete results of the consultation are attached in Appendix A.12

A.1.7.7 Satisfaction Survey

Following the training, a satisfaction survey was conducted online, which returned the following average results:

Table 4. Summary results from the satisfaction survey

Question	Average answer
Did you find the information delivered in the webinar useful?	Very useful
How would you rate your knowledge on the topics presented before the webinar?	Some knowledge
How much do you consider the workshop helped you to improve your knowledge in the topics presented?	Much improvement

Question	Average answer
Did you find the information delivered in the webinar useful?	Very useful
How do you evaluate the quality of the presentations	Good
Which Session was of most interest	"Day 2 (Fiscal Incentives, permits)"
Would you be interested in additional webinars on topics related to Energy Regulation	Yes

The complete results of the consultation are attached in appendix A.17.

A.1.8 E&S Progress Report Review

In order to provide recommendations on how to improve the quarterly reports and semi-annual reports for social and environmental monitoring of SEPRO and PIC, Mott MacDonald's team of social and environmental consultants reviewed the semi-annual report of social and environmental monitoring (January-June 2021; July-December 2021), and a latest quarterly report No. 08 (January-March 2022).

The review and consultations were conducted by the Social specialist, Sokphea Young, and the Environmental specialist, Ben Lim.

Consultations

The team organised consultation meetings with SEPRO/PIC to discuss the views and thoughts of SEPRO/PIC on improving and addressing ADB's comments on the reports on the following dates:

- 15 June 2022: with EDC's SEPRO and PIC's national consultants
- 20 June with EDC's SEPRO representatives and PIC's national and international consultants (national environment specialist and the team leader)

In addition to a preliminary meeting with ADB and EDC on 9 May 2022.

Mott MacDonald's comments and recommendations are based on the review of documents/reports of EDC's SEPRO and PIC, and consultation meetings with SEPRO and PIC.

Report

The report prepared by the team is attached as Appendix A.35

Final presentations

A final meeting was organized on 30 June 2022 at 2.30PM to present the findings and recommendations.

The following participants attended the final meeting: Ms. Oeng Lysorn (EDC), Mr. Bin Sopheakda (Deputy of SEPRO), Mr. Sour Chheang Yu (PIC's National Environmental Safeguard Specialist), Sai Shigeru (Resettlement Expert of PIC), and Murai Kazuo (Team Leader of PIC), Mr. Sokphea Young (Project Social Specialist), Mr Cosme de Arana (Project Team Leader).

A.2 Agenda of the training on “Testing and Commissioning”- Webinar 1

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Online Webinar - 1 Training Session on Testing and Commissioning of Solar PV plants.

8 October 2020 (Thu): 3pm to 5pm

Tentative Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
1	Opening & Introduction	10 min	3:00 PM
2	Commissioning tests and inspections for photovoltaic (PV) systems under IEC 62446-1	60 min	3:10 PM
a.	Commissioning tests		
b.	Relevant standard IEC 62446-1		
c.	Understanding of the testing/commissioning required for solar PV plants		
d.	MM lessons learnt based on project experience – focus on SEA countries		
3	Plant performance test	30 min	4:10 PM
a.	Solar PV plant performance test and pre-test conditions, typically expected to be achieved prior to the test		
b.	Mott MacDonald lessons learnt and key considerations during the test		
c.	Relevant standard (IEC61724)		
3	Q&A	20 min	4:40 PM
	Close		5:00 PM

A.3 List of participants in the “Testing and Commissioning” workshop

No.	Name of Attendance	Organization
1	Rann Seihakkiry	EDC
2	CHIPHONG SARASY	MME
3	SEAB SOVANARIM	Distribution
4	SORN SOKNY	Generation
5	RET PONLEU	Distribution
6	PHAL Sereiratha	EAC
7	CHHUN Ratana	EAC
8	Darith LENG	Transmission
9	Eng Viyura	EAC
10	Chun Vutha	MME
11	Muon Vathana	Transmission
12	Chhunn Chhim	REF
13	Sok pal	IES
14	Vuth Kimhak	MME
15	Chan Samnang	Transmission
16	Ms. Oeng Lysornng	Planning
17	Ms. Thong Sokleng	Planning
18	Lim Kimhav	Planning
19	Mao Bona	Planning
20	Tong Menghour	Planning
21	Sen Visal	Planning
22	Nhet Ra	Planning
23	Ms. NY KAKNIKA	IES
24	Ms. PHAI SOKY	IES
25	Ms. VOEUN SREYNEAN	IES
26	Ms. KHENG DALIN	IES
27	Ms. MANG SARATH	IES
28	Ms. YIM SREYRATH	IES
29	Ms. CHHAI LINA	IES

A.4 Agenda of the training on “Model PPA” – Webinar 2

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Online Webinar - 2 Training Session on Model PPAs.

Tentative (TBC) 11 January 2020 (Thu): 3pm to 5.20pm

Tentative Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
1.	Opening & Introduction	10 min	3pm
2.	Overview Of A Typical PPA	5 min	
3.	Buyer and Seller Obligations	5 min	
4.	Commercial Provisions	40 min	3.20pm
a.	Term and programme		
b.	The Independent Engineer		
c.	The sale of energy		
d.	Performance and product guarantees		
e.	Performance securities		
f.	Delay liquidated damages		
g.	Production guarantees and performance liquidated damages		
h.	Force majeure and termination		
i.	Decommissioning works and bond		
j.	Deemed energy		
k.	MM lessons learnt and key considerations based on project experience – focus on SEA countries		
5.	Technical Provisions	40 min	4pm
a.	Design considerations		
b.	Facility requirements		
c.	Technology features and requirements		
d.	Performance and product guarantees		
e.	Quality assurance		
f.	SCADA / Metering		
g.	Testing/commissioning requirements		
h.	Curtailement		
i.	Operation and maintenance		
j.	MM lessons learnt and key considerations based on project experience – focus on SEA countries		
6.	Comparison of Findings	20 min	4.40pm
7.	Q&A	20 min	5pm
	Close		5.20pm

A.5 List of participants in the “Model PPA” workshop

No.	Name of Attendance	Position
1	CHIPHONG SARASY	MME
2	Sok pal	IES
3	SEAB SOVANARIM	Distribution
4	SORN SOKNY	Generation
5	RET PONLEU	Distribution
6	PHAL Sereiratha	EAC
7	CHHUN Ratana	EAC
8	Darith LENG	Transmission
9	Eng Viyura	EAC
10	Chun Vutha	MME
11	Muon Vathana	Transmission
12	Chhunn Chhim	REF
13	Vuth Kimhak	MME
14	Chan Samnang	Transmission
15	Ms. Oeng Lysorng	Planning
16	Mao Bona	Planning
17	Ms. Chea Dane	Planning
18	Lim Kimhav	Planning
19	Ms. Sea Naichy	Generation
20	Ms. Kheng Malika	Generation

21	Ms. Cheath Sreylin	Generation
22	Ms. Cheang Sophaktra	EAC
23	Ms. San Vannith	EAC
24	Ms. Kheng Dalin	IES
25	Ms. Seng Sovat	IES
26	Ms. Long Linda	IES
27	Ms. Voeun Sreynang	IES
28	Ms. Phai Soky	IES
29	Ms. Beth Chansomaly	IES
30	Ms. Chhoy Ouksa	IES

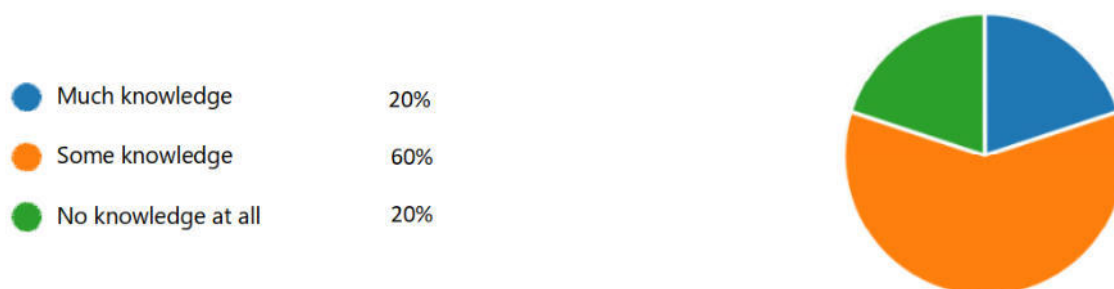
A.6 Evaluation Survey from the training on “Testing and commissioning” Webinar 1

An evaluation survey was circulated among the 29 participants of the training on “Testing and commissioning” delivered on 8 October 2020. Prior to completing the survey, participants were asked for consent to use and process the information provided. A large number of participants declined to provide the data, which reduces the sample to 5 participants from which the data has been extrapolated.

1. Did you find the information delivered in the webinar useful?



2. Did you have previous knowledge on the topics presented?



3. How much do you consider the workshop helped you to improve your knowledge in the topics presented?

Much improvement	20%
Some improvement	80%
No improvement	0%



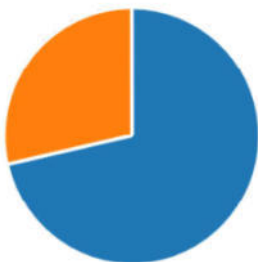
4. How do you evaluate the quality of the presentations?

Good	40%
Average	60%
Below expectations	0%



5. Which topic among the sessions was of most interest?

Commissioning tests and insp...	100%
Plant performance tests	40%



6. Would you be interested in additional webinars on topics related to Solar PV, Battery Energy Storage Systems and/or Energy Regulatory Frameworks



7. Do you have any comments or suggestions for future Capacity Building workshops under this project?

ID ↑	Name	Responses
2	anonymous	I would like to know more about Battery Storage system. Especially, how to design capacity of battery storage.

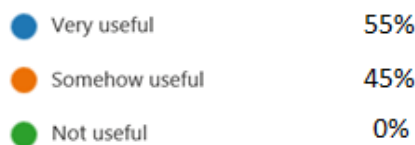
Figure A.1: Results from satisfaction survey of webinar-1

A.7 Evaluation Survey from the training on “Model PPA” – Webinar 2

An evaluation survey was circulated among the 29 participants of the training on “Testing and commissioning” delivered on 25 January 2021. Prior to completing the survey, participants were asked for consent to use and process the information provided. A large number of participants declined to provide the data, which reduces the sample to 11 participants from which the data has been extrapolated.

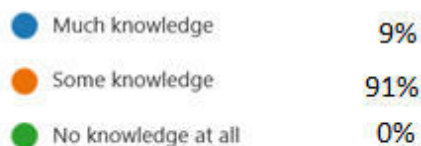
1. Did you find the information delivered in the webinar useful?

[More Details](#)



2. Did you have previous knowledge on the topics presented?

[More Details](#)



3. How much do you consider the workshop helped you to improve your knowledge in the topics presented?

[More Details](#)



4. How do you evaluate the quality of the presentations?

[More Details](#)

Good	45%
Average	55%
Below expectations	0%



5. Which topic among the sessions was of most interest?

[More Details](#)

PPA Commercial provisions	50%
PPA Technical provisions	50%



6. Would you be interested in additional webinars on topics related to Solar PV, Battery Energy Storage Systems and/or Energy Regulatory Frameworks

[More Details](#)

Yes	100%
Maybe	0%
No	0%



7. Do you have any comments or suggestions for future Capacity Building workshops under this project?

4 Responses

ID ↑	Name	Responses
1	anonymous	please add some questions or homework for the trainees.
2	anonymous	It is a vital project but when the meeting via online, it is a little bit difficult to listen to and understand your presentation.
3	anonymous	The workshop should be more times and details.
4	anonymous	Provide additional explanation and benefit of the items that other PPA is different from EDC PPA

Figure A.2: Results from satisfaction survey of webinar-2

A.8 Solar PV and Grid Integration Workshop Agenda

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Online Webinar

Training Session on Solar PV and Grid Integration

24 – 25 May 2021 (Mo-Tu): 2pm to 6.00pm

Agenda

Day 1 (24 May 2021)

S/N	Agenda Item	Duration	Start Time (Cambodia)
1.	Opening & Introduction	10 min	2pm
2.	Solar PV Applications	10 min	2.10pm
	Grid-connected solar PV systems		
	Off-grid solar PV systems		
3.	Solar resource and site assessment	1 h 40 min	2.20pm
	Solar resource		
	Sun path and solar resource variation		
	Solar resource assessment		
	Energy yield assessment - PR and losses overview		
	Site suitability, natural hazards, and risks assessment		
	Break	10 min	4.00pm
4.	Technology	60 min	4.10pm
	PV module		
	Inverter		
	Power transformer		
	Mounting structure		
5.	Solar PV design	20 min	5.10pm
	Q&A	30 min	5.30pm
	Close		6.00pm

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Online Webinar

Training Session on Solar PV and Grid Integration

24 – 25 May 2021 (Mo-Tu): 2pm to 6.00pm

Agenda

Day 2 (25 May 2021)

S/N	Agenda Item	Duration	Start Time (Cambodia)
1.	Opening	5 min	2pm
2.	Grid Integration	1 h 55 min	2.05pm
	Solar PV systems and impact on grid reliability		
	Technology to support solar impact on grid reliability		
	Grid codes		
	Grid management techniques		
	Break	10 min	4.00pm
3.	Safety of Solar Installation and Operation	40 min	4.10pm
	Safety codes and standards for solar installations		
	Safety guidelines for solar operation		
4.	Commissioning and Operation	30 min	4.50pm
	Commissioning according to IEC62446-1 67		
	Performance acceptance test		
	Determination of operating performance		
5.	Economic aspects of a PV plant	10 min	5.20pm
6.	Modelling using PVsyst – introductory demonstration	20 min	5.10 pm
	Possible follow up topics	10 min	5.30 pm
	Q&A	20 min	5.40 pm
	Close		6.00pm

A.9 BESS Workshop Agenda

Online Webinar Training Session on BESS

12 – 13 July 2021 (Mo-Tu): 2pm to 6pm

Agenda

Day 1 (12 July 2021)

S/N	Agenda Item	Duration	Start Time (Cambodia)
	Opening and introduction	10 min	2pm
1	Overview of Energy Storage	10 min	2.10pm
	<i>Energy storage categories</i>		
	<i>History of battery energy storage</i>		
2	Battery basics and technologies	45 min	2.20pm
	<i>The basics</i>		
	<i>Battery technologies</i>		
	<i>Types of Li-ion batteries</i>		
	Guest speaker: BESS case study	1h 00min	3.05pm
	Break	10 min	4.05pm
3	Introduction of Battery Energy Storage System (BESS)	1 h 30 min	4.15pm
	<i>Overview of BESS components</i>		
	<i>Battery package: cell-module-rack</i>		
	<i>Power Conversion System (PCS)</i>		
	<i>Battery Management System (BMS)</i>		
	<i>Battery auxiliary systems</i>		
	Q&A	15 min	5.45pm
	Close		6pm

Online Webinar Training Session on BESS

12 – 13 July 2021 (Mo-Tu): 2pm to 6pm

Agenda

Day 2 (13 July 2021)

S/N	Agenda Item	Duration	Start Time (Cambodia)
	Opening and introduction	10 min	2pm
1	BESS applications	1hr 30 min	2.05pm
	<i>Overview of BESS applications</i>		
	<i>Renewable energy integration</i>		
	<i>Time shifting of energy</i>		
	<i>Ramp rate control</i>		
	<i>Ancillary services</i>		
	<i>Stacking of BESS application</i>		
	Break	10 min	3.50pm
2	BESS Design	1h 45 min	3.45pm
	<i>Key design considerations</i>		
	<i>BESS sizing and siting</i>		
	<i>Modelling Software Demo</i>		
	Q&A	30 min	5.30pm
	Close		6pm

A.10 Attendance list Solar PV workshop

No.	Name of Attendance	Position
1	CHIPHONG SARASY	MME
2	Sok pal	IES
3	SEAB SOVANARIM	Distribution
4	SORN SOKNY	Generation
5	Ms. Lorn Thyna	Distribution
6	PHAL Sereiratha	EAC
7	CHHUN Ratana	EAC
8	Darith LENG	Transmission
9	Eng Viyura	EAC
10	Chun Vutha	MME
11	Muon Vathana	Transmission
12	Chhunn Chhim	REF
13	Vuth Kimhak	MME
14	Chan Samnang	Transmission
15	Ms. Oeng Lysorn	Planning
16	Mao Bona	Planning
17	Ms. Chea Dane	Planning
18	Ms. Sea Naichy	Generation
19	Ms. Kheng Malika	Generation
20	Ms. Cheath Sreylin	Generation
21	Ms. Cheang Sophaktra	EAC
22	Ms. San Vannith	EAC
23	Seng Hort	Planning
24	Lek sereyratana	Distribution (Svay Reang)
25	Sokhon Punleu	Distribution (Svay Reang)

26	Ms. Khun Chanthy	Distribution (Svay Reang)
27	Ms. Ren Sothearoth	Distribution (Kompong Cham)
28	Boo Monorum	Distribution (Kompong Cham)
29	Ms. Heng Kimseang	Distribution (Kompong Cham)
30	Thun Sophara	Distribution (Siem Reap)
31	Peng Sokcheang	Distribution (Siem Reap)
32	Ms. Sot Somphos	Distribution (Siem Reap)
33	Mel Saman	Distribution (Kompong Speu)
34	Pheak Soksoursdey	Distribution (Kompong Speu)
35	Ms. Long Chanthakhantey	Distribution (Kompong Speu)
36	Om Chanvantha	Distribution (Prey Veng)
37	Va Sela	Distribution (Prey Veng)
38	Ms. Khan theanrady	Distribution (Prey Veng)
39	Long Syravuth	Distribution (Battambang)
40	Chhay Vannak	Distribution (Battambang)
41	Ms. Lang Nary	Distribution (Battambang)
42	Chhun sarin	Distribution (Kratie)
43	Loeng Sokhach	Distribution (Kratie)
44	Sreang Srin	Distribution (Steung Treng)
45	Ms. Chan Sreysros	Distribution (Steung Treng)
46	Ty Chanthy	Distribution (Steung Treng)
47	Nov Botnan	Distribution (Rattanakiry)
48	Lun Tola	Distribution (Rattanakiry)
49	Morn Samorn	Distribution (Tboung Khmum)

50	Ung Kheang	Distribution (Tboung Khmum)
51	Theng setha	Distribution (Mondolkiry)
52	Pak Pov	Distribution (Mondolkiry)
53	Pen Sa Im	Distribution (Kompot)
54	Orng ratchana	Distribution (Kompot)
55	Rum Theavuth	Distribution (Sihanouville)
56	Choem Sopheanith	Distribution (Sihanouville)
57	Ms. Naem Khemnary	Distribution (Sihanouville)
58	Taing Soveat	Distribution (Banteaymeanchey)
59	Soeun Pheakdey	Distribution (Banteaymeanchey)
60	Ms. Yean Samei	Distribution (Banteaymeanchey)
61	Chheng Sony	Distribution (Takeo)
62	Khout Kimsat	Distribution (Takeo)
63	Ms. Chhoy Ouksa	IES
64	Ms. Kheng Dalin	IES
65	Ms. Long Linda	IES
66	Ms. Voeun Sreynang	IES
67	Ms. Chhoy Ouksa	IES
68	Ms. Soam Sophon	IES
69	Ms. Chhin Sokheng	IES

A.11 Attendance list BESS workshop

No.	Name of Attendance	Position
1	CHIPHONG SARASY	MME
2	Sok pal	IES
3	SEAB SOVANARIM	Distribution
4	SORN SOKNY	Generation
5	Ms. Lorn Thyna	Distribution
6	PHAL Sereiratha	EAC
7	CHHUN Ratana	EAC
8	Darith LENG	Transmission
9	Eng Viyura	EAC
10	Chun Vutha	MME
11	Muon Vathana	Transmission
12	Chhunn Chhim	REF
13	Vuth Kimhak	MME
14	Chan Samnang	Transmission
15	Ms. Oeng Lysorn	Planning
16	Mao Bona	Planning
17	Ms. Chea Dane	Planning
18	Ms. Sea Naichy	Generation
19	Ms. Kheng Malika	Generation
20	Ms. Cheath Sreylin	Generation
21	Ms. Cheang Sophaktra	EAC
22	Ms. San Vannith	EAC
23	Seng Hort	Planning
24	Lek sereyratana	Distribution (Svay Reang)
25	Sokhon Punleu	Distribution (Svay Reang)

26	Ms. Khun Chanthy	Distribution (Svay Reang)
27	Ms. Ren Sothearoth	Distribution (Kompong Cham)
28	Boo Monorum	Distribution (Kompong Cham)
29	Ms. Heng Kimseang	Distribution (Kompong Cham)
30	Thun Sophara	Distribution (Siem Reap)
31	Peng Sokcheang	Distribution (Siem Reap)
32	Ms. Sot Somphos	Distribution (Siem Reap)
33	Mel Saman	Distribution (Kompong Speu)
34	Pheak Soksoursdey	Distribution (Kompong Speu)
35	Ms. Long Chanthakhantey	Distribution (Kompong Speu)
36	Om Chanvantha	Distribution (Prey Veng)
37	Va Sela	Distribution (Prey Veng)
38	Ms. Khan theanrady	Distribution (Prey Veng)
39	Long Syravuth	Distribution (Battambang)
40	Chhay Vannak	Distribution (Battambang)
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42	Chhun sarin	Distribution (Kratie)
43	Loeng Sokhach	Distribution (Kratie)
44	Sreang Srin	Distribution (Steung Treng)
45	Ms. Chan Sreysros	Distribution (Steung Treng)
46	Ty Chanthy	Distribution (Steung Treng)
47	Nov Botnan	Distribution (Rattanakiry)
48	Lun Tola	Distribution (Rattanakiry)
49	Morn Samorn	Distribution (Tboung Khmum)

50	Ung Kheang	Distribution (Tboung Khmum)
51	Theng setha	Distribution (Mondolkiry)
52	Pak Pov	Distribution (Mondolkiry)
53	Pen Sa Im	Distribution (Kompot)
54	Orng ratchana	Distribution (Kompot)
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56	Choem Sopheanith	Distribution (Sihanouville)
57	Ms. Naem Khemnary	Distribution (Sihanouville)
58	Taing Soveat	Distribution (Banteaymeanchey)
59	Soeun Pheakdey	Distribution (Banteaymeanchey)
60	Ms. Yean Samei	Distribution (Banteaymeanchey)
61	Chheng Sony	Distribution (Takeo)
62	Khout Kimsat	Distribution (Takeo)
63	Ms. Chhoy Ouksa	IES
64	Ms. Kheng Dalin	IES
65	Ms. Long Linda	IES
66	Ms. Voeun Sreyneang	IES
67	Ms. Koun Kimhorn	IES
68	Ms. Seng Kimlang	IES
69	Ms. Chhin Sokheng	IES
70	Ms. San Tola	IES
71	Ms. Sek Pisey	IES
72	Ms. Phyrum Linnaeliza	IES
73	Ms. Neak Ya	IES
74	Ms. Yim Toeum	IES
75	Ms. Yon Kanika	Transmission
76	Ms. Eat Mary	Transmission
77	Ms. Rous Dary	Transmission

A.12 Consultation on topics to further elaborate

1 Poll	Please rate your interest in a further in-depth session on "smart inverter" from 1 to 4				RANK
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	0	2	10	13	3
Average time taken to answer	0.00	20.81	37.35	32.06	
2 Poll	Please rate your interest in a further in-depth session on "operation and maintenance of PV plants" from 1 to 4				
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	0	4	6	13	5
Average time taken to answer	0.00	16.31	14.79	17.38	
3 Poll	Please rate your interest in a further in-depth session on "economic aspects of a PV plant" from 1 to 4				
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	0	5	10	10	4
Average time taken to answer	0.00	17.33	14.75	14.66	
4 Poll	Please rate your interest in a further in-depth session on "solar plant design" from 1 to 4				
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	0	1	5	20	1
Average time taken to answer	0.00	10.31	13.87	8.22	
5 Poll	Please rate your interest in a further in-depth session on "modelling software (PVsyst)" from 1 to 4				
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	0	3	9	17	2
Average time taken to answer	0.00	22.61	11.44	7.46	

Figure A.3: Report produced by Kahoot! on the consultation about topics of interest – Solar PV and grid integration workshop

1 Poll	Please rate your interest in a further in-depth session on "economic aspects of a PV plant and BESS" from 1 to 4				RANK
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	0	2	9	12	2
Average time taken to answer (seconds)	0.00	11.98	36.20	26.36	
2 Poll	Please rate your interest in a further in-depth session on "modeling exercise with Homer Pro" from 1 to 4				
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	0	2	11	11	1
Average time taken to answer (seconds)	0.00	17.53	21.13	19.97	

Figure A.4: Report produced by Kahoot! on the consultation about topics of interest – BESS workshop

1 Poll	Please rate your interest for further session on "Assessing appropriate level of renewables in the Cambodia"				RANK
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	1	2	6	5	2
2 Poll	Please rate your interest for further session on "Safety regulations for Solar PV and BESS"				
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	1	2	4	8	1
3 Poll	Please rate your interest for further session on "Cyber security issues with decentralised generation"				
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	1	4	5	4	3
4 Poll	Please rate your interest for further session on "Assessment of labour capacity in Cambodia in renewable transition"				
Answer options	▲ 1 - not interested	◆ 2 - okay to know	● 3 - interested to know	■ 4 - very interested to know	
Number of answers received	4	5	2	2	4

Figure A.5: Report produced by Kahoot! on the consultation about topics of interest – Energy Regulatory

A.13 Satisfaction Survey

1 Poll	Did you find the information delivered in the webinar useful			AVERAGE RESULT
Answer options	▲ Very useful	◆ Somehow useful	● Not useful	
Number of answers received	14	9	1	Very useful
Average time taken to answer	15.79	12.32	22.48	
2 Poll	How would you rate your knowledge on the topics presented			
Answer options	▲ Good background knowledge	◆ Some background knowledge	● No background knowledge	
Number of answers received	9	13	1	Good background knowledge
Average time taken to answer	16.46	9.43	7.02	
3 Poll	How much do you consider the workshop helped you to improve			
Answer options	▲ Significant improvement	◆ Some improvement	● No improvement	
Number of answers received	12	11	0	Significant Improvement
Average time taken to answer	5.74	7.92	0.00	
4 Poll	How do you evaluate the quality of the presentations?			
Answer options	▲ Above expectations	◆ In line with expectations	● Below expectations	
Number of answers received	6	17	0	At or above expectatinos
Average time taken to answer	8.61	9.18	0.00	

Figure A.6: Report produced by Kahoot! on the satisfaction survey – Solar PV and grid integration workshop

1 Poll	Did you find the information delivered in the webinar useful			Result
Answer options	▲ Very useful	◆ Somehow useful	● Not useful	
Number of answers received	11	9	1	Very useful
Average time taken to answer (seconds)	15.77	10.84	9.09	
2 Poll	How would you rate your knowledge on the topics presented before the webinar			
Answer options	▲ Good background knowledge	◆ Some background knowledge	● No background knowledge	
Number of answers received	11	9	1	Good background knowledge
Average time taken to answer (seconds)	20.88	10.89	4.72	
3 Poll	How much do you consider the workshop helped you to improve your knowledge in			
Answer options	▲ Significant improvement	◆ Some improvement	● No improvement	
Number of answers received	10	10	1	Significant or some improvement
Average time taken to answer (seconds)	14.11	34.22	18.76	
4 Poll	How do you evaluate the quality of the presentations?			
Answer options	▲ Above expectation	◆ About the expectation	● Below expectation	
Number of answers received	4	14	3	At or above the expectation
Average time taken to answer (seconds)	4.71	10.34	7.22	

Figure A.7: Report produced by Kahoot! on the satisfaction survey – BESS workshop

A.14 Group photos



Figure A.8: Screenshot showing participants during the Solar PV workshop implementation

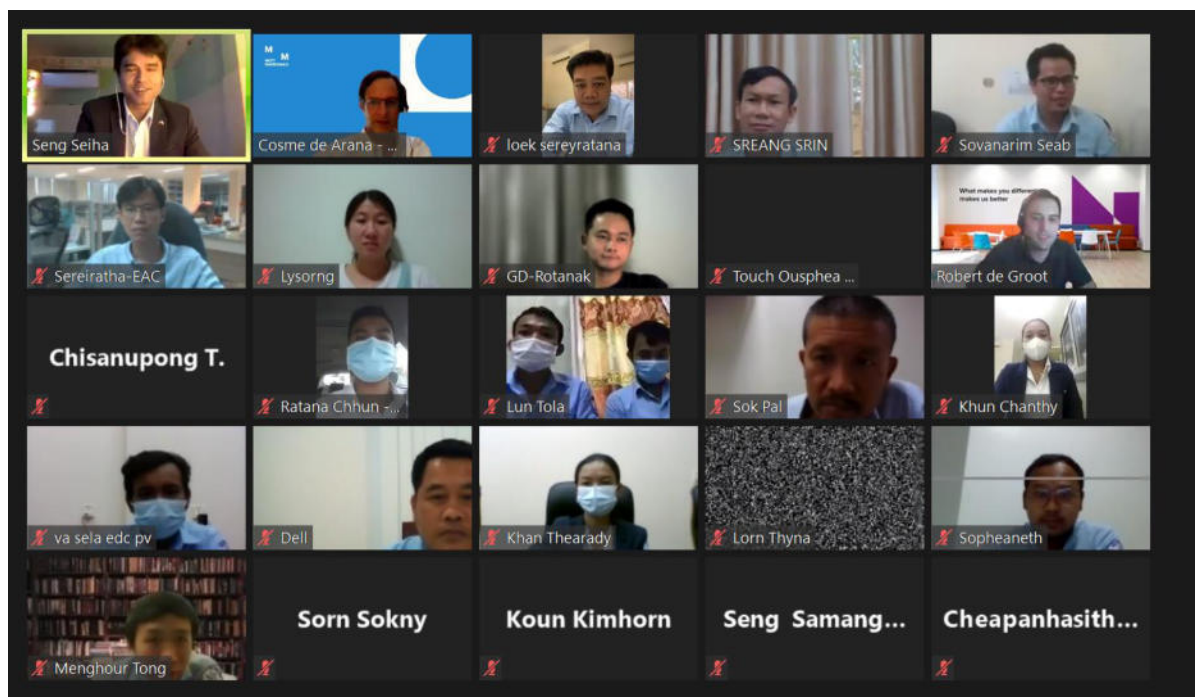


Figure A.9: Screenshot showing participants during the BESS workshop implementation – 1

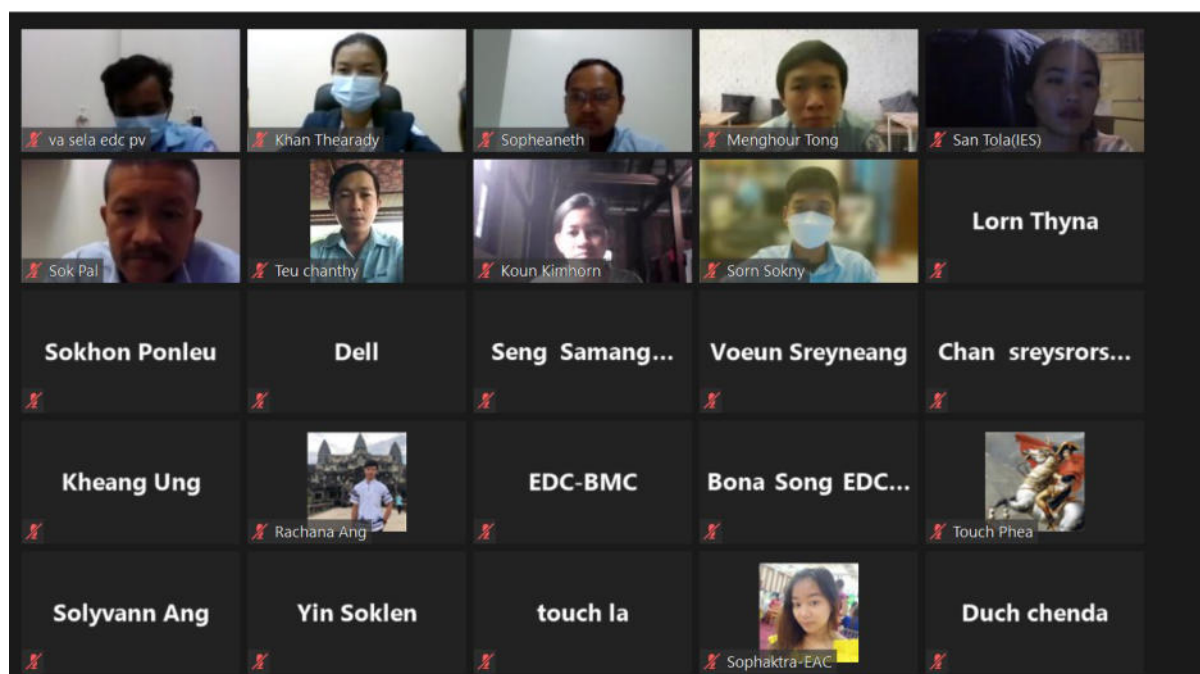


Figure A.10: Screenshot showing participants during the BESS workshop implementation – 2

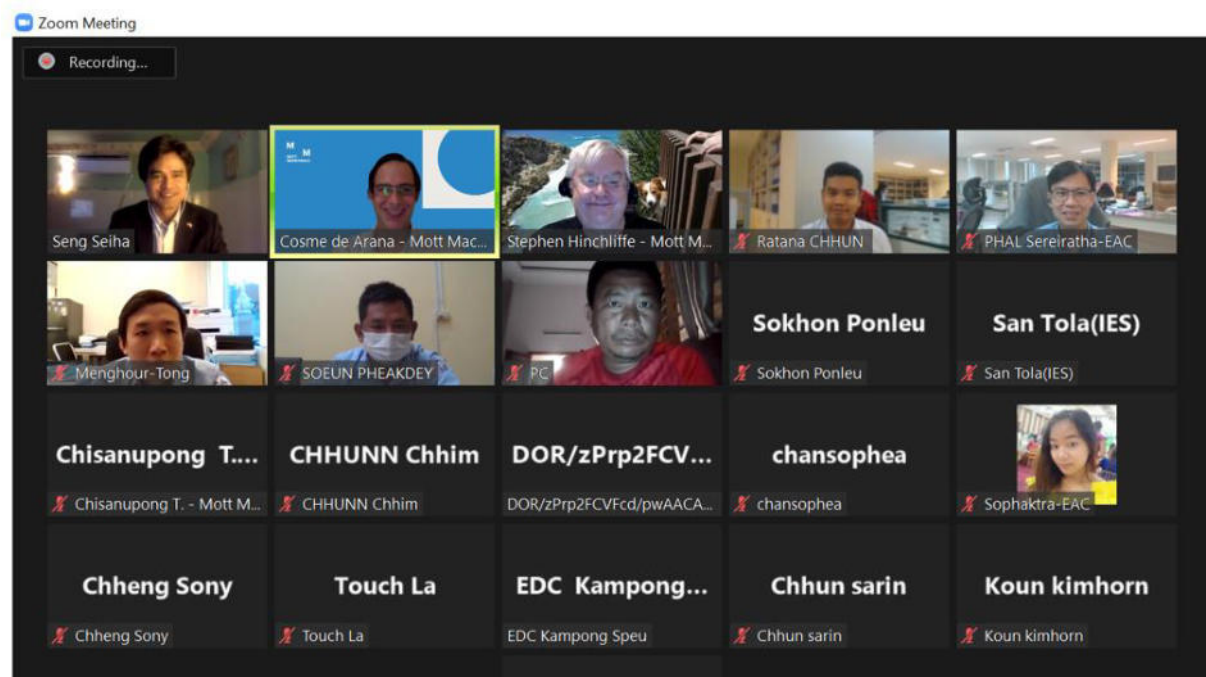


Figure A.11: Screenshot showing participants during the Energy Regulatory Workshop

A.15 Satisfaction Survey – Solar PV Design and PVSyst Webinars

1. Did you find the information delivered in the webinar useful?

[More Details](#)

[Insights](#)

Very useful	75%
Somehow useful	25%
Not useful	0%



2. Did you have previous knowledge on the topics presented?

[More Details](#)

[Insights](#)

Much knowledge	30%
Some knowledge	70%
No knowledge at all	0%



3. How much do you consider the workshop helped you to improve your knowledge in the topics presented?

[More Details](#)

[Insights](#)

Much improvement	80%
Some improvement	20%
No improvement	0%

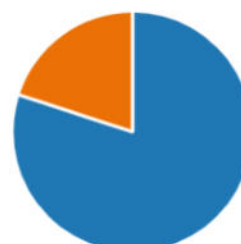


4. How do you evaluate the quality of the presentations?

[More Details](#)

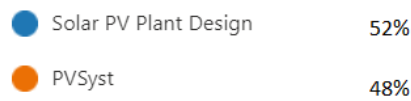
[Insights](#)

Good	80%
Average	20%
Below expectations	0%



5. Which session was of most interest?

[More Details](#)



6. Would you be interested in additional webinars on topics related to Solar PV

[More Details](#)

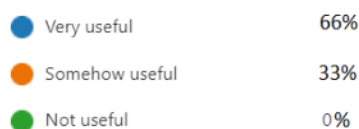


Figure A.12: Results from satisfaction survey of webinar on PV Design and PVSyst

A.16 Satisfaction Survey – Economic Aspects of BESS and HOMER Pro Webinars

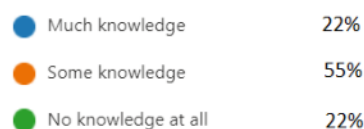
1. Did you find the information delivered in the webinar useful?

[More Details](#)



2. Did you have previous knowledge on the topics presented?

[More Details](#)



3. How much do you consider the workshop helped you to improve your knowledge in the topics presented?

[More Details](#)



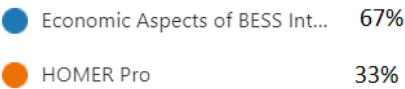
4. How do you evaluate the quality of the presentations?

[More Details](#)



5. Which session was of most interest?

[More Details](#)



6. Would you be interested in additional webinars on topics related to BESS

[More Details](#)



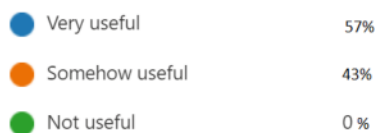
Figure A.13: Results from satisfaction survey of webinar on Economics of BESS and HOMER Pro

A.17 Satisfaction Survey - Energy Regulatory Workshop

1. Did you find the information delivered in the webinar useful?

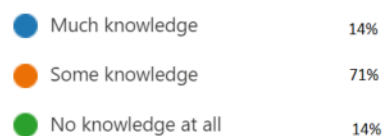
[More Details](#)

 Insights



2. Did you have previous knowledge on the topics presented?

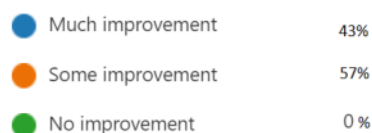
[More Details](#)



3. How much do you consider the workshop helped you to improve your knowledge in the topic presented?

[More Details](#)

 Insights



4. How do you evaluate the quality of the presentations?

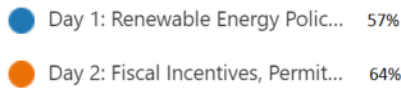
[More Details](#)

 Insights



5. Which session was of most interest?

[More Details](#)



6. Would you be interested in additional webinars on topics related to Energy Regulation

[More Details](#)

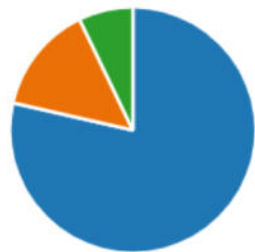


Figure A.14: Results from satisfaction survey of Regulatory Workshop

A.18 Agenda of the training on Solar PV Design – Webinar 3

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Webinar - 3 Training Session on Solar PV Design

13 September 2021 (Mon): 2pm to 5pm

Tentative Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
1	Opening & Introduction	10 min	2:00 PM
2	Design of a PV plant layout, key considerations for PV configuration design, and plant design for bifacial and tracker systems	50 min	2:10 PM
a.	Design of DC and AC capacity		
b.	Key considerations of plant layout and configuration design		
c.	Plant design for bifacial modules and tracker systems		
	Break	10 min	3:00 PM
3	Design of Balance of Plant (BoP)	90 min	3:10 PM
a.	DC generation system		
b.	AC collection system		
c.	Grid interconnection scheme		
4	Q&A	20 min	4:40 PM
	Close		5:00 PM

A.19 Agenda of the training on PVSyst – Webinar 4

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Webinar - 4 Introduction to PVSyst

14 September 2021 (Tue): 3pm to 5pm

Tentative Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
1	Opening & Introduction	10 min	3:00 PM
2	Energy Yield Assessment (EYA) concepts	30 min	3:10 PM
a.	Concept of EYA, solar resource assessment, performance ratio, and losses		
b.	Preparation for EYA and PVSyst simulation		
3	Introduction to PVSyst	70 min	3:40 PM
a.	Basic functions of PVSyst and example of simulation of a solar PV plant		
b.	Discussion on PVSyst report		
4	Q&A	10 min	4:50 PM
	Close		5:00 PM

A.20 Agenda of the training on Economic Aspects of BESS – Webinar 5

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Webinar - 5 Economic aspects of BESS integration

27 September 2021 (Mon): 3pm to 5pm

Tentative Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
1	Opening & Introduction	10 min	3:00 PM
2	Revenue streams for Energy Storage	45 min	3:10 PM
a.	Co-located energy storage applications		
b.	Stand-alone energy storage applications		
3	Techno-economics of a BESS project	45 min	3:55 PM
a.	Technical inputs to financial models		
b.	Cost benchmarks for BESS		
4	Q&A	20 min	4:40 PM
	Close		5:00 PM

A.21 Agenda of the training on BESS Simulation with HOMER – Webinar 6

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Webinar - 6 BESS simulation with HOMER

28 September 2021 (Tue): 3pm to 5pm

Tentative Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
1	Opening & Introduction	10 min	3:00 PM
2	Introduction to HOMER Pro (presentation)	30 min	3:10 PM
a.	Capabilities and limitations of Homer Pro simulation software		
b.	Preparation for Homer Pro simulation		
3	Homer Pro demonstration	60 min	3:40 PM
a.	Homer Pro demo 1: Grid-connected solar + BESS		
b.	Homer Pro demo 2: Off-grid electrification		
4	Q&A	20 min	4:40 PM
	Close		5:00 PM

A.22 Agenda of the Workshop on Energy Regulation

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Online Webinar

Training Session on Energy Regulatory

2 – 3 December 2021 (Th-Fr): 2pm to 5pm

Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
	Opening and introduction	10 min	2pm
1	Renewable Energy Policy - I	1hr 20 min	2.10pm
	<i>Renewable Purchase Obligations</i>		
	<i>Renewable Energy Certificates</i>		
	<i>Gross Metering</i>		
	<i>Net Metering</i>		
	Break	10 min	3.30pm
2	Renewable Energy Policy - II	1hr 20 min	3.40pm
	<i>Capacity limits and generation cap of rooftop solar systems</i>		
	<i>Commercial settlement and metering standards for rooftop solar systems</i>		
	<i>Solar-Plus-Storage</i>		
	<i>Battery Systems</i>		
	<i>Renewable Energy Auctions</i>		
	Close		5pm

Day 1 (2 December 2021)

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Online Webinar

Training Session on Energy Regulatory

2 – 3 December 2021 (Th-Fr): 2pm to 5pm

Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
	Opening and introduction	10 min	2pm
1	Fiscal Incentives	1hr 20 min	2.10pm
	<i>Feed in Tariffs</i>		
	<i>Tax Exemptions and Allowance</i>		
	Break	10 min	3.30pm
	Final session and discussion	1hr 20 min	3.40pm
2	Permitting and Licencing Arrangements		
3	Grid Access Arrangements		
4	Discussion on options for Cambodia		
	Close		5pm

Day 2 (3 December 2021)

A.23 List of Attendance to Webinars on Solar PV Design and PVsyst

LIST OF ATTENDANCE

Venue : Video conference

Date :.....13th - 14th September 2021

.....Time:.....

Subject :.....PVsyst and PV Design.....

No.	Name of Attendance	Position
1	Sok pal	IES
2	SEAB SOVANARIM	Distribution
3	SORN SOKNY	Generation
4	Ms. Lorn Thyna	Distribution
5	PHAL Sereiratha	EAC
6	CHHUN Ratana	EAC
7	Darith LENG	Transmission
8	Eng Viyura	EAC
9	Chun Vutha	MME
10	Muon Vathana	Transmission
11	Chhunn Chhim	REF
12	Vuth Kimhak	MME
13	Chan Samnang	Transmission
14	Ms. Oeng Lysorn	Planning
15	Ms. Sea Naichy	Generation
16	Ms. Cheath Sreylin	Generation
17	Ms. Cheang Sophaktra	EAC

18	Ms. San Vannith	EAC
19	Tong Menghour	Planning
20	Ms. Chhoy Ouksa	IES
21	Ms. Kheng Dalin	IES
22	Ms. Long Linda	IES
23	Ms. Voeun Sreyneang	IES
24	Ms. Koun Kimhorn	IES
25	Ms. Seng Kimlang	IES
26	Ms. Chhin Sokheng	IES
27	Ms. San Tola	IES
28	Ms. Sek Pisey	IES
29	Ms. Phyrum Linnaeliza	IES
30	Ms. Neak Ya	IES
31	Ms. Yim Toeum	IES
32	Ms. Yon Kanika	Transmission
33	Ms. Eat Mary	Transmission
34	Ms. Rous Dary	Transmission
35	Roath Kulika	EAC
36	Sok Natha	Transmission
37	Touch La	Planning
38	Nou Ratanak	Generation
39	Ny Sochinly	Transmission
40	Soeun Sophanit	Planning
41	Kean Panha	Planning
42	Din Daro	Planning

A.24 List of Attendance to Webinars on Economic Aspects of BESS and HOMER Pro

LIST OF ATTENDANCE

Venue : Video conference

Date :.....27th - 28th September 2021Time:.....3:00-5:00pm.....

Subject :.....BESS.....

No.	Name of Attendance	Position
1	Sok pal	IES
2	SEAB SOVANARIM	Distribution
3	SORN SOKNY	Generation
4	Ms. Lorn Thyna	Distribution
5	PHAL Sereiratha	EAC
6	CHHUN Ratana	EAC
7	Darith LENG	Transmission
8	Eng Viyura	EAC
9	Chun Vutha	MME
10	Muon Vathana	Transmission
11	Chhunn Chhim	REF
12	Vuth Kimhak	MME
13	Chan Samnang	Transmission
14	Ms. Oeng Lysorn	Planning
15	Ms. Sea Naichy	Generation
16	Ms. Cheath Sreylin	Generation
17	Ms. Cheang Sophaktra	EAC

18	Ms. San Vannith	EAC
19	Tong Menghour	Planning
20	Ms. Chhoy Ouksa	IES
21	Ms. Kheng Dalin	IES
22	Ms. Long Linda	IES
23	Ms. Voeun Sreyneang	IES
24	Ms. Koun Kimhorn	IES
25	Ms. Seng Kimlang	IES
26	Ms. Chhin Sokheng	IES
27	Ms. San Tola	IES
28	Ms. Sek Pisey	IES
29	Ms. Phyrum Linnaeliza	IES
30	Ms. Neak Ya	IES
31	Ms. Yim Toeum	IES
32	Ms. Yon Kanika	Transmission
33	Ms. Eat Mary	Transmission
34	Ms. Rous Dary	Transmission
35	Roath Kulika	EAC
36	Sok Natha	Transmission
37	Touch La	Planning

A.25 List of Attendance to the Energy Regulatory Workshop

**The Evaluation Survey was also circulated among these participants*

LIST OF ATTENDANCE

Venue : Video conference

Date :.....2 - 3 December 2021

.....Time:.....

Subject :.....Energy Regulation

No.	Name of Attendance	Position
1	Sok pal	IES
2	SEAB SOVANARIM	Distribution
3	SORN SOKNY	Generation
4	Ms. Lorn Thyna	Distribution
5	PHAL Sereiratha	EAC
6	CHHUN Ratana	EAC
7	Darith LENG	Transmission
8	Eng Viyura	EAC
9	Chun Vutha	MME
10	Muon Vathana	Transmission
11	Chhunn Chhim	REF
12	Vuth Kimhak	MME
13	Chan Samnang	Transmission
14	Ms. Oeng Lysornng	Planning
15	Ms. Sea Naichy	Generation
16	Ms. Cheath Sreylin	Generation
17	Ms. Cheang Sophaktra	EAC

18	Ms. San Vannith	EAC
19	Tong Menghour	Planning
20	Ms. Chhoy Ouksa	IES
21	Ms. Kheng Dalin	IES
22	Ms. Long Linda	IES
23	Ms. Voeun Sreyneang	IES
24	Ms. Koun Kimhorn	IES
25	Ms. Seng Kimlang	IES
26	Ms. Chhin Sokheng	IES
27	Ms. San Tola	IES
28	Ms. Sek Pisey	IES
29	Ms. Phyrum Linnaeliza	IES
30	Ms. Neak Ya	IES
31	Ms. Yim Toeum	IES
32	Ms. Yon Kanika	Transmission
33	Ms. Eat Mary	Transmission
34	Ms. Rous Dary	Transmission
35	Roath Kulika	EAC
36	Sok Natha	Transmission
37	Touch La	Planning
38	Nou Ratanak	Generation
39	Ny Sochinly	Transmission
40	Soeun Sophanit	Planning
41	Kean Panha	Planning
42	Din Daro	Planning

A.26 Agenda of the webinar on O&M of PV Plants

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Webinar Operation and maintenance of solar PV plants

11 May 2022 (We): 2.30pm to 5.30pm

Tentative Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
1	Opening & Introduction	5 mins	2:30 PM
2	Operation and maintenance of solar PV plants		
a.	Operation of solar PV plants	25 mins	2:35 PM
b.	Maintenance of solar PV plants	40 mins	3:00 PM
c.	Safety in solar PV plants	10 mins	3:40 PM
d.	Plant performance during operation	60 mins	3:50 PM
e.	Financial performance	20 mins	4:50 PM
3	Q&A	20 mins	5:10 PM
	Close		5:30 PM

A.27 List of participants to the O&M of PV Plants webinar

LIST OF ATTENDANCE

Venue : Video conference

Date :.....11th May 2022Time:.....2:00-5:30pm

Subject O&M of PV plants – Workshop

No.	Name of Attendee	Position
1	Sok pal	IES
2	SEAB SOVANARIM	Distribution
3	SORN SOKNY	Generation
4	Ms. Lorn Thyna	Distribution
5	Roath Kulika	EAC
6	Eng Viyura	EAC
7	Chun Vutha	MME
8	Ny Sochinly	Transmission
9	Chhunn Chhim	REF
10	Tong Menghour	Planning
11	Ms. Oeng Lysorng	Planning
12	Degeorgel Dul	Distribution
13	Nou Ratanak	Generation
14	Touch La	Planning
15	Sokhon Punleu	Distribution (Svay Reang)
16	Ms. Khun Chanthy	Distribution (Svay Reang)
17	Nara	Distribution (Kompong Speu)

18	Pheak Soksoursdey	Distribution (Kompong Speu)
19	Va Sela	Distribution (Prey Veng)
20	Ms. Khan theanrady	Distribution (Prey Veng)
21	Chhun sarin	Distribution (Kratie)
22	Duch Chenda	Distribution (Kratie)
23	Sreang Srin	Distribution (Steung Trenng)
24	Lun Tola	Distribution (Rattanakiry)
25	Ung Kheang	Distribution (Tboung Khmum)
26	Rum Theavuth	Distribution (Sihanouville)
27	Choem Sopheanith	Distribution (Sihanouville)
28	Taing Soveat	Distribution (Banteaymeanchey)
29	Ms. Yim Toeum	IES
30	Ms. Kheng Dalin	IES
31	Ms. Long Linda	IES
32	Ms. Voeun Sreynang	IES
33	Ms. Chhoy Ouksa	IES
34	Ms. Soam Sophon	IES
35	Ms. Chhin Sokheng	IES
36	Ms. Chhom Thorneng	IES
37	Ms. Sem Sophorn	IES
38	Ms. Phoeun Mengly	IES
39	Ms. Nham Putheara	IES
40	Ms. Phan San	IES
41	Ms. Sek Pisey	IES

42	Ms. San Tola	IES
43	Pel Cheappanhasith	
44	Keo Chetra	
45	Heng Saskasda	
46	Huy Vichet	
47	Kuch savareth	
48	Li parinha	
49	Muy Thoeurn	
50	Nop Kunvathana	
51	Nuth Sataea	
52	Prang Rathea	
53	Ms. Rachana Ang	
54	Ms. Yon Kanika	

A.28 Agenda of the webinar on Advanced BESS topics

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Webinar BESS Design and Operation

27 June 2022 (Mo): 2pm to 5pm

Tentative Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
1	Opening & Introduction	5 mins	2:00 PM
2	BESS costs and related financial modelling inputs	45 mins	2:05PM
3	BESS design and specifications	50 mins	2:50 PM
4	BESS O&M aspects	50 mins	3:40 PM
5	Q&A	30 mins	4:30
	Close		5:00 PM

A.29 List of participates to the webinar on advanced BESS topics

LIST OF ATTENDANCE

Venue : Video conference

Date :.....27th June 2022Time:.....2:00-5:00pm.....

Subject :.....BESS.....

No.	Name of Attendance	Position
1	Sok pal	IES
2	SEAB SOVANARIM	Distribution
3	SORN SOKNY	Generation
4	Ms. Lorn Thyna	Distribution
5	Roath Kulika	EAC
6	Eng Viyura	EAC
7	Chun Vutha	MME
8	Phal Sereiratha	EAC
9	Chhunn Chhim	REF
10	Tong Menghour	Planning
11	Ms. Oeng Lysorn	Planning
12	Degeorgel Dul	Distribution
13	Nou Ratanak	Generation
14	Touch La	Planning
15	Sokhon Punleu	Distribution (Svay Reang)
16	Ms. Khun Chanthy	Distribution (Svay Reang)
17	Sok Natha	Transmission

18	Pheak Soksoursdey	Distribution (Kompong Speu)
19	Va Sela	Distribution (Prey Veng)
20	Ms. Khan theanrady	Distribution (Prey Veng)
21	Chhun sarin	Distribution (Kratie)
22	Duch Chenda	Distribution (Kratie)
23	Ms. Chan Sreysros	Distribution (Steung Treng)
24	Lun Tola	Distribution (Rattanakiry)
25	Ung Kheang	Distribution (Tboung Khmum)
26	Rom Theavuth	Distribution (Sihanouville)
27	Ms. Long Chanthakhantey	Distribution (Kompong Speu)
28	Mel Saman	Distribution (Kompong Speu)
29	Ms. Yim Toeum	IES
30	Ms. Naem Khemnary	Distribution (Sihanouville)
31	Boo Monorum	Distribution (Kompong Cham)
32	Morn Samorn	Distribution (Tboung Khmum)
33	Ms. Chhoy Ouksa	IES
34	Ms. Soam Sophon	IES
35	Ms. Chhin Sokheng	IES
36	Ms. Chhom Thorneng	IES
37	Ms. Sem Sophorn	IES
38	Ms. Phoeun Mengly	IES
39	Ms. Nham Putheara	IES
40	Ms. Eat Mary	Transmission
41	Ms. Sek Pisey	IES
42	Ms. San Tola	IES
43	Pel Cheappanhasith	
44	Um Chan Vantha	
45	Soeun Pheakdey	

46	Sophara	
47	Chhay Lyheang	Planning
48	Ly parinha	
49	Ms. Rous Dary	Transmission
50	Aun Sopanhavath	
51	Chhay Vannak	Distribution (Battambang)
52	Mao Bona	Planning
53	Ms. Rachana Ang	
54	Ms. Yon Kanika	
55	Serakyuth	
56	Rathena	
57	Noch Yin	
58	Oudam	

A.30 Agendas of the training session series on PVsyst and HOMER Pro software

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Webinar Advanced PVsyst - Intensive workshop #1

7 April 2022 (Thu): 3pm to 5pm

Tentative Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
1	Opening & Introduction	10 min	3:00 PM
2	Get ready for PVsyst	30 min	3:10 PM
a.	Required computer specification		
b.	Download software and purchase license		
c.	PVsyst Installation – PVsyst Directory		
3	PVsyst functions	50 min	3:40 PM
a.	Basic functions of PVsyst and example of simulation of a solar PV plant		
b.	Discussion on PVsyst report		
4	Q&A	30 min	4:30 PM
	Close		5:00 PM

ADB - TA-9736 CAM: “National Solar Park Project – Capacity Development in the Electric Utility Industry”

Webinar Advanced Homer Pro - Intensive workshop

25 April 2022 (Mon): 3pm to 5pm

Tentative Agenda

S/N	Agenda Item	Duration	Start Time (Cambodia)
1	Opening & Introduction	10 min	3:00 PM
2	Get ready for Homer Pro	20 min	3:10 PM
a.	Required computer specification		
b.	Download software and purchase license		
c.	Homer Pro Installation and License Activation		
3	Homer Pro functions	70 min	3:30 PM
a.	Overview of functions of Homer Pro and example of simulation and optimization of a hybrid power plant		
b.	Homework assignment: build your own simulation model		
4	Q&A	20 min	4:40 PM
	Close		5:00 PM

A.31 List of participants to the training session series on PVSyst and HOMER Pro software

LIST OF ATTENDANCE

Venue : Online

Date :07 April 2022.....Time:.....3:00-5:00 pm.....

Subject :Advanced PVsyste.....

No.	Name of Attendance	Position
1	CHIPHONG SARASY	MME
2	SEAB SOVANARIM	Distribution
3	<u>Dul Degeoge</u>	Distribution
4	SORN SOKNY	Generation
5	Eng Viyura	EAC
6	Ms. <u>Cheang Sophaktra</u>	EAC
7	Sok pal	IES
8	Vuth Kimhak	MME
9	Ms. Oeng Lysorng	Planning

A.32 Progress Evaluation Results

An overview of the answers provided by the respondents of the questionnaire is given in below:

The knowledge that the respondents require in their daily work is given in Figure A.20 From this overview it can be seen that the respondents consider knowledge of a broad range of topics as necessary for their daily work activities. The most common activity is on Solar PV contracts, which was selected by 70% of the participants.

Knowledge of which topics do you require in your daily work?

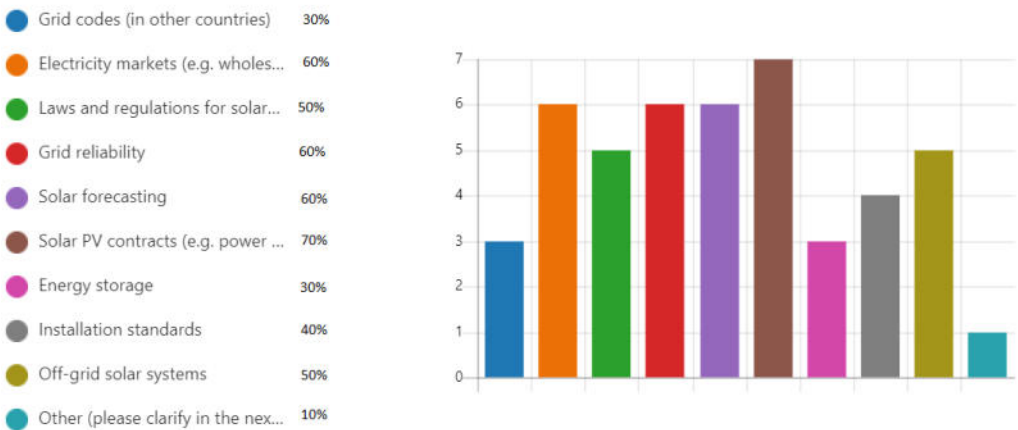


Figure A.15: Questionnaire – Job responsibilities of respondents

Figure A.16 shows the perceived knowledge improvement in various topics related with Solar PV. It can be seen that the majority consider they have acquired significant knowledge on these topics at professional level, and mainly able to apply this to their work.

Please rate your level of improved knowledge of each topic below:

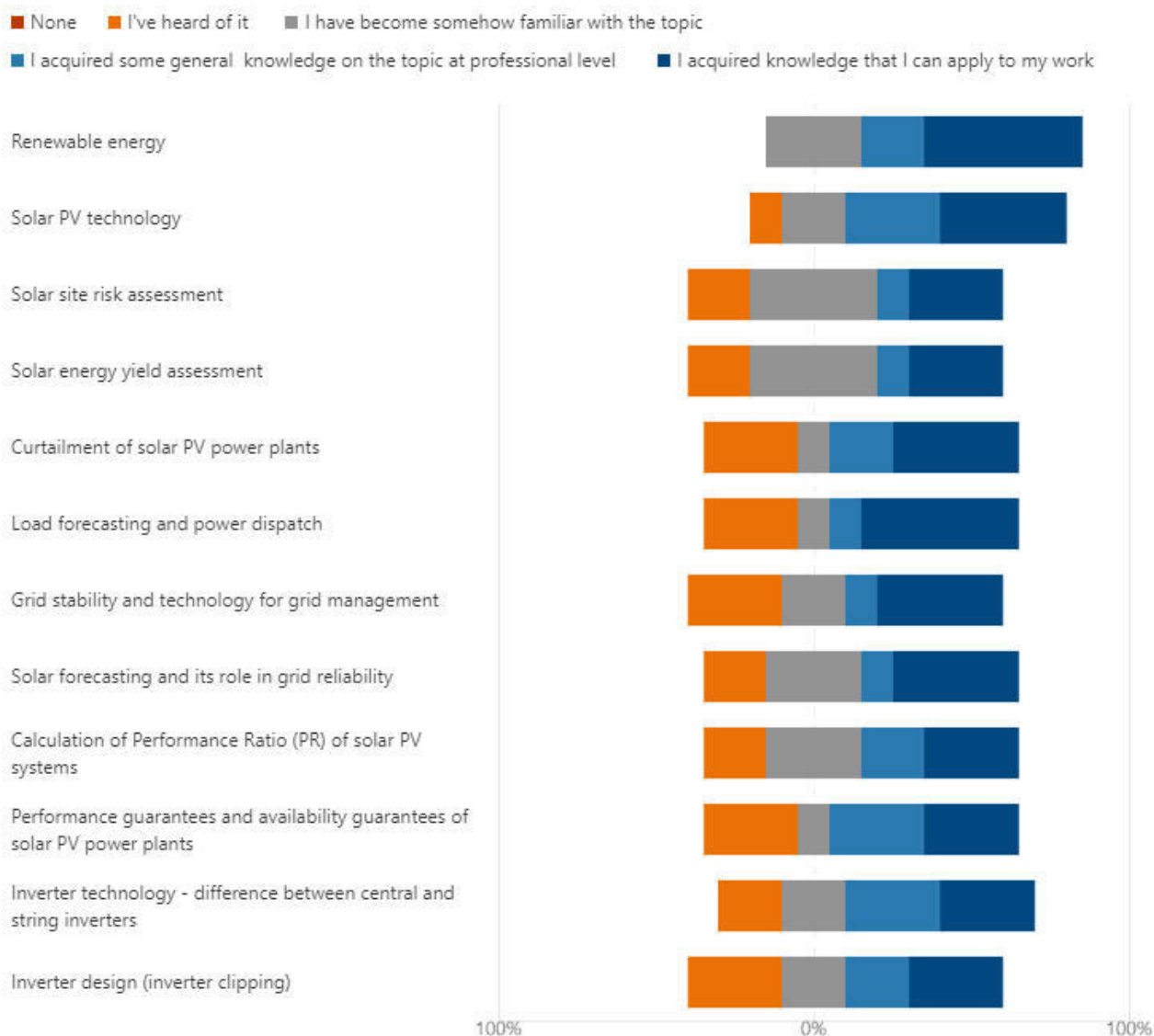


Figure A.16: Level of improved knowledge on Solar PV

Figure A.17 shows the perceived knowledge improvement in various topics related with BESS. The majority consider they have somehow acquired knowledge on these topics. Among these, approximately half of them consider what the learnt is enough to be applied to their work, while the other half just became familiar with these topics.

Please rate your level of improved knowledge of each topic below:

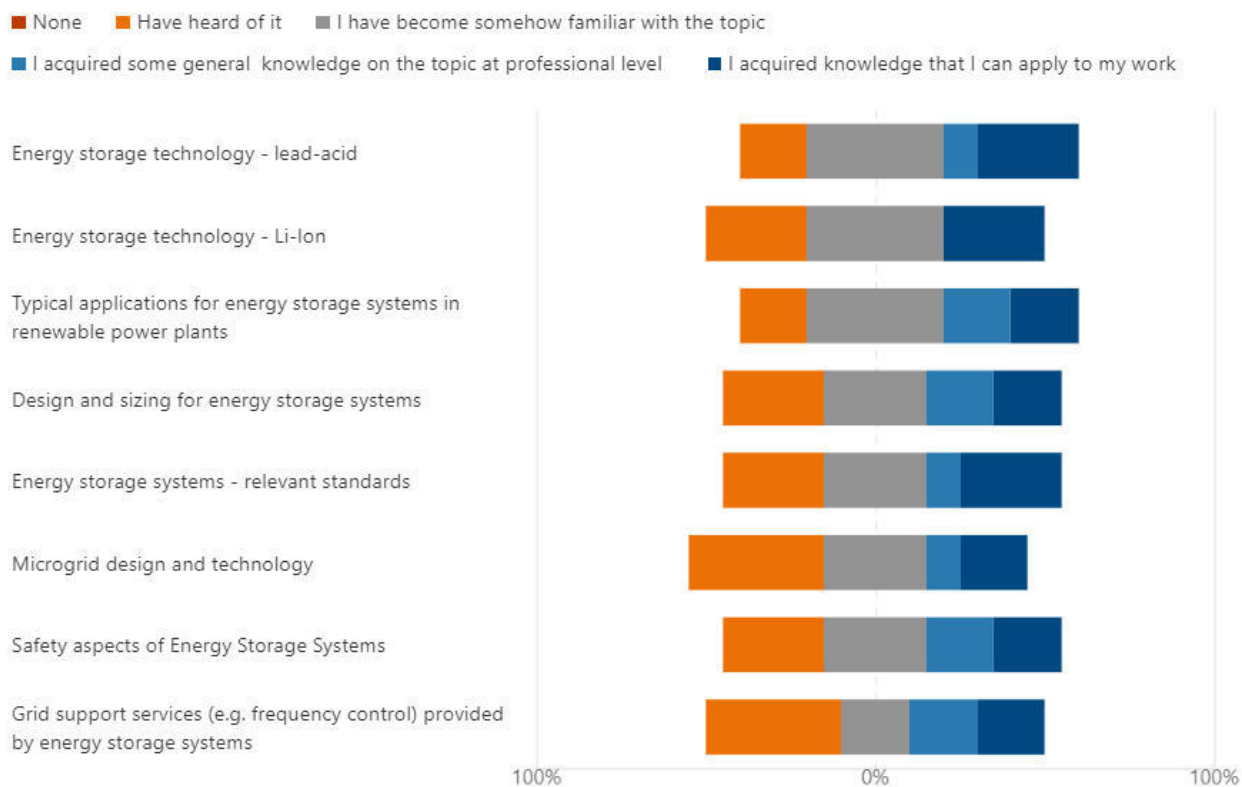


Figure A.17: Level of improved knowledge on BESS

Figure A.18 shows the perceived knowledge improvement in various topics related with Energy Regulation. The majority consider they have somehow acquired knowledge on these topics. Among these, approximately half of them consider what the learnt is enough to be applied to their work, while the other half just became familiar with these topics.

Please rate your level of improved knowledge of each topic below:

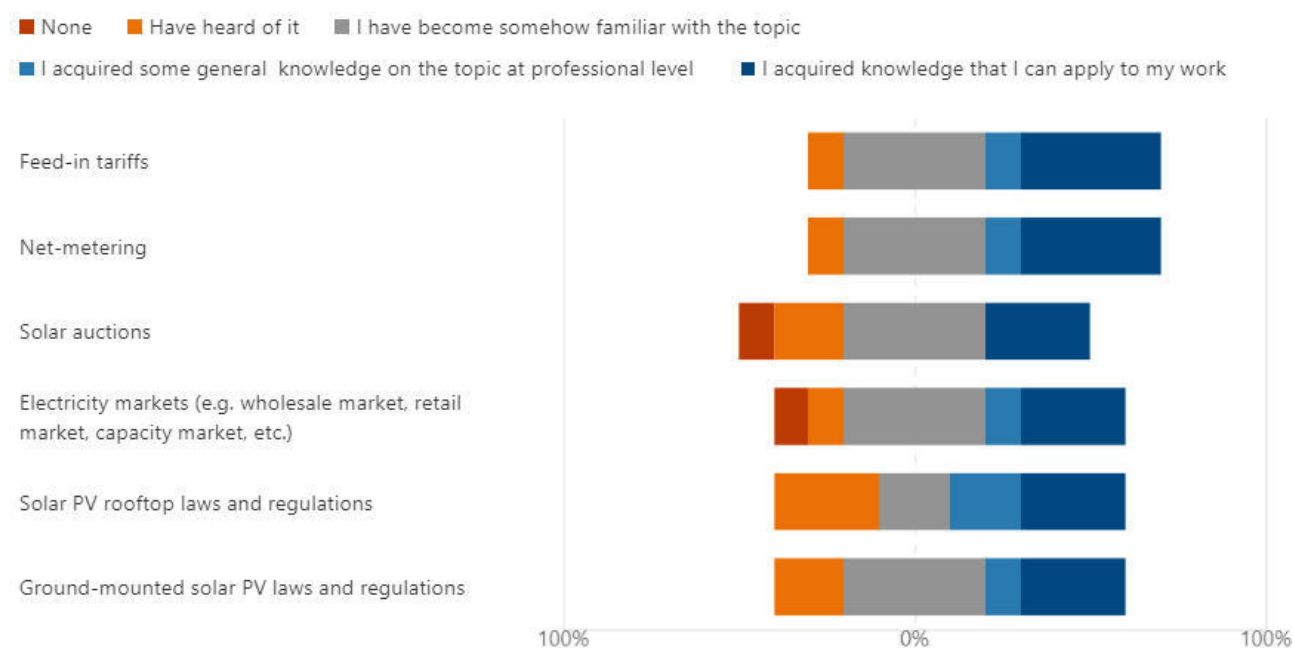


Figure A.18: Level of improved knowledge on Energy Regulation

A.33 Survey results on the webinars “O&M of PV plants”, and “Advanced BESS Topics”

1. Did you find the information delivered in the O&M OF PV PLANTS webinar useful?

[More Details](#)

[Insights](#)

Very useful	73%
Somehow useful	27%
Not useful	0%



2. Did you find the information delivered in the ADVANCED BESS TOPICS webinar useful?

[More Details](#)

[Insights](#)

Very useful	73%
Somehow useful	27%
Not useful	0%



3. Did you have previous knowledge on O&M OF PV PLANTS?

[More Details](#)

[Insights](#)

Much knowledge	0%
Some knowledge	82%
No knowledge at all	18%



4. Did you have previous knowledge on ADVANCED BESS TOPICS?

[More Details](#)

[Insights](#)

Much knowledge	9%
Some knowledge	73%
No knowledge at all	18%



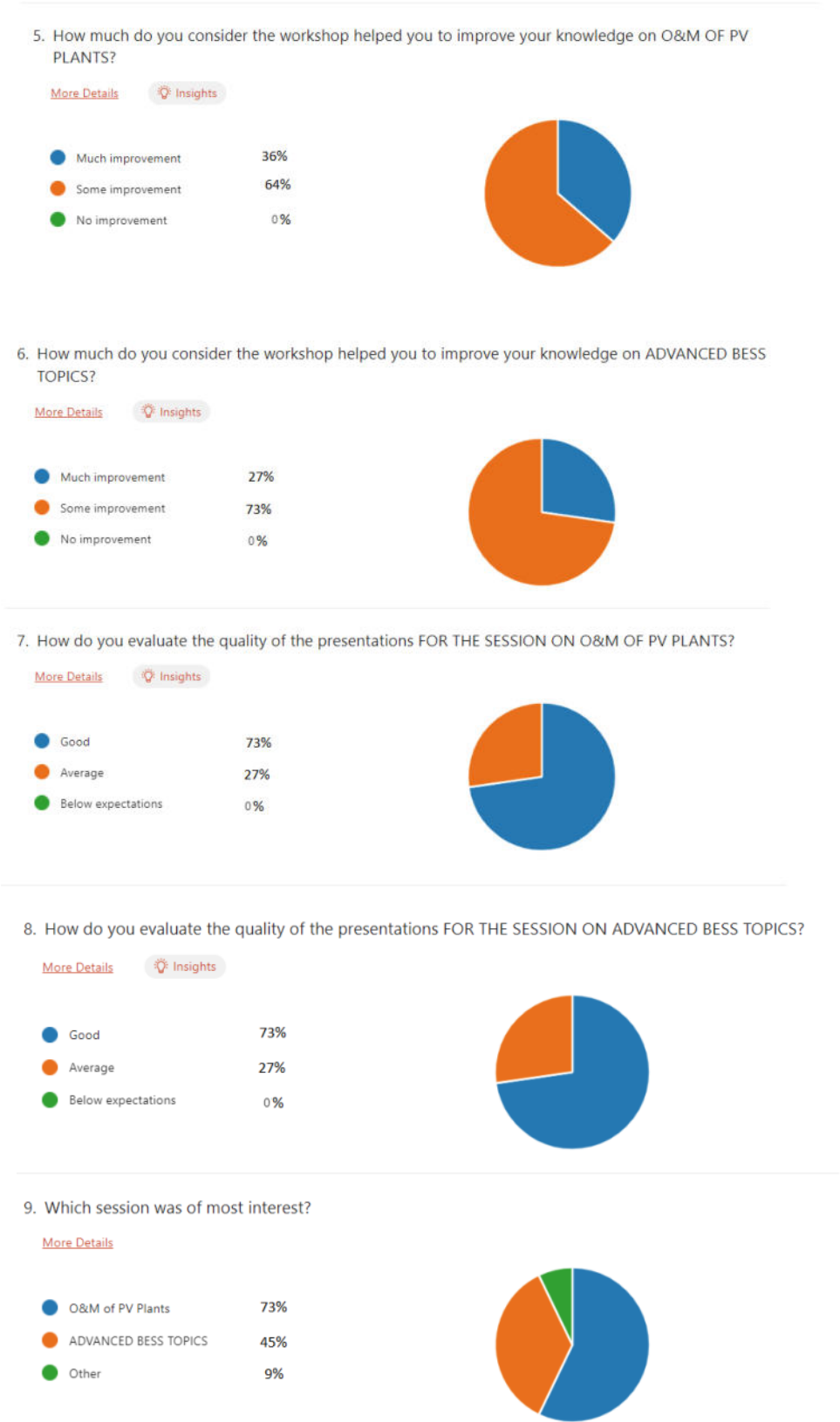
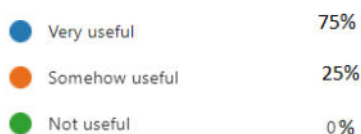


Figure A.19: Survey results on “O&M of PV Plants” and “Advanced BESS topics” trainings

A.34 Survey results on the training sessions of PVSyst and HOMER Pro software

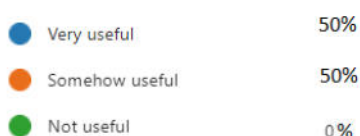
1. Did you find the information delivered in the on the PVSyst sessions useful?

[More Details](#)



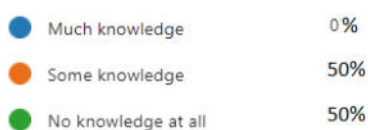
2. Did you find the information delivered in the on the HOMER PRO sessions useful?

[More Details](#)



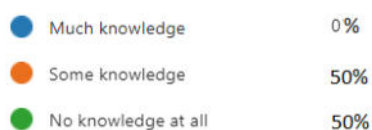
3. Did you have previous knowledge on the PVSyst software?

[More Details](#)



4. Did you have previous knowledge on HOMER PRO?

[More Details](#)



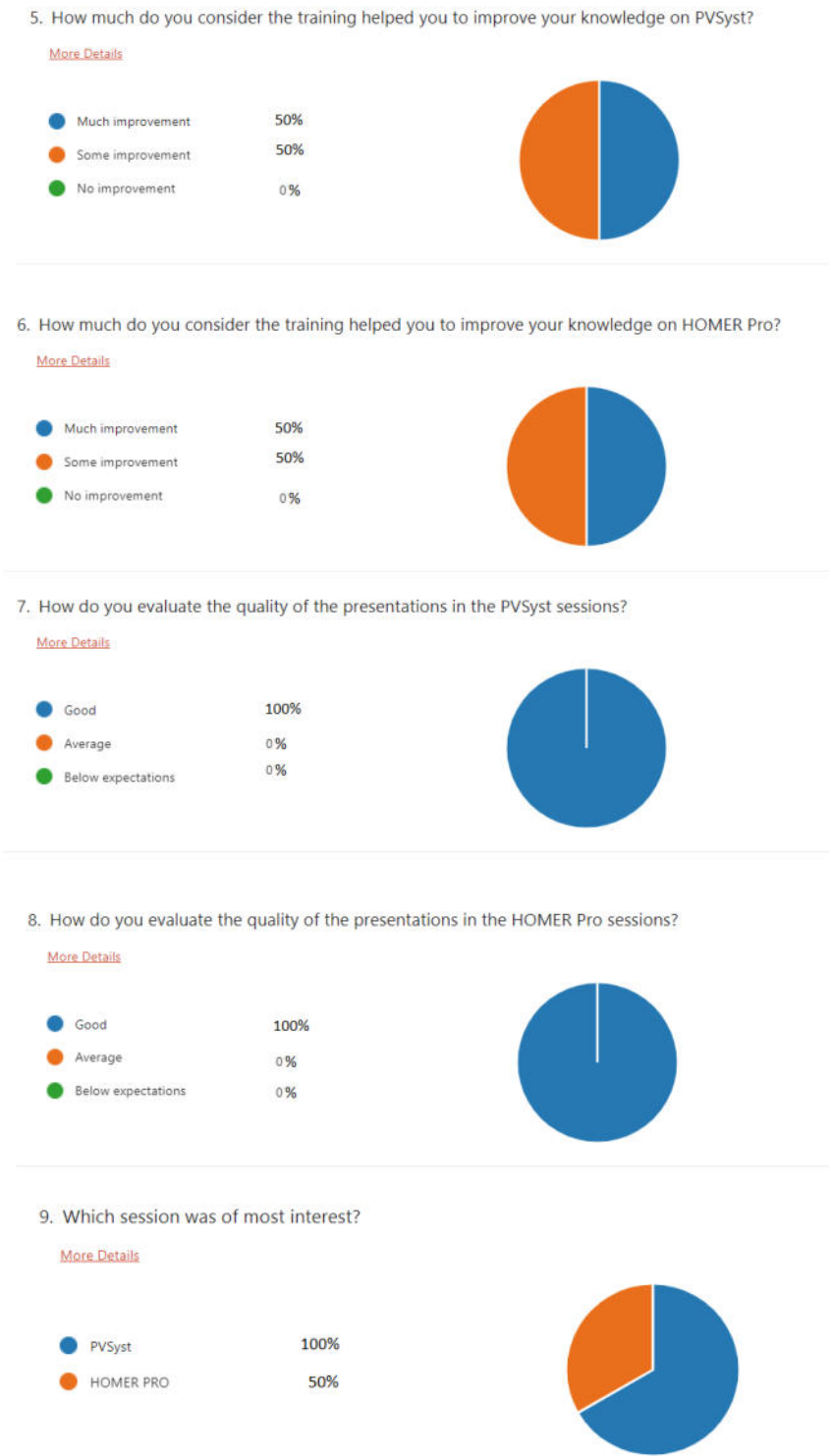


Figure A.20: Survey results on PVSyst and HOMER Pro trainings

A.35 Memoir E&S quarterly and semi-annual reports review

**Report inserted on Pages 106-110*

ADB CAM National Solar Park

Project:	National Solar Park Project Capacity Development in the Electricity Industry		
Our reference:	416587	Your reference:	TA-9736 CAM
Prepared by:	Sokphea Young, Ben Lim	Date:	30 June 2022
Approved by:	Cosme de Arana	Checked by:	Sokphea Young
Subject:	E&S quarterly and semi-annual reports review		

1 Introduction

- Electricité du Cambodge (EDC) has received an Asian Development Bank's (ADB) Loan (3789(COL)-CAM) to develop a National Solar Park (NSP), which consists of constructing a transmission line, a sub-station and a solar PV farm. EDC engaged external consultants, known as the project implementation consultant (PIC), to support its Social, Environment and Public Relations Office (SEPRO) to monitor social and environmental performance of the engineering, procurement and construction (EPC) contractor. The EPC contractor is responsible for implementing the environmental management plan (EMP) and construction environmental management plan (CEMP), whereas SEPRO is responsible for implementing the land acquisition and resettlement action plan (LARP) to meet the ADB's Safeguard Policy Statement (SPS) (2009). On a quarterly, semi-annually basis, PIC assisted SEPRO in writing the environmental and social construction monitoring reports and submitted them to ADB for review and approval. ADB has expressed concerns about the insufficient quality of the quarterly reports and semi-annual reports. ADB has engaged Mott MacDonald Ltd to support EDC's SEPRO to improve the quarterly reports and semi-annual reports.
 - The Republic of Korea e-Asia and Knowledge Partnership Fund (EAKPF) is supporting the National Solar Park implementation by providing funding for the capacity building component of the project. This fund was established in June 2006 by the Republic of Korea and aims to bridge the digital divide and promote improved access to information and creating and sharing of knowledge through information and communications technology (ICT) in the Asia and Pacific region. The fund aims to contribute to poverty reduction and the economic and social development of ADB's developing member countries (DMCs) through its two windows: the e-Asia program and the knowledge partnership program.
 - The objective of this memoir is to present Mott MacDonald's findings, comments, and recommendations on how to improve the quarterly reports and semi-annual reports for social and environmental monitoring of SEPRO and PIC.
 - This task is part of the wider capacity building programme delivered to EDC in solar power plant construction and operation, project design and supervision, grid integration, battery energy storage and energy regulatory issues.
 - This memoir is structured as below
 - Approach
 - Social
 - Environment
 - Conclusion
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2 Approach

- Mott MacDonald's comments and recommendations in this report are based on the review of documents/reports of EDC's SEPRO and PIC, and consultation meetings with SEPRO and PIC.
- Mott MacDonald's team of social and environmental consultants reviewed semi-annual report of social and environmental monitoring (January-June 2021; July-December 2021), and a latest quarterly report No. 08 (January-March 2022). The semi-annual reports contain track changes and comments from ADB and responses of PIC and SEPRO. Reviewing the tracked changes and correspondence between SEPRO/PIC and ADB allows Mott MacDonald team to understand how the comments were addressed and how the reports were revised and improved.
- Mott MacDonald team also organised consultation meetings with SEPRO/PIC to discuss the views and thoughts of SEPRO/PIC on improving and addressing ADB's comments on the reports.
 - 15 June 2022: with EDC's SEPRO and PIC's national consultants¹
 - 20 June with EDC's SEPRO representatives and PIC's national and international consultants² (national environment specialist and the team leader)
 - 30 June 2022: final presentation of the results of the view by Mott MacDonald Ltd to SEPRO and PIC³

3 Social

- Our team found that there are inconsistencies between quarterly and semi-annual reports pertaining to structure, data and information, and the ability to explain or justify issues or progress of the social monitoring. The content of the semi-annual social monitoring report seems to be drawn from the quarterly report. In the quarterly report, several points are not presented in the form of recording accumulative progress and outcomes of the monitoring to fulfil the data and information required to write semi-annual social monitoring report.
- Report structure:
 - The quarterly report structure does not provide qualitative data or explanatory text that explain the project's progress and achievements on social issues. Social challenges and issues encountered in each reporting period are not discussed.
 - In the quarterly report, there is repetitive information that is drawn from the project environmental and social plans, such as grievance redress steps, institutional arrangements, but there is limited information and insights on the progress, achievements, and outcomes of the project activities.
 - The quarterly report should be structured as follows: outline the planned social mitigation or management measure, describe what has been implemented, what was monitored, and what the gaps, issues, and challenges that arose during the reporting period. The quarterly report should highlight whether the mitigation is ultimately working or not and set out additional measures where further action is required to achieve compliance with ADB's standards.
 - The semi-annual report should reflect the issues that need to be monitored and standards that need to be complied with as well as what risks are to be avoided, minimised or mitigated by the EPC or by the EDC's SEPRO. It is understood that EDC's SEPRO is responsible for land acquisition and

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² Mr. Bin Sopheakda (Deputy of SEPRO); Ms. Oeng Lysorn (EDC); Mr. Sour Chheang Yu (National Environmental Safeguard Specialist), and Mr Kazuo Murai (PIC Team Leader).

³ Participants: Mr. Bin Sopheakda (Deputy of SEPRO); Ms. Oeng Lysorn (EDC); Sour Chheang Yu (PIC's National Environmental Safeguard Specialist); Mr. Sai Shigeru (PIC's International Resettlement Expert) and Mr Kazuo Murai (PIC Team Leader).

compensation. The progress of land acquisition and compensation was highlighted in the report, but there are gaps in terms of compliance with what is planned in the social management plan (as part of ESMP), LARP, and the actual activities that were carried out.

- ADB provided a report template for the semi-annual report to follow which was quite complex. The complexity might be arisen from the mismatched data and information between the two reports: quarterly reports and semi-annual reports. ADB did not provide a template for the quarterly report. PIC and SEPRO should adapt the same template for the quarterly report as for the semi-annual report to ease the process of data and information consistency between the two reports.
- Managing flow of information:
 - The management of the flow of information between EPC and PIC/SEPRO needs improvement as it helps the report writers explain the progresses, and issues and challenges that all these parties encountered. Based on the consultation meeting, it seems the reasons behind each activity of EPC were not well explained, for example, why the construction was delayed or the progress was slow, and why there were various issues. When the quarterly report/SAR report is drafted, PIC and SEPRO need to organise a meeting with the EPC contractor to understand the context surrounding the identified issues.
- Data presentation and interpretation, and justification and explanation:
 - As clarified by SEPRO, PIC is responsible for interpreting data provided by SEPRO. The data interpretation, as manifested by the quarterly reports and semi-annual reports, needs to be qualified by qualitative explanation. However, the quarterly report and SAR do not provide qualitative explanations to support the data presented.
 - The quarterly reports and semi-annual reports remain quite descriptive and does not provide insights into the progress, results or outcomes of the activities carried out. Quarterly report no. 8, for instance, highlighted that a “Capacity Building Needs Assessment” had been conducted but the report did not present what the results of the assessment (see third sub bullet points under Digesting and addressing comments).
- Digesting and addressing comments:
 - Based on the consultation meetings, PIC is responsible for writing and addressing comments from ADB. EDC’s SEPRO provided data on sections related to land acquisition and resettlement. While SEPRO did the final check of the report before issuing it to ADB, PIC, as a technical advisor of EDC, is responsible for the quality of the report given the resource and capacity limitation of EDC’s SEPRO.
 - Addressing ADB comments should be systematic. All comments on the quarterly report or SAR need to be converted to comment records/matrices in a spreadsheet that allows all parties to track which comments were addressed and how, which required editing the report, and to address any clarifications. A meeting with ADB’s specialists should be organised in order for PIC and SEPRO to hear and clarify comments which are difficult to address verbally.
 - During the meeting that Mott MacDonald attended, PIC and SEPRO appeared not to have the capacity to explain and interpret data and provide justification to respond to ADB comments. For example, ADB had asked about “gender and women’s participation” in the meeting, and PIC said that no women in the village could attend the meeting; most of them have day jobs in the garment factories. The PIC and SEPRO should have justified why there were no women participating in the meeting whilst understanding that a separate meeting at a time convenient to women should have been set up so that women’s views could also be heard and incorporated into the project. In another case, there was a need to provide justification pertaining to Covid-19 prevention measures (as required by ADB) even though most of the workers are fully vaccinated. The PIC and SEPRO should have understood the need to explain how additional Covid-19 prevention measures over and above vaccination, such as alcohol gel or gloves, were incorporated into the project’s practices.

4 Environment

- Report structure:
 - It is understood that the semi-environmental monitoring report is developed based on the monthly reports of the EPC and also PIC/SEPRO's quarterly reports. The consistency of information between EPC reports and PIC/SEPRO's quarterly report needs improvement. The quarterly reports appear not to provide sufficient information and data to develop the semi-annual report. The template and structures of both reports should be consistent, having some contents overlapping each other.
- Languages and terms:
 - The aim of monitoring reports is to present results of the monitoring undertaken, the results, comment on compliance or non-compliance, mitigation measures, improvement activities and KPIs. The monitoring reports should be fully aligned with what was initially assessed in the environmental and social impact studies and transposed in the CEMP and EMP.
 - For instance, the “contractors should continue the implementation of the environmental monitoring plan, perform self-monitoring, including the preparation of the CEMP”, should have been written as the “contractors should adhere to the ...”. This is an example to improve.
- Resource mobilisation and capacity:
 - It is understood that the EMP and EIA report need to be updated as required by ADB, but the update has not been done due to several reasons, one of which is the lack of information/data. The PIC needs experts to study and collect data to write and modify the report. The PIC should have highlighted and justified this limitation to ADB as early as possible. The ability to explain why some activities were not carried out needs assistance from more senior environmental experts, especially the management of the task required.
- Managing flow of information:
 - As per the comment above in the social section.
- Data presentation and interpretation, and justification and explanation:
 - In the semi-annual report it is not fully clear if the report covers the actual solar park besides the transmission line and substation. It mentions the solar park in the introduction only. Furthermore for completeness the report should include a brief project description:
 - List all the required permits and licenses for the construction of each of the (3) project components (i.e. environmental permits, building permits, waste generation licences, water abstraction licences, electrical connection permits etc and as applicable). This should specify name of licence/permit, issuing authority, validity and compliance requirements.
 - The report makes statements such as: ‘*There were no significant environmental impacts observed during the reporting period*’. This may raise questions as to what is meant by significant, if so it would be beneficial to qualify/define the magnitude of the impacts and risks.
 - The noise monitoring undertaken should include comparison with ADB standards that are more stringent than the national Cambodian standards for occupational health and safety. Recommendations of inclusion of ADB standards in the noise monitoring tables.
 - The section named ‘Recommendation’ appears to be actions identified to improve the management and monitoring on site. This section should contain details on who will be responsible to implement such action, timelines/by when and the Key Performance Indicator (KPI) (outcome pursued). Furthermore some actions/recommendations appear too generic such as: ‘Overall improvement of environmental performance needs to be monitored’, which will make its implementation difficult and evaluation of success difficult. Suggestion is to break it down into smaller and specific concrete actions that would be easily followed, implemented and assessed.
 - The SAR appears very descriptive on what should and will be done, reporting various tables with this information which are similar to the information presented in the EMPs, however the SAR should

present the actual results of the monitoring undertaken, levels of compliance and actions to be taken in case of non-compliance.

- Several types of information are missing such as:
 - Health and safety statistics
 - Waste management and disposal (details of waste types/streams, quantities generated and disposed of)
 - Resource usage (water, energy, fuel etc)
 - Wastewater/septic tanks clean up
 - Land contamination/environmental incidents and remedial actions undertaken
 - Details of all environmental, health and safety training provided.
- The semi-annual environmental monitoring report contains social information on consultation, perhaps this should be only included in the semi-annual social monitoring report.

5 Conclusions

- We recommend that training on report writing on social and environmental monitoring is provided to EDC's SEPRO and the PIC. We recommend that SEPRO, as the owner of the project, appoints a competent specialist (both social and environmental components) with English proficiency to attend the training, and experience in writing reports for lenders such as ADB.
- Structure and consistency are needed between the quarterly reports and semi-annual reports.
- We recommend to set up a quality assurance system for reports before they are submitted to ADB. This could be:
 - Data collected from SEPRO and from the field
 - Report is originated by the national consultants
 - Report is reviewed, edited and finalised by the PIC team leader
 - The report is then reviewed and checked by SEPRO. SEPRO may need to work with PIC to improve the report before submitting to ADB
 - Establish a system to address comments on the report
- When SEPRO receives comments from ADB:
 - SEPRO should work with PIC to digest the comments. All comments need to be converted to a comment record matrix
 - SEPRO and PIC may need to set up a meeting with ADB to clarify comments or to explain the comments verbally
 - PIC should address the comments both in the report and in the comment and response matrix
 - PIC will need to finalise the report
 - SEPRO will need to check the report and re-issue to ADB
- Language, style and contents:
 - SEPRO and PIC should follow ADB's Handbook of Style and Usage: 2017 Edition. The handbook provides guidance on how to write the report in simple and plain language accessible to non-expert readers⁴.
 - Overall there is the need to proofread the reports as various typographical errors have been identified in the reports.

⁴ See ADB's [Handbook of Style and Usage 2017 \(adb.org\)](http://adb.org)

