



Hydropower solutions for developing and emerging countries

## D6.5

# Final Report on five framework conditions workshops



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## 1 Introduction

HYPOSO is a multi-approach project to tackle several objectives: identification and mapping of the European hydropower industry, hydropower stakeholders in the HYPOSO target countries, education of new hydropower experts through capacity building activities and bringing together relevant actors from the EU hydropower sector with stakeholders in the target countries. Interaction with stakeholders is therefore an integral part of the activities, as workshops and interviews with national/local stakeholders are envisaged in all target countries which are outside the European Union, namely workshops in Bolivia, Colombia, and Ecuador in Latin America, and in Cameroon and Uganda in Africa. Additionally, capacity building courses will be carried out in Bolivia and Ecuador, and in Cameroon and Uganda.

## 2 Information about Deliverable

This deliverable provides information on five workshops on framework conditions for hydropower organised in the target countries in line with the description of Task 6.1. According to the schedule indicated in the task description, the workshops in African target countries should have been held by month 13 (September 2020 - Uganda) and 18 (February 2021 - Cameroon) and the workshops in three Latin American target countries by month 27 (November 2021). However, since the COVID-19 pandemic limited the possibilities of travelling as well as organising and participating in gatherings, and due to the postponement of the events which were to accompany some workshops (HYDRO AFRICA or the Annual Energy Week in Uganda and Small Hydro Latin America in Colombia), the project partners had to postpone the organisation of the workshops until pandemic restrictions were lifted or reduced. Moreover, in case of Uganda, the workshop postponed until December 2022 had to be postponed again due to emergence of Ebola virus in Uganda. In addition, the final dates of the workshops were dependent on the dates of other HYPOSO events, as the project partners sought to combine the organisation of the framework condition workshops with other HYPOSO project events (project meetings, visits to the selected pilot sites etc.) to optimise the opportunity for relevant HYPOSO experts to attend the workshops.

## 3 Objectives

WP6 is dedicated to bringing together European hydropower industry representatives with local stakeholders and the aim of this work package is to accelerate the market uptake of EU hydropower technologies in the target countries. One of the tools to achieve this objective is Task 6.1 - Workshops on the framework conditions for hydropower in the target countries. Within the duration of the HYPOSO project five workshops were planned to be organized, one in each target country. The aim of these workshops was to present and discuss the framework conditions for the development of small hydropower projects (SHP) in the target countries on the grounds of the analysis performed by HYPOSO experts in WP3 and described in the Report

on framework analysis and research needs in five target countries (D3.2) as well as based on the examples of case studies of small hydropower projects selected in WP5. The debate held during the workshops should result in formulating ideas of recommendations for decision makers in each target country on how to facilitate small hydropower projects development and create better framework conditions for hydropower investments in the target countries to enable the European know-how to foster the transition of energy systems in these countries into more sustainable ones.

Two workshops (in Uganda and Colombia) were planned to be accompanied by B2B matchmaking conferences, organized by WIP, in which interested representatives from the European hydropower sector should have the opportunity to make business and meet deciders from the target countries.

## 4 Workshop on the framework conditions for small hydropower in Cameroon

### 4.1 Overview

The Workshop on Small Hydropower Framework Conditions in Cameroon was held on 28 January 2022 in Yaoundé, the capital of Cameroon. It was organised by the project partners TRMEW (Poland) and SHW (Cameroon) under the auspices of the Ministry of Water Resources and Energy of Cameroon. The workshop, taking place in Yaoundé's recognisable Hilton Hotel, brought together 29 participants (for the detailed list of participants see chapter 4.4.2).



Figure 1: Participants of the Workshop on Small Hydropower Framework Conditions in Cameroon

Valerie Nkue, the representative of the Ministry of Water Resources and Energy opened the event and welcomed the guests, and after that Ewa Malicka (TRMEW) presented the general information on the HYPOSO project as well as on the objectives of the workshop. The latter ones were defined as:

- presentation and discussion on the framework conditions for the development of small hydropower projects in Cameroon based on the analysis performed by HYPOSO experts and examples of selected case studies of small hydropower projects,
- discussion about the actual situation and needs for hydropower in Cameroon,
- discussion about proposals of facilitating the conditions of small hydropower projects development,
- concluding and making draft proposals of recommendations.



Figure 2: Speakers and moderators of the Workshop on Small Hydropower Framework Conditions in Cameroon (from the left: J. Steller, B. Pelikan, V. Nkue, J. Kenfack, E. Malicka and N. Frosio)

Next, Joseph Kenfack (SHW) presented the main outcomes of the analysis of the framework conditions for hydropower in Cameroon made within the project together with a Lithuanian partner – VDU. He gave an overview on the electricity sector in Cameroon and described the actual situation of the hydropower sector, including small hydro. As issues to address for the development of small hydropower in Cameroon he listed:

- the need of better policies, regulations, and institutions,
- information, awareness, and technical capabilities, and
- lack of financial resources.

As main challenges to consider regarding developing small hydropower projects in Cameroon he pointed out favouring large hydropower schemes by the Government to export energy to neighbouring countries, shortcomings in establishing the renewable energy development framework, rules, and conditions, as well as the problem of ensuring good energy prices to attract private investments. Besides, he indicated the following facts as barriers:

- scarcity of hydrological information, climate, and other statistical data, especially for rural areas
- difficulties in establishing a private company in the hydropower sector
- low social acceptance of hydropower projects and harsh acceptance from some rural communities due to ancestral uses of water; and
- heavy bureaucracy for initiating a hydro project.

J. Kenfack flagged financing challenges faced by investors in small hydro in Cameroon. They included the following issues:

- Start-up companies in private sector meaning no money for equity,
- Local commercial banks available instead of investment/development banks,
- Very expensive XAF (Central African CFA Franc) mechanism (very high interest rate),
- Lack of guaranty from the governments or local banks,
- Risk of devaluation for XAF mechanism and not controlled locally,
- Money transfer issues,
- No support for funding project maturation process,
- No databank for projects to be developed, and
- Lack of accurate data on the potential, leading to poor visibility on financial models.

J. Kenfack concluded with stating that recommendations for Cameroon to facilitate national investment in small hydropower sector provided with a focus on selected pilot sites and implemented could enable the snowball effect fostering other investments.



Figure 3: Participants of the Workshop on Small Hydropower Framework Conditions in Cameroon

Subsequently, Nino Frosio (FN) presented the three selected pilot sites (Falaise, Fassong Wentcheng and Mougue), for which, within HYPOSO, prefeasibility studies will be elaborated and presented to the European hydropower industry. These sites had been visited by the project experts before the workshop. He concluded that the preliminary location of the main

hydraulic works, such as intakes, conveying works and powerhouses, had been chosen in a proper way by local partners and pointed out that the most critical items of projects development are related to the transport of construction materials and pipes along very steeped slopes, but he added that the European experience and know-how would be very useful in addressing this type of problems using suitable and effective technologies. He also stated that the site visits were milestones in providing reliable prefeasibility studies for pilot projects, therefore an important step had been done, despite the Covid-19 limitations. Besides, N. Frosio appreciated the effective collaboration with the proposers' technicians who allowed the HYPOSO project experts to carry the site visits out in an effective and comfortable way, despite difficult access to the sites. He also thanked the local authorities for their very kind support and active involvement for the projects' exploitation.

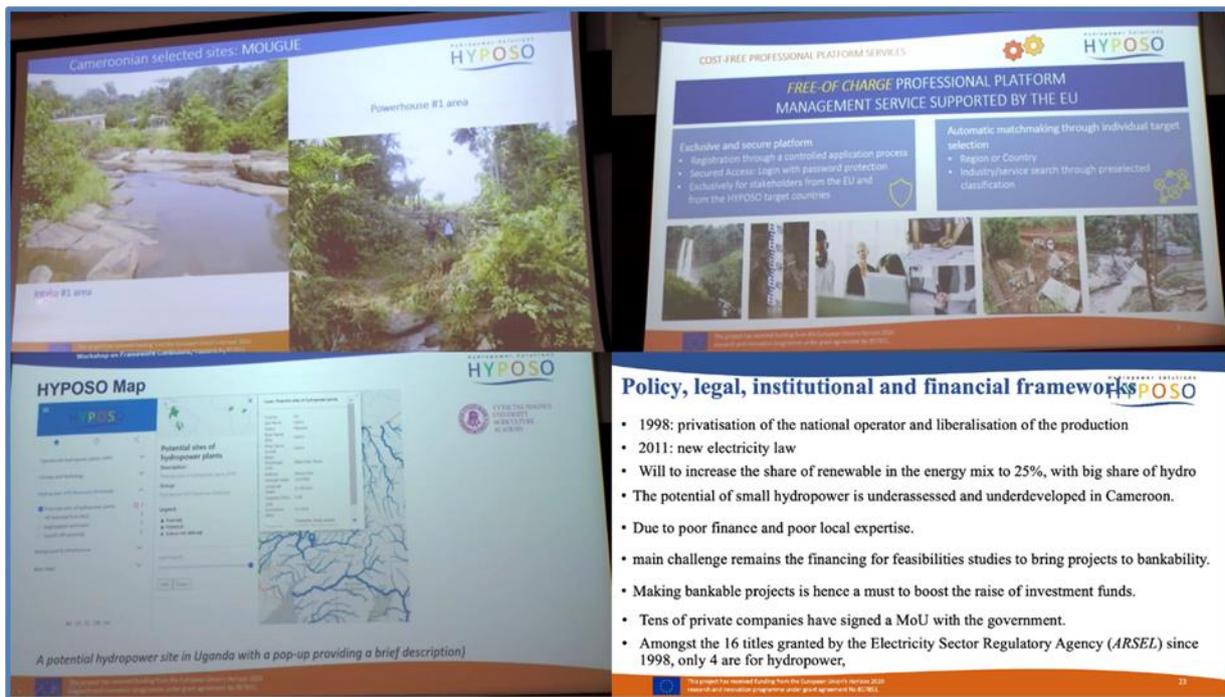


Figure 4: Image of fragments of presentations from the Workshop on Small Hydropower Framework Conditions in Cameroon

The presentations were followed by the discussion, moderated by prof. Bernhard Pelikan (FN) together with J. Kenfack, on the actual situation and needs for hydropower in Cameroon as well as on the ideas how these needs can be met and how the development of small hydro projects can be facilitated. The views and ideas were discussed together with invited guests, i.e., representatives of the Ministry of Water Resources and Energy, Investment Promotion Agency, EU Delegation, and utilities, as well as with project developers and investors. The details of the debate are described in chapter 4.2. One of the important matters indicated by the participants was the requirement to expand the pilot projects into next stages of development after the prefeasibility studies are completed. The main points of the discussion were then summarized by prof. Pelikan who, on these grounds, formulated the ideas of recommendations for decision makers in Cameroon on how to tackle the barriers faced by small hydro developers and investors (see chapter 4.3).

At the end of the workshop further outcomes of the HYPOSO project - the HYPOSO Map and the HYPOSO Platform - were presented to the participants as tools made to increase the number of investments in sustainable projects in target countries as well as to stimulate the market uptake of EU technologies there.

The workshop was filmed, and the recording is available for interested parties.



Figure 5: Speakers and participants of the Workshop on Small Hydropower Framework Conditions in Cameroon

## 4.2 Discussion

The debate on recommendations for Cameroon to facilitate national investment - friendly climates for hydropower based on the presented case studies and outcomes of the framework analysis was a key part of the workshop. It was moderated by B. Pelikan and J. Kenfack. While opening the debate B. Pelikan explained that the aim of the meeting is to discuss legal, financial, and economical environment to increase the share of renewables, especially small hydropower, in Cameroon. He underlined that the country is very rich in hydropower resources and that it is highly recommended to use unexploited small hydropower potential for electricity generation. Then he invited guests to ask questions and make statements.

The first question was addressed by Marcel Mbella, Technical Coordinator of the Support Council for the Implementation of Partnership Contracts in Cameroon. He asked if the HYPOSO project comprises only studies and capacity building activities or if it also includes investments in construction and operation of a small hydropower plants. In his opinion Cameroon needs both kinds of actions. He also stated that there are two main issues preventing the development of small hydro projects: problems with availability of hydrological data and with the affordability linked to the cost of service. He explained that in case of small flows and heads of small hydropower plants, the electricity produced is costly in relation to money invested in construction of such plants, so it is not affordable for the poor population of the country. B.

Pelikan explained that investments in construction of hydropower plants are not financed within the HYPOSO project, but the question of potential investors is an issue being analysed by the HYPOSO project experts. He admitted that it is quite difficult because to obtain funding it is necessary to present bankable projects. This means that some advanced documents need to be provided to prove bankability and even pre-feasibility studies might not be enough.



Figure 6: Participants discussing at the Workshop on Small Hydropower Framework Conditions in Cameroon

Concerning the hydrological data – B. Pelikan admitted that this is a problem indeed and that other countries covered by the HYPOSO project also face similar issues: hydrological data are crucial to develop hydropower projects but, in many cases, they are not reliable or available. Concerning the issue of affordability of projects B. Pelikan explained that to be sure that the projects are reliable it is necessary to verify the question of their profitability in the studies that are being made (pre-feasibility). J. Kenfack referred to M. Mbella’s remark concerning the lack of hydrological data. He said that in case of the selected pilot sites the hydrology had been monitored for 3 years before the sites visits. The problem of data accessibility was anticipated at the beginning of the HYPOSO project and was properly addressed at that time. But he admitted that the solution is needed for the country as general, not only for three selected sites.

Subsequently, Michel Tacam, Coordinator of the national NGO Action for Integrated and Sustainable Development, spoke. He explained that he was involved in developing micro hydro plants in a mountain area of Cameroon and wanted to share some thoughts with regards to that experience. In his opinion, if the projects were larger than the ones they developed (i.e., more than 100 kW of installed capacity), more data and good feasibility studies are needed as well as experts to make these studies, and money to pay to experts. He indicated that there is a problem to access financial resources for feasibility studies. He explained that there are some

funds for construction of hydropower plants, but feasibility studies made by good experts are needed in the first place. M. Tacam posed a question whether the HYPOSO project includes the studies only on the 3 selected sites or more sites are foreseen for development. In his mind, support in capacity building is needed but support in conducting feasibility studies in terms of resources access is a bigger challenge and it is more needed to support such activities. J. Kenfack referred to the presentation he had delivered earlier that day and said that he had pointed out the direction which should be followed to boost the small hydro development. He explained that the HYPOSO project is meant to show the pilot projects and to show what the needs are to develop more sites. Then, B. Pelikan referred to the snowball effect metaphor mentioned before. It can have double effects. He believed that when the pilot sites are completed and running successfully, other stakeholders might find it encouraging and could try to follow. Moreover, successful projects may also encourage potential investors who might be willing to invest in similar projects. J. Kenfack underlined that in Europe there is knowledge, and businesses can be done with the use of that knowledge by African stakeholders. He added that within WP3 of the HYPOSO project lots of sites and sections of rivers with hydropower potential are being identified in the whole country.

Next, M. Mbella put a question again, whether any pilot site is more developed to see what the next steps regarding the projects would be. B. Pelikan explained that in accordance with the schedule of HYPOSO, so far there had been sites visits in Uganda and then in Cameroon. All three sites had been visited in Cameroon; two of them were assessed as very good and the third one was not as obviously easy to be developed but is still promising. The next step would be the finalisation of the studies until the end of June 2022. Having the studies, the owners of the sites would be able to look for potential investors. E. Malicka added that the HYPOSO project experts also explore possibilities to finance the pilot projects and were informed that the European Investment Bank might be interested in financing one of the sites. But this is still an ongoing process of recognising possibilities. Also, she mentioned, there is a project partner within the HYPOSO consortium who is working on the financial analysis and finding the way to finance pilot projects. She also added that within the HYPOSO Map, 500 small hydropower potential sites for Cameroon are going to be identified and described with some basic data. They can be used to follow the examples of the pilot projects and by developing them the snowball effect can be achieved. She also mentioned the tool provided in the HYPOSO project – the HYPOSO Platform, where all stakeholders as well as financial institutions can find each other and establish cooperation.

Then, Francis Nzukou, Coordinator in the United Nations Industrial Development Organization, took the floor. He expressed the will to share his experience on developing a project like HYPOSO, where pre-feasibility studies had been conducted for two sites. The projects are being developed in cooperation with the Ministry of Water Resources and Energy and developers for the projects are being selected at that moment. Before sharing the opinion on main issues and barriers for small hydro development, F. Nzukou wanted to clarify the definition of small

hydropower for the needs of the discussion. According to the law in Cameroon, it should not exceed 5 MW of installed capacity, but the limit of 10 MW is used in many other countries and regulations. Regarding the barriers, F. Nzukou pointed out that actors involved in developing projects are not in control of the legal framework. They can only participate in discussions with administration like the one held at that moment. Therefore, he appreciated the presence of the representative of the Ministry of Water Resources and Energy at the meeting. Next, F. Nzukou asked about the HYPOSO project itself. He wondered what the interest of the EU enterprises is in the selected projects if only the prefeasibility studies are done. He was also curious about the role of SHW in the projects. After that, F. Nzukou described the problem that appeared after the capacity training carried out within the project, he was involved in. The trained persons couldn't find a chance to apply their knowledge. There were no projects they could be involved in. He wondered if the continuation of trainings would be a solution. Next issue raised by F. Nzukou was the necessity to bring the project to bankability. This issue led him to the question about the CAPEX of the pilot projects in HYPOSO. His last question was about the purpose of generated electricity; he wondered if it would feed some mini grids or if the plants will be connected to the national grid. The answer to the last question was given instantly by B. Pelikan, who explained that all three pilot projects will be connected to the national grid. He also commented on the problem of the capacity building courses. In his opinion the final aim of providing courses is not to keep the students depended on continued trainings but train the trainers who can teach others how to make prefeasibility studies. J. Kenfack answered the question about the definition of small hydro. He admitted that according to regulations in Cameroon, small hydro is defined as the one of less than 5 MW of installed capacity, but, he added, scientifically speaking it is not exactly true and 10 MW is more justified. Concerning SHW's role in the HYPOSO project, J. Kenfack explained that SHW helps developing projects to city councils and gets them involved in the project as participants to make sure some people will be able to use the lesson learnt in the project. Regarding the issue of the capacity building, J. Kenfack explained that the idea is to demonstrate hydropower plants practically and increase the level of knowledge by showing real hydropower plants to people representing different fields and backgrounds. Regarding the CAPEX of the pilot projects, J. Kenfack explained that it will not be known before completing the studies. So, the decisions on the projects development and financing will be made after that. Answering the last question posed by F. Nzukou, J. Kenfack said that since the consumption in rural areas is low and the investment cost is high, it is not reasonable to stick to the rural area using only mini grids, but it is much wiser to get connected to the national grid.

Next, Valerie Nkue, Director in the Ministry of Water Resources and Energy, referred to the remark about the role of administration in creating the framework for hydropower development. He said that he would like to receive recommendations from experts like participants of the workshop and that the Ministry of Water Resources and Energy is there to listen. He also asked a question to the HYPOSO experts. He had noticed that private investors are often not willing to invest in small hydropower being afraid these projects are not

profitable. So, the question was if, according to experts' experience from their own countries, there are private investors who invest in and operate small hydropower plants. Answering this question, B. Pelikan used the example taken from his own experience in renovating and operating a SHP in Austria in cooperation with a business partner. He explained that in many countries investments in small hydropower plants are well known ways of conducting business. However, he added there is a condition which must be met that the investment is settled on a good basis. Then, E. Malicka gave an example of Poland where 600 out of 700 hydropower plants are operated by private owners. She explained that there are a lot of family businesses conducted in this way and that the association she represents gathers private owners of small hydro. She added that these businesses have their ups and downs, are complicated because of regulations they are subject to, but still new private small hydro businesses are being developed. B. Pelikan added that one of their advantages is being long term investments.



Figure 7: Active discussion during the Workshop on Small Hydropower Framework Conditions in Cameroon

Then, Cédric Ekenglo from the partially state-owned electricity company Eneo (Energy of Cameroon), representing off-takers of the generated electricity, had some questions in the discussion. He asked at which moment of development of small hydro pilot projects an off-taker is considered and integrated. How is the power purchase agreement (PPA) secured and managed? He stated that it is not easy in Cameroon. He wanted to know if the pilot projects are developed in cooperation with city councils and if city councils can buy electricity from developers in these cases. J. Kenfack answered that the city councils are not planned as off-takers because the generation from small hydro projects exceeds the demand in case of city councils. According to J. Kenfack there is a need for a regulation which should guarantee that all generated electricity is automatically fed to the grid. This would be the best option for small hydro projects. B. Pelikan agreed and again referred to the example of his own small hydro investment. In that case, generated electricity was delivered to a local factory, but the amount

not used by the factory was delivered to the grid and rewarded within the feed in tariff mechanism. It was profitable for both parties. C. Ekenglo replied that in Cameroon such mechanisms do not exist and there are very few industries, so the problem remains to secure a PPA.

Next, Steven Raul, Program Officer at the Delegation of the European Union to Cameroon spoke. He explained that he had been involved in the electricity sector and in projects which involved both construction and financing operations in small hydropower sector in Cameroon since 2018. He raised an issue of administrative procedures as the first step that needs to be done while starting the project. He pointed out that there was a work already done regarding this, which resulted in developing manuals on procedures for small hydropower plants development. He suggested that these manuals could be used to facilitate small hydro investments and encouraged to use these manuals and make them available on the HYPOSO website.

After that, Dan Marlone Nabutsabi representing the Hydro Power Association of Uganda expressed the will to share his experience about issues and barriers similar in Uganda and Cameroon and to show that in some cases in Uganda the solution had been found. Due to the problem of the bureaucracy well known in many countries, D. Marlone's advice was to cooperate with individuals instead of institutions whenever it is possible. He also informed the participants that in the 1980s, Uganda had only one hydropower dam, generating 180 MW. This created a situation of load shedding to help manage the deficits of power in the grid. But after the energy sector was liberalised in 1999, more private sector actors joined the sector and by 2020, the overall generation had shot to 1,179 MW, with hydro taking 80 per cent. The last remark was that in Uganda there is a standardised PPA, and the template is available for all interested parties. He mentioned the maximum capacity of small hydropower in Uganda as 20 MW, showing that the definition differs from country to country.

Next, V. Nkue referred to the problem raised by F. Nzukou concerning the lack of application of knowledge learnt at capacity courses. He explained that this kind of knowledge can be and is used not only by developers of small hydropower plants but also by administration and he gave himself as an example of a person for whom basic knowledge about small hydropower plants is needed at work to evaluate projects presented by investors.

After that, Iguebor Nadesh Beri from the Investment Promotion Agency took the floor. She appreciated the HYPOSO project and pointed out that the Agency she represents would welcome the investors for the pilot sites and would be happy to accompany them in the process of investment. She explained that the energy sector is among the prioritised ones in Cameroon, so the Agency is designed to encourage more projects in this sector and attract investors both national and international. Therefore, they are ready to assist and guide investors.

Again, V. Nkue spoke and expressed the interest of the Ministry of Water Resources and Energy interest in access to the PPA standard template made in Uganda and its potential use in Cameroon.

Next, the discussion led again to feed in tariffs which obviously require a political decision but were once more mentioned as very important for projects to be developed.

The last input to the discussion was given by I. Nadesh. She added that under national law there are some financial and administrative incentives for private investors and some of them can be used by investors in the small hydropower sector. The Investment Promotion Agency can lead investors and show them possibilities in this matter. There is also a guide about the possibilities available at <http://www.investincameroon.net> .



Figure 7: Participants of the discussion at the Workshop on Small Hydropower Framework Conditions in Cameroon

### 4.3 Conclusions and recommendations

After the debate the time has come for the summary of the discussion and formulating ideas for recommendations, which was made by B. Pelikan. He referred to three issues which frequently appeared in the discussion and could be used as key words:

- MONEY was the first one.

This word “money” as a key one in a conclusion seemed not to be surprising for B. Pelikan, since money issues are a driving force in many cases. Here, money was highlighted as a major issue in two aspects: firstly, in terms of financing prefeasibility studies, and secondly in terms of encouraging potential investors. B. Pelikan noticed that these issues might be partly addressed through the Agency service to guide investors. They are also a subject of work in the HYPOSO project. Funding options analysis for the selected projects will be a part of the feasibility study. This analysis should result in some models which could be used as examples for other projects.

The analysis will comprise more than just standard solutions but also some new models of acquiring funds.

- REGULATIONS was the second key word.

This problem includes the need of a feed in tariffs mechanism which was raised several times and was recommended as an important regulation supportive and easy for small hydropower, which could facilitate and encourage small hydro investments.

Another regulatory scheme which was mentioned in the discussion and highlighted by B. Pelikan was a one-stop shop which could enable getting all necessary licences and concessions for small hydropower investment in one place instead of costly and time-consuming practice of applying for permits in numerous institutions.

Finally, the idea of standardized procedures mentioned several times was very appealing to participants of the workshop. B. Pelikan expressed his hope that a kind of partnership in exchanging information, started at the workshop between stakeholders from Uganda and Cameroon, can lead to a first very practical effect i.e., sharing the PPA template elaborated in Uganda.

- CAPACITY BUILDING was recognised as the third key world.

B. Pelikan stated that capacity training activities will not make sense without practical application of the knowledge acquired, so such activities should be always connected with the further development of projects. He concluded that it is encouraging that there were so many applicants (over 67) to the capacity building courses which were going to take place the following week in Cameroon and this fact indicated that the work being done is valuable.

## 4.4 Annexes

### 4.4.1 Programme

To have an impression about the programme of the workshop an image of the distributed agenda of the event is shown in Figure 9.



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### Programme

**Workshop on Small Hydropower Framework Conditions in Cameroon**

28<sup>th</sup> January 2021, Hilton Yaoundé  
11.00 – 15.15

11.00 - 11.15	Introduction - general information on the HYPOSO project - <i>E. Malicka (TRMEW)</i>
11.15 – 11.45	Presentation of framework conditions for hydropower in Cameroon based on the outcomes of the HYPOSO framework analysis - <i>J. Kenfack (SHW)</i>
11.45 – 12.30	Presentation of the selected 3 case studies in Cameroon and potential barriers for these projects' development - <i>N. Frosio (Frosio Next)</i>
12.30 – 13.30	<i>Lunch break</i>
13.30 – 14.30	Discussion on recommendations for Cameroon to facilitate national investment - friendly climates for hydropower based on the presented case studies and outcomes of the framework analysis - <i>Moderators: B. Pelikan (Frosio Next) and J. Kenfack (SHW)</i>
14.30 – 14.45	Summary of the discussion and recommendations - <i>B. Pelikan (Frosio Next)</i>
14.45 – 15.00	Appendix 1 HYPOSO Map – identification of potential small hydropower sites in Cameroon - <i>J. Steller (IMP PAN)</i>
15.00 – 15.15	Appendix 2 HYPOSO Platform - <i>E. Malicka (TRMEW)</i>

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The HYPOSO Project has received funding from the European Union's H2020 research and innovation programme under grant agreement No 857851



Figure 8: Programme of Workshop on Small Hydropower Framework Conditions in Cameroon

#### 4.4.2 Participants

To have an impression about the participants of the workshop the list is shown in Figure 10.

N°	NAME	INSTITUTION	FUNCTION
1	TAKAM Michel	Action for Integrated and Sustainable Development	S.E
2	KAMGA T. Cédric	Action for Integrated and Sustainable Development	Environmental Officer
3	NKUE Valerie	Ministry of Water Resources and Energy	Director
4	TITA BEKONO David	Ministry of Water Resources and Energy	Assistant Director
5	HAMADOU MOUMINI	The Energy of Cameroon	Production Manager
6	IGUEBOR NADESH BERI	Investment Promotion Agency	Reception and assistance service r
7	NZUKOU Francis	United Nations Industrial Development Organization	Coordinator
8	ANDONO MEKE RegINE	General Delegation for National Security	Discreet Security
9	EYENGA Pascal	Electricity Sector Regulatory Agency	Head of Service
10	CHOAKE NGOMBE Brice Gaëtan	Ministry of Water Resources and Energy	Engineer
11	BIKOBA OTOMO Irael	General Delegation for National Security	Discreet Security
12	MENGBWA MBIDA épouse NDI Génévie	General Delegation for National Security	Discreet Security
13	BELONG MPON Dan Edwin	Special Fund for Equipment and Inter-Municipal Intervention o	Head of Service
14	AGHOKENG Willy Maxime	Rural Electrification Agency	Studies Assistant Director
15	AMBOMO NDONGO Hélène Hortense	Investment Promotion Agency	Reception and assistance service a
16	MBACK Patrice	Ministry of Decentralization and Local Development	Design engineer N°2
17	MBELLA Marcel	Support Council for the Implementation of Partnership Contra	Coordinator
18	EKENGLO Cédric	The Energy of Cameroon	Engineer
19	DAN Marlone	HPAU	HYPOSO Proj. MNG
20	Steven RAULT	European Union Delegation	Program officer
21	Antoine DJIETCHEU	Afrique Performance	Press photographer
22	Janusz STELLER	IMP PAN	Researcher
23	Nino FROSIO	Frosio Next	Engineer
24	BERWHARD Pelikan	Frosio Next	Engineer
25	KENFACK Joseph	SOLARHYDROWATT Sarl	Manager
26	Eva Malicka	TRMEN	President
27	MAFEUGANG Nadine S.	SOLARHYDROWATT Sarl	Engineer
28	MAMGUE K. Clotilde	SOLARHYDROWATT Sarl	Administrative Assistant
29	KENNE Aristide	SOLARHYDROWATT Sarl	Electrotechnician

Figure 9: List of participants of Workshop on Small Hydropower Framework Conditions in Cameroon

## 5 Workshop on the framework conditions for small hydropower in Uganda

### 5.1 Overview

The Workshop on Small Hydropower Framework Conditions in Uganda was held on 15 March 2023 in Kampala, the capital of Uganda. It was organised by the project partners TRMEW (Poland) and HPAU (Uganda). The workshop, taking place in Kampala's well-known conference venue - Africana Hotel & Convention Centre, brought together 49 participants ranging from developers, government agencies, private sector actors, participants in the capacity building courses, consumers and the media (for the detailed list of participants see chapter 5.4.2).

Dan Marlone Nabutsabi, the HYPOSO Project Manager in Uganda and the Acting Chairman for the Hydro Power Association of Uganda (HPAU) began the workshop by briefly taking the participants through the program of the day. He also informed them that the day doubled as it was also the World Consumer Rights Day, commemorated on 15 March every year.



Figure 10: Participants of the Workshop on Small Hydropower Framework Conditions in Uganda

After the opening D. Marlone asked the participants to introduce themselves. D. Marlone then recognized the presence of Elizabeth Kaijuka Okwenje from the Ministry of Energy and Mineral Development (MEMD) as well as Ewa Malicka (TRMEW) and Tasniem Jawaid (EREF) - the HYPOSO partners who had travelled from Europe to participate in the workshop. He then conveyed apologies from the HYPOSO Project Coordinator, Ingo Ball, who had not travelled to Uganda due to delayed visa process.

After the introduction, opening remarks were given by E. Okwenje. She gave a brief update on the hydropower status in the country. She expressed the will of the Government of Uganda to encourage private developers, as enshrined in the Energy Policy, National Development Plan III and Vision 2040, to increase access to clean energy. She then appreciated the HYPOSO project

for all the support rendered so far to the local developers, especially the three pilot sites identified. In conclusion, she expressed the need to have a successor project when the HYPOSO project ends, so that the identified pilot sites could be nurtured through the construction up to commissioning phase.

The opening remarks given by the Chief Guest were followed by the presentation delivered by E. Malicka who, on behalf of I. Ball, shared with the participants the general information about the HYPOSO project.

Among what she presented included:

- Project overview,
- Objectives of the Project,
- The structure,
- HYPOSO in numbers,
- Impact in target countries in Africa (Uganda and Cameroon), and
- The proposed B2B matchmaking event for the African partners.

She shared briefly about the Workshop on Framework Conditions that took place in Cameroon early in 2022 and about the sites visits and the capacity building courses held in Cameroon and in Uganda. E. Malicka then elaborated on the HYPOSO Handbook and the last activities for Africa - the B2B matchmaking event to be organised at RENEXPO in Salzburg (Austria) on 30 March 2023 and the business cooperation study tour for stakeholders from the target countries to be organised from 3 to 13 May 2023 in Europe.



*Figure 11: From the left: D. Marlon opening the Workshop on Small Hydropower Framework Conditions in Uganda and E. Okwenje giving an overview of small hydropower sector in Uganda and its role in clean energy transition from the perspective of the State Policy*

Finally, E. Malicka listed the objectives of the workshop that had just begun as follows:

- presentation and discussion on the framework conditions for the development of small hydropower projects in Uganda based on the analysis performed by HYPOSO experts and examples of selected case studies of small hydropower projects,
- discussion about the actual situation and needs for hydropower in Uganda,
- discussion about proposals of facilitating the conditions of small hydropower projects development,
- concluding and making draft proposals of recommendations.

Concluding, E. Malicka referred the participants to the HYPOSO project website for more information ([www.hyposo.eu](http://www.hyposo.eu)), adding that they could also subscribe to the Project Newsletter.

Next, D. Marlone presented about the main outcomes of the analysis of the framework conditions for hydropower in Uganda made within the HYPOSO project together with a Lithuanian partner – VDU. He started by introducing himself as the Acting Chairman for HPAU and recognised his National Executive Committee members. He also informed the participants that he was the new Chairman for Uganda National Renewable Energy and Energy Efficiency Alliance (UNREEEA) and the HYPOSO Project Manager. Next, he introduced his Project team. He then requested members who participated in the previous HYPOSO Capacity Building Courses, both in Kampala and in Yaoundé, Cameroon, to stand up for recognition.

Then, during his presentation, D. Marlone shared the following about Uganda:

- A brief about Uganda,
- The power generation mix,
- The energy situation,
- State of small hydropower sector in Uganda,
- Policy and legal framework,
- Investment opportunities in small hydro power development, and,
- The need to invest in small hydro in Uganda due to the good environment.

He explained that:

- SHPs in Uganda are defined as plants with installed capacity of up to 20 MW and total national potential is about 400 MW.
- By 2019 there were about 20 operational SHPs with total installed capacity of 145.3MW, mainly by IPPs.
- Unlike large hydro, which are located along the Nile, most SHPs are around Mt Rwenzori on the western border and Mt Elgon on the eastern border.
- Over 50 potential SHP sites have been identified on Uganda 's rivers, with a total of 210 MW.
- Investment costs into SHP are estimated between 3 million and 4 million USD per MW installed – isolated or grid connected.

Describing the policy and legal framework he remarked that:

- Uganda 's SHP policy is integrated within the whole energy and hydropower sector – legal framework for developers and operators.
- Submission of application to award of generation license by ERA takes maximum 180 days.
- REFITs give an incentive to SHPs (0.5-20 MW) if they intend to connect to the national grid.
- All project sizes benefit from standardized PPAs.

D. Marlone highlighted conducive investment environment for small hydropower in Uganda and mentioned that SHP development has just started to progress which triggers the need of basic knowledge about hydropower and transfer of the European-top-level experience and state-of-the-art hydro technology to Ugandan researchers.

As challenges he noted:

- high upfront costs and limited access to early-stage support and equity investment as interest rates from commercial lenders are quite high due to the perceived high risks of the investment, and
- a perception of high risk of default on payment by the single off-taker.

According to D. Marlone this may, however, be a great investment opportunity for companies and organizations that are ready to plough in long term venture capital.

As the main issue to address for the development of small hydropower in Uganda, he identified need for more capacity building for developers of small hydro power in Uganda, which the government would take on as part of the curriculum of its higher institutions of learning. He also reiterated the policy environment by the Uganda government to support the development of small hydropower to help increase access to clean energy, which, he said, was enshrined in documents like the Vision 2040, the NDP III and NRM Manifesto, among others.

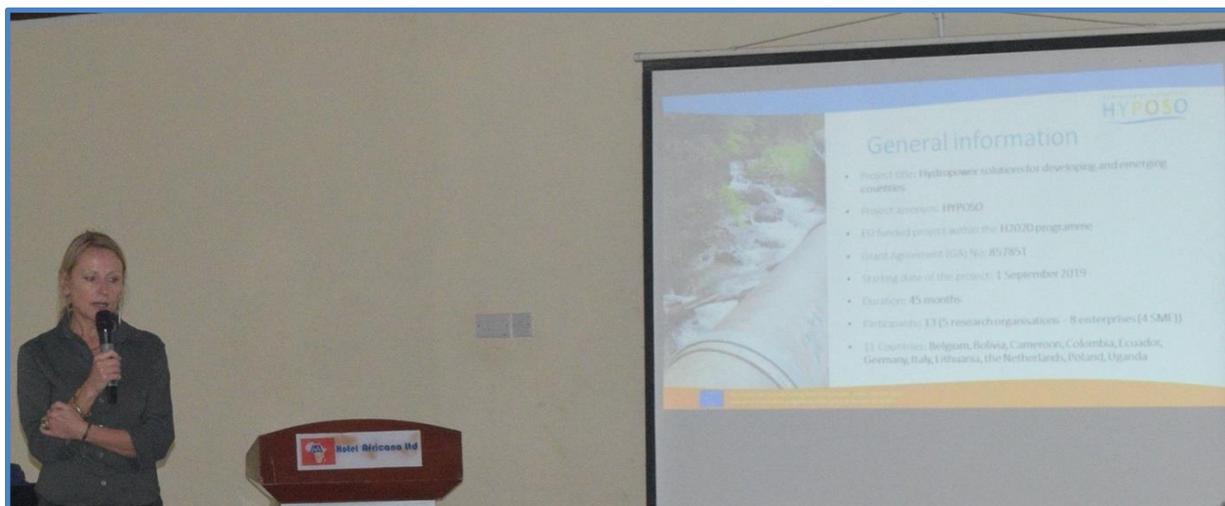


Figure 12: E. Malicka presenting general information on the HYPOSO project and the objectives of the workshop

Subsequently, Beatrice Baratti (FN) in a pre-recorded presentation gave an overview on the three selected pilot sites (Cheptui, Kibaale and Mihunga HPPs), for which prefeasibility studies had been elaborated within HYPOSO tasks. These sites had been visited by the project experts in 2021.

The key highlights of the presentation included:

- Preliminaries before site selection,
- The selected sites,
- Issues found (technical and environmental),
- Conclusions and potential barriers for selected projects development,
- Final remarks.

In conclusions B. Baratti stated that the preliminary chosen location of the intakes and powerhouses are proper. She said that some improvement is possible for the conveying works however it could be very expensive for the Kibaale scheme. She added that connection distances to the national grid stay in a range not affecting the cost too much. She pointed out that there do not seem to be any significant barriers to the implementation of the projects; their social acceptability is good and suitable mitigation measures of environmental impact have been foreseen in the design. In the final remarks B. Baratti stated that the sites visits allowed HYPOSO experts a detailed overview of the proposed schemes. Furthermore, thanks to the effective collaboration with the partners' and the proposers' technicians, they were able to collect all the basic information needed to prepare the sites evaluation at pre-feasibility level. It was also noted that the proposed schemes well represent the variety of hydroelectric technologies, due to their wide range of head (605 – 126 – 30 m). Finally, she said that from the point of view of the exploitable flow rates, the data available are suitable to carry out a reliable evaluation of the expected production, but they must be improved before going on with the following design stages.

Next, further outcomes of the HYPOSO project were presented. The HYPOSO Map with all options for its use was shown in a pre-recorded presentation and a tutorial video made by Gitana Vyčienė (VDU). Specifically, the presentation covered:

- Introduction,
- Objectives,
- Materials and methods, and
- Specific HP potential.

Subsequently, the HYPOSO Platform as an international promotion and partner mapping tool was presented by T. Jawaid. He said it was put up as an avenue to identify business opportunities and partner mapping with EU companies. He also mentioned that the Platform was about matchmaking and promotion of networking for the European hydropower industry and their counterpart in the target countries. He went on to emphasise the benefits of the Platform, which include:

- that it is free of charge, exclusive and secure,
- has an international target market, and
- is a one-stop shop.

Then, T. Jawaid guided the participants about how to register on to the HYPOSO Platform. The registration was either direct through [www.hyposo.eu](http://www.hyposo.eu) or downloading the registration form via [platform@hyposo.eu](mailto:platform@hyposo.eu). T. Jawaid also requested the attendees to download the HYPOSO Handbook from the HYPOSO website.

The following two presenters shared their view about the state of small hydropower in Uganda and its role in transition to clean energy. As mentioned earlier, this day was also the World Consumer Rights Day, whose theme was 'Clean Energy Transitions.' E. Okwenje highlighted on the overview of hydropower regarding the state policy. She related the fact that government had the will to support the development of small hydropower projects in the country, as one of the ways of increasing access to clean energy. She explained that this was clearly enshrined in some key policy documents, like the Vision 2040 whose target is to increase access to 80% by 2040, National Development Plan III and the Energy Policy.

After providing the state perspectives by E. Okwenje, Geoffrey Kamese from Uganda Consumer Action Network (U-CAN) presented the Consumer Advocacy Group perspective. First, he thanked the HYPOSO project for the opportunity to present consumer perspectives on the subject matter. He mentioned that energy was a critical point for everyone, depending on how each person consumed it. He mentioned the different sources of energy options that consumers had at disposal, adding that the development and consumption of hydropower needed to be encouraged, because it was consumer friendly and has various benefits. G. Kamese argued that small hydropower was an important area to consider for a consumer. He added that the cost of developing SHP was relatively low, compared to the big dams, hence a high benefit for the consumers. In conclusion, G. Kamese said that regarding consumer rights, he voted for the construction and use of small hydropower in Uganda, as the best option that will help Uganda transition to clean energy.

This was followed by the last two presentations on barriers and experiences in small hydropower plants development from the point of view of the private sector (presented by the HYPOSO pilot project's developers Benard Mbaine and Jan Pilar from SEBEI HYDRO) and the public sector (presented by David Lubega representing the government agency UEGCL).

B. Mbaine, the developer of Cheptui SHP, one of the three sites selected in the HYPOSO project in Uganda, gave a brief presentation on the barriers and experiences of SHP development under private sector. He said, as a developer, their company had started developing Cheptui SHP, which they had planned to commission in 2025. One of the challenges they had faced was mainly financing. They also needed high level project designers, but who, unfortunately, could not be found in Uganda. He said this outsourcing added costs.

Adding on the above, J. Pilar, from the same company, also spoke about the barriers and experiences of SHP. One of the key impediments to SHP development, he said, was lack of

reliable data to help investors make informed decisions. He expressed gratitude that the HYPOSO project had helped address this through the creation of the HYPOSO Map and Platform. He mentioned the need for power in Uganda and strengthened on how to make it count is by building SHP in Uganda. He also cited the restriction by Electricity Regulatory Authority (ERA) for any developer not to hold licenses for more than one project at a time.

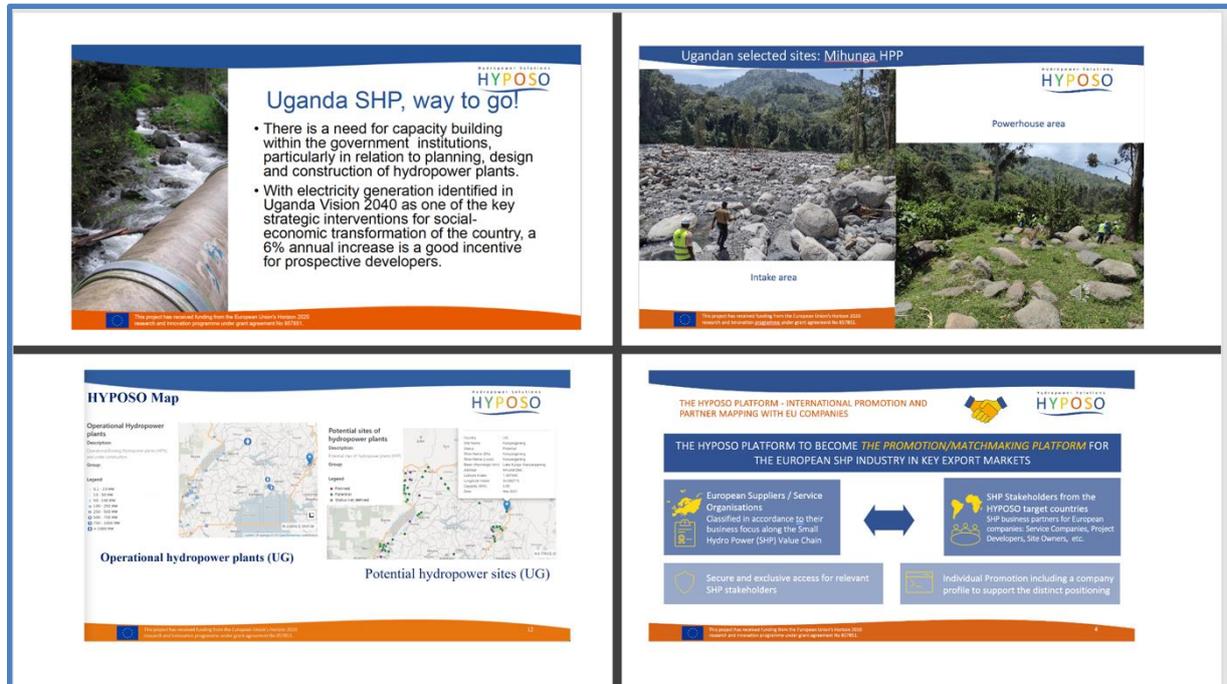


Figure 13: Image of fragments of presentations from the Workshop on Small Hydropower Framework Conditions in Uganda

D. Marlone interjected that the reason why HPAU was founded was to help its members speak with a collective voice to influence government revise any such policies that hinder smooth investment in hydropower development. He urged the participants to contact the HPAU staff present for details of how to subscribe.

In the last presentation which followed, D. Lubega presenting the public sector's view on small hydropower development, listed the projects run by the government. He thanked the team for organizing the workshop which made it possible to know what is on ground. He went on to share experiences and barriers that the government is facing towards SHP. He mentioned that the government has several regulatory functions which would help the developers. He mentioned that as a nation the primary function was to avail power to its people and encouraged developers to help them in that cause. D. Lubega also said that the government had tried to put mechanism in place to increase power generation to its nationals. He noted that several developers start projects but are faced with delays and that affect planning on the side of the government. He added that developers have scarce and incorrect information about projects presented which is not sufficient for financing from the government. He thanked HYPOSO for putting in an effort of giving information about sites and requirements with regards to hydropower. To the HYPOSO project, he requested the team to use well the information they had captured during the studies and update it on the platform. He urged the team to move

from studies to preliminaries that can be used for execution of the project. He expressed the desire of the government to make the reports of the feasibility studies accessible to the public through the HYPOSO Platform. He appreciated HYPOSO for the work done and mentioned that he was supposed to point out barriers but saw worth pointing out recommendations instead.

After the first part of the workshop the certificates of completion of the HYPOSO Capacity Building Course were awarded to graduates of the course organised for African key stakeholders in January and February 2022 within HYPOSO WP4.

This part was followed by the discussion, moderated by D. Marlone together with T. Jawaid, on the actual situation and needs for hydropower in Uganda as well as on the ideas how these needs can be met and how the development of small hydro projects can be facilitated. The views and ideas were discussed together with invited guests, representing governmental institutions, utilities, as well as with project developers and investors. The details of the debate are described in chapter 5.2. The main points of the discussion were then summarized by E. Malicka who, on these grounds, also formulated the ideas of recommendations for decision makers in Uganda on how to tackle the barriers faced by small hydro developers and investors (see chapter 5.3).



*Figure 14: Speakers of the Workshop on Small Hydropower Framework Conditions in Uganda (from the left: T. Jawaid, J. Pilar)*

The workshop was filmed, and the recording is available for interested parties. During the workshop short interviews about the HYPOSO project and the workshop were recorded with D. Marlone, E. Okwenje and E. Malicka and broadcasted by UBC TV, Uganda's national station. They are available at the following link:

[EU HYPOSO Project helps support small hydro power development in Uganda](#)

## 5.2 Discussion

The debate on recommendations for Uganda to facilitate national investment - friendly climates for hydropower based on the presented case studies and outcomes of the framework analysis was moderated by D. Marlone and T. Jawaid. While opening the debate D. Marlone explained that the aim of the meeting is to discuss legal, financial, and economical environment to increase the share of renewables, especially small hydropower, in Uganda. Then he invited guests to ask questions and make statements.

The first question was addressed by Shaban Sserunkuma (CONSENT). He wanted to learn more about kinetic turbines and how they could be used in Uganda. Responding to this, T. Jawaid suggested looking at the technologies described in the HYPOSO Handbook.

Stephen Lumu (KIBAALEHPC) expressed concern about acquiring different permits from the various regulatory bodies, which he said seemed to be uncoordinated among the government agencies. He requested that these agencies put an effective way of communication concerning their services to the developers. J. Pilar expressed the same view about acquiring permits and gave his experience where he submitted in December 2021, but by March 2023 he had not got the permit yet.



Figure 15: Participants discussing at the Workshop on Small Hydropower Framework Conditions in Uganda

Paul Mwirumubi (HPAU) had an argument that the regulatory bodies be housed in a central place for easy access of permits and processing of applications. He expressed concern that some government agencies at times seemed to finance themselves to conduct feasibility studies; then when investors came, another feasibility study for the same project would be carried out. About the HYPOSO project, he wondered what the future would be like, after the project ended. He said there was need for a successor project to HYPOSO, to help take the

selected sites to the next level. Finally, he commended the effort by developers coming together under one forum like HPAU, citing the Regional Power Pool which, he said, came about mainly as a result of a joint voice from the developers.

B. Mbaine spoke about having a voice as developers and mentioned that this would have been the best platform for policy makers to be represented. He said the grid infrastructure needed a lot of investment. He also pointed out the 'Deemed Energy Clause,' which he noted with concern that it was not there in the Power Purchase Agreement. He also wondered about how the one-stop shop would operate, adding that private developers were not involved during the consultation. He noted with concern the latest climate change effects, especially about the floods that frequently happened on River Nyamwamba, urging the developers to be aware of such natural risks as they planned their projects. He expressed the need for insurance cover for potential risks faced by such projects, which, he said, should not be borne by the developer alone.

Another participant asked about the HYPOSO Map and how often the map would be updated, due to constant changes in hydrology.



Figure 16: Speakers and Participants of the Small Hydropower Framework Conditions Workshop in Uganda

Joseph Bwambale (TICOPLAN) noted that the biggest challenge was power evacuations from the HP projects. He urged the HYPOSO team to make themselves familiar with documents that had evacuation timelines and plans. He also urged the HYPOSO members to fill the standardised documents that were available at ERA and NEMA (National Environment Management Authority) websites, for guidance. He then advised developers to always endeavour to do intensive studies before handing in their applications.

Emmanuel Ruhweza (GREEN FOCUS ENGINEERING) emphasised the issue of finances that needed to be sought when developers had done some preliminary phases on their projects.

D. Lubega talked about the issue to centralise regulatory functions and objected the issue of other functions housing each other regarding hydropower.

### 5.3 Conclusions and recommendations

After the debate the time has come for the summary of the discussion and formulating ideas for recommendations. E. Malicka took the participants through a roundup of the discussions. Below are the points she highlighted:

- The financing issue, in particular the problem of the financial capacity of the Ugandan site owners/developers to meet the financial requirements.
- Need of local expertise on HPP designing.
- Lack of infrastructure to deliver electricity generated in planned SHPPs to the power grid leading to risk of non-bankability of projects.
- Need of outcomes from feasibility studies to be shown to HYPOSO pilot projects developers.
- Scarcity of in-depth information to develop sites identified in the HYPOSO Map and the need of continuation of HYPOSO.
- Prohibition by the electricity regulator to proceed with a few projects at the same time and necessity to complete one project before applying for another.
- The problem of time-consuming procedures to obtain permits while other permits expire and need for regulatory bodies to communicate to each other or need for a one-stop shop for HP development; E. Malicka explained the issue of having a one-stop shop, which she said would help have the different regulatory functions under one roof but is not easy to introduce as the example of the European countries also show.
- Need to engage government to provide solutions to overcome the barrier mentioned above and need for representation of HP developers on government consultative forums as well as the need for representation of government at hydropower sector's events.
- Lack of knowledge and/or information by applicants to develop hydropower projects and mistakes made by them in applications.
- Impacts of climate change and need to regularly update the HYPOSO Map.
- Need for insurance cover for HP projects; E. Malicka commented that, like in case of the Polish small hydropower association she represents, an insurance programme for SHP owners could be negotiated by an association in Uganda. Each SHP owner can then conclude an insurance contract on secure terms negotiated for members by their association.

After summarizing the discussion and drafting the ideas of recommendations E. Malicka reminded attendees of upcoming HYPOSO events:

- The B2B meetings between African stakeholders and EU hydropower industry,
- The HYPOSO business cooperation study tour for stakeholders from the target countries, and
- the Final HYPOSO event in Delft with presentation of recommendation papers elaborated among others based on the conclusions from the small hydropower framework conditions workshops.

Finally, E. Malicka gave a vote of thanks for the participation that made this Workshop on Framework Conditions very successful. She thanked D. Marlone and the HPAU team for organising the event.

Salima Kyomuhendo, a key stakeholder from UNREEEA, gave a vote of thanks to the HYPOSO team for organising the function on behalf of the participants.

T. Jawaid then gave closing remarks on behalf of the HYPOSO Project Coordinator. He appreciated all participants for their active engagement during the workshop.

D. Marlone emphasised the need for a successor project to the HYPOSO Project. He then encouraged participants to visit the websites of [www.hyposo.eu](http://www.hyposo.eu), [www.hpaul.org](http://www.hpaul.org) and [www.unreeea.org](http://www.unreeea.org) for more information and updates. He informed the participants that the Africa 2023 Conference and Exhibition on Water Storage and Hydropower Development that was postponed in 2022 was scheduled for July at Munyoyo Commonwealth Resort Hotel. The HYPOSO Project was expected to participate. He promised the participants more information once it was available. As for the team that was expected to travel for the European business cooperation study tour in May, he said preparations were underway and the shortlisted participants would be informed accordingly. He encouraged the participants to keep in touch in case of any follow up discussions. He then declared the workshop closed.

## 5.4 Annexes

### 5.4.1 Programme

To have an impression about the programme of the workshop an image of the distributed agenda of the event is shown in Figure 18.





*Hydro Power Solutions for Developing and Emerging Countries*

### Programme

#### Workshop on Small Hydropower Framework Conditions in Uganda

HOTEL AFRICANA, KAMPALA

Time	Activity	Responsible
8.30am-9.00am	Arrival and registration	Secretariat
9.00am-9.15am	Self introductions	Secretariat
9.15am-9.30am	Opening remarks from the Chief Guest	MEMD
9.30am-9.45am	Key note address from HYPOSO Advisory Board Member	Eng. Irene Muloni
9.45am-10.00am	Introduction - general information on the HYPOSO project	Ewa Malicka/Ingo Ball
10.00am-10.30am	Coffee Break	Hotel
10.30am-10.45am	Presentation of framework conditions for hydropower in Uganda based on the outcomes of framework analysis of the HYPOSO project	Dan Marlone
11.45am-12.00pm	Presentation of the selected 3 case studies in Uganda and potential barriers for these projects' development	Studio Frosio – pre-recorded
12.00pm-12.20pm	HYPOSO Map – identification of potential small hydropower sites in the target country	VDU – pre-recorded
12.20pm-12.30pm	HYPOSO Platform	Tasniem Jawaid

*A Project Funded by the European Union, Implemented by Hydro Power Association of Uganda*  
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 Email: [dmarlone@yahoo.com](mailto:dmarlone@yahoo.com), Websites: HPAU [www.hpau.org](http://www.hpau.org), HYPOSO [www.hyposo.eu](http://www.hyposo.eu)

  		
12.30pm-1.00pm	Small Hydropower in Uganda and its Role in Clean Energy Transition – the perspective of the State Policy	MEMD
1.00pm-2.00pm	Lunch Break	Hotel
2.00pm-2.20pm	Barriers and experiences in the Small Hydropower Plants SHP development – the view of the private sector	Developer
2.20pm-2.40pm	Barriers and experiences in the Small Hydropower Plants SHP development – the view of the public sector.	Electricity Regulatory Authority
2.40pm-3.45pm	Discussion on recommendations for Uganda to facilitate national investment - friendly climates for hydropower based on the presented case studies and outcomes of the framework analysis	All participants – Dan Marlone/Tasniem Jawaid moderating
3.45pm-4.00pm	Summary of the discussion and follow up actions	Ewa Malicka
4.00pm-4.30pm	Award of Capacity Building Course Certificates	Tasniem Jawaid
4.30pm-5.00pm	Coffee and Departure at Leisure	Hotel

*A Project Funded by the European Union, Implemented by Hydro Power Association of Uganda*  
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 Email: [dmarlone@yahoo.com](mailto:dmarlone@yahoo.com), Websites: HPAU [www.hpau.org](http://www.hpau.org), HYPOSO [www.hyposo.eu](http://www.hyposo.eu)

Figure 17: Programme of Workshop on Small Hydropower Framework Conditions in Uganda

### 5.4.2 Participants

To have an impression about the participants of the workshop the list is shown in Figure 19.

NO.	NAME	ORGANIZATIONS	DESIGNATION
1.	BUKUSUBA RODNEY	UNREEEA	MEMBER
2.	ELIZABETH K. OKWENJE	MEMD	PRINCIPLE ENERGY OFFICER
3.	MASENDI PATRICK	CREEC	PROJECT COORDINATOR
4.	BRONIAKATUSIIME	SMART TV	REPORTER
5.	MUSUBUZITESSU	SMART TV	CAMERA MAN
6.	TIBAGALIKAFELISTUS	REBI LTD	ACCOUNTANT
7.	SEMBATYABENARD	HPAU	SECRETARY
8.	DAVID LUBEGA	UEGCL	CM-NAMANVE
9.	MAEDERO SAMUEL	UCAN	TREASURER
10.	LOYCEMAEDERO	UCAN	MEMBER
11.	B.SARAH MABANGI	BAM ENTERPRISE LTD	MANAGING DIRECTOR
12.	ABDU KALEMA	HPAU	TREASURER
13.	ENG.DAVID CHEPTOEK	DIRECTORATEOF WATER RESOURCE MANAGEMENT	AG ASSISTANT COMMISSIONER
14.	ARNOLD JONATHAN AYENY	CREEC	PROJECT ENGINEER
15.	TASNIEMJAWAID	EREF	RENEWABLE ENERGY EXPERT
16.	EWAMALICKA	TRMEW	PRESIDENT
17.	JACOB SENDAGIRE	UNREEEA	PROGRAMS COORDINATOR
18.	NALUGYA AISHA	RWENKUBA ELECTRICITY CO.LTD	ELECTRICAL ENGINEER
19.	RACHEALKISAKYE	HPAU	SECRETARIAT
20.	MUHIRWA SHIRLEY	HYPOSO	SECRETARIAT
21.	ENG.JOSEPH BWAMBALE	TICOPLAN	MD
22.	KEDDIDAPHINE	UCAN	SECRETARY
23.	MUKUNYA STANLEY	UBC TV	REPORTER
24.	MBAINEBENARD	SEBEI HYDRO	DIRECTOR
25.	JAN PILAR	SEBEI HYDRO	DIRECTOR
26.	MUTUNGYI MUHAMMAD	HPAU	SECRETARIAT
27.	KAMESEGE OFREY	BIVA	ED
28.	WINYI A.HAKIM	HPAU	MEMBER
29.	SYAYIPUMA PATRICK	RWENZORI POWER	DIRECTOR
30.	EMMANUEL RUHWEZA	GREEN FOCUS ENGINEERING	DIRECTOR
31.	BENSON KIZZA	POWERCON LTD	SECRETARY
32.	ELEANORAH C. TUNDA	HPAU	MEMBER
33.	LUMU STEPHEN	KIBAALHPC	DIRECTOR
34.	SOPHIE MUKITE	UCAN	OFFICER
35.	SOLOMON OKONGOOOLA	HPAU	NEC MEMBER
36.	SHABANSERUNKUMA	CONSENT	DIRECTOR
37.	PAUL MWIRUMBI	HPAU	BOARD MEMBER
38.	KYOMUHENDOSALIMA	UNREEEA	FINANCE MANAGER
39.	ALI KAYONJO	GFE	CEO
40.	MBEIZA CHRISTINE	HPAU	SECRETARIAT
41.	MARK LUBEGA	HPAU	C/M
42.	EMILLYMUSIIMENTA	HPAU	MEMBER
43.	NAMBIRESTY	HPAU	MEMBER
44.	NAGAWATRACY	HPAU	MEMBER
45.	KAYONDO SAM TREVOR	HPAU	MEMBER
46.	SAM SENDIWALA	HPAU	MEMBER
47.	NAKABOWA SARAH	HPAU	MEMBER
48.	KAYEMBA HAKIM	HPAU	MEMBER
49.	DAN MARLONE	HPAU/HYPOSO	CHAIRMAN (AG)

Figure 18: List of participants of Workshop on Small Hydropower Framework Conditions in Uganda

## 6 Workshop on the framework conditions for small hydropower in Bolivia

### 6.1 Overview

The Workshop on Small Hydropower Framework Conditions in Bolivia was held on 22 July 2022 in Cochabamba. It was organised by the project partners TRMEW (Poland) and UMSS (Bolivia). The workshop, taking place at Universidad Mayor de San Simón (UMSS), brought together 19 on site participants and over 55 online (for the detailed list of registered participants see chapter 6.4.2).



Figure 19: Participants of the Workshop on Small Hydropower Framework Conditions in Bolivia

Andres Gonzales (UMSS) opened the event and welcomed the guests, and after that Ms Ewa Malicka (TRMEW) gave opening remarks. Next, she presented the general information on the HYPOSO project as well as on the objectives of the workshop. The latter ones were defined as:

- presentation and discussion on the framework conditions for the development of small hydropower projects in Bolivia based on the analysis performed by HYPOSO experts and examples of selected case studies of small hydropower projects,
- discussion about the actual situation and needs for hydropower in Bolivia,
- discussion about proposals of facilitating the conditions of small hydropower projects development,
- concluding and making draft proposals of recommendations.

Subsequently, Mauricio Villazon (UMSS) presented the main outcomes of the analysis of the framework conditions for hydropower in Bolivia made within the project together with a Lithuanian partner – VDU. He gave an overview on the electricity mix and energy situation in Bolivia and described the actual situation of the small hydropower sector. He explained that:

- Small and micro hydropower plants are mainly built in isolated and dispersed rural areas.
- Most of the isolated rural areas are far from the national grid, so electricity generation from small/micro hydropower plants is the most efficient energy solution for these areas.

- Bolivian small hydropower plants are up to 5 MW, however within the HYPOSO project, the standard definition is up to 10 MW.



Figure 20: M. Villazon presenting the outcomes of the analysis of the framework conditions for hydropower in Bolivia

M. Villazon spoke about research need in the hydropower sector in Bolivia, stating that:

- Small number of companies limit the development of projects.
- There is lack of incentive from national government, organizational structures, financing mechanisms.
- There is no specialised Hydropower or Hydropower engineering study program in Bolivia.
- Hydropower is usually part of renewable or energy studies or even civil or mechanical engineering.

He listed the only academic institutions that somehow are involved in the hydropower sector, and they are:

- Laboratorio de Hidraulica (Hydraulics Lab) is a research unit of Universidad Mayor de San Simon (Cochabamba), and
- Instituto de Hidraulica e Hidrologia (Institute for Hydraulics and Hydrology) is a research unit of the Universidad Mayor de San Andres (La Paz).

Concluding, M. Villazon emphasised that:

- The HYPOSO project aims to support the development of emerging countries through hydropower solutions.
- Bolivia is a country with a high potential for generating electricity through the hydropower development (either micro, small, medium, or large schemes).

- There are very few companies in Bolivia offering services or equipment for hydro projects.
- There are restrictions about data access (national and private institutions).
- There is a need to encourage link between private companies (i.e., equipment manufacturing and/or distribution within the hydropower sector) and local institutions (e.g., national government, universities, and local companies).
- There is a need to improve organizational structures and financing mechanisms for encouraging the development of hydropower projects.



Figure 21: N. Frosio presenting three selected pilot sites

Next, Nino Frosio (FN) presented the three selected pilot sites (ROR\_464009, ROR\_464033 and Lampaya Pampa), for which, within the HYPOSO project, prefeasibility studies will be elaborated and presented to the European hydropower industry. These sites were visited by the project experts before the workshop. He concluded that the preliminary location of the main hydraulic works, such as intakes, conveying works and powerhouses, seemed to be proper and pointed out that in the RoR schemes, the most critical items were related to conveying structures, located along mountain slides with possible instability problems. Therefore, he stated, tunnels seem to be the most reliable option, despite its cost. He also said that the construction of a 95.000 m<sup>3</sup> pond foreseen for the Lampaya Pampa scheme was for sure challenging, however, it seemed to represent a great chance for the economic viability of that project.

In his final remarks, N. Frosio mentioned that the sites visits had encountered unexpected difficulties in accessing to some parts of the proposed schemes but the effective collaboration

with the partners' and the proposers' technicians had allowed partners who visited the sites to collect the basic information needed to arrange the sites evaluation at prefeasibility level.

N. Frosio added that the heads they had checked using GPS equipment and on the available maps nearly correspond to those mentioned in the preliminary evaluation of the proposers. In his opinion, the accurate flow rate measures, carried out regularly and in proper way by the proposers, would be a very important support to the design and to a reliable evaluation of the expected generation of the power plant.

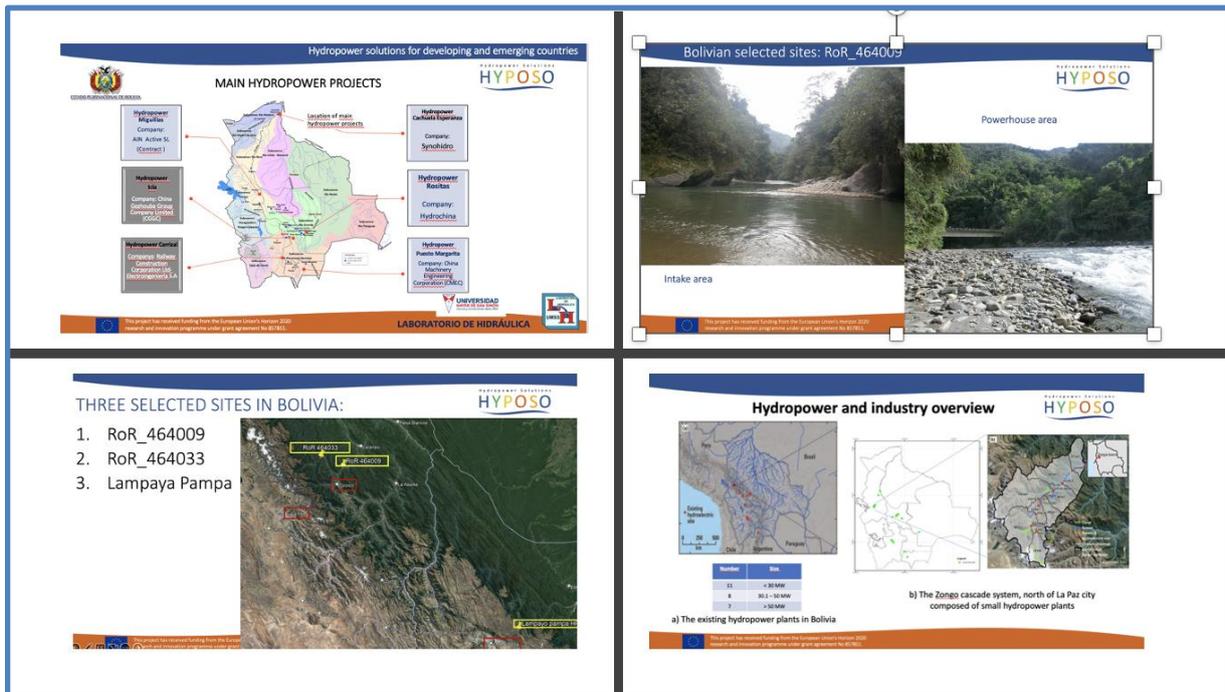


Figure 22: Image of fragments of presentations from the Workshop on Small Hydropower Framework Conditions in Bolivia

The presentations were followed by the discussion, moderated by prof. Bernhard Pelikan (FN), on the actual situation and needs for hydropower in Bolivia as well as on the ideas how these needs can be met and how the development of small hydro projects can be facilitated. The views and ideas were discussed together with invited guests, i.e., representatives of:

- Ministry of Energy,
- Ende Corporacion (National Electricity Corporation),
- Ende Corani,
- Ende Valle Hermoso,
- CNDC (national committee of Electricity Dispatchment),
- Antezana importations,
- FTI Bolivia,
- Ice Ingenieros,
- Synergia,
- UMSS (students and researchers of different units).

The details of the debate are described in chapter 6.2. The main points of the discussion were then summarized by prof. Pelikan which could serve as potential recommendations for decision makers in Bolivia on how to tackle the barriers faced by small hydro developers and investors (see chapter 6.3).

At the end of the workshop further outcomes of the HYPOSO project - the HYPOSO Map and the HYPOSO Platform - were presented to the participants as tools made to increase the number of investments in sustainable projects in target countries as well as to stimulate the market uptake of EU technologies there.

During the workshop an interview about the HYPOSO project and the workshop was recorded with A. Gonzales and broadcasted by UMSS media. It is available at the following link:

[https://fb.watch/jAehi8zI\\_4/](https://fb.watch/jAehi8zI_4/)



Figure 23: E. Malicka presenting the HYPOSO Map

## 6.2 Discussion

The debate on recommendations for Bolivia to facilitate national investment - friendly climates for hydropower based on the presented case studies and outcomes of the framework analysis was moderated by B. Pelikan. While opening the debate B. Pelikan explained that the aim of the meeting was to discuss legal, financial, and economical environment to increase the share of renewables, especially small hydropower, in Bolivia. B. Pelikan mentioned that some characteristics of the small hydropower sector in Bolivia and some needs in this respect had been already presented earlier that day by M. Villazon in his presentation.

The discussion started with a statement, made by one of the participants, that in Bolivia small hydropower projects are seen as the way to provide access to electricity for small towns or rural areas. As an example, he mentioned the region of Coroico river where the right side of the river has access to the grid while the left side has no access. He continued explaining that it is possible to make connections to the national electricity grid but also it is possible to have some substations fed by small hydropower plants to supply electricity to small towns or villages.

N. Frosio commented that one of the important aims of the HYPOSO project is to keep the social perspective. He recalled his experience in Africa pointing out that it is not only an access to electricity which can be important for local populations but also the cost of electricity provided. Other participants agreed that in Bolivia rural populations face similar problems. Mr



Figure 24: Participants discussing at the Workshop on Small Hydropower Framework Conditions in Bolivia

Janusz Steller (IMP PAN) added that he would appreciate to receive information on the needs of local communities living close to HYPOSO pilot sites because in the HYPOSO project he is responsible for providing the social impact assessment for these sites. He also wondered how electricity generated in SHPPs being pilot projects would be distributed. He suggested that it would be reasonable to even erect some local distribution grids to be able to distribute the electricity locally. In connection with this statement, another question emerged, whether the pilot sites would be connected to the grid or if they were planned to be off grid. B. Pelikan explained that they would be connected but the idea of the HYPOSO project is that they should have a substation and supply electricity to people leaving nearby. N. Frosio made a comment that from the technical point of view connection to the grid is always great opportunity for the power plant because if it is not connected to the grid, it exploits maximum 60 percent of the possible production.

Another participant asked if within the HYPOSO project there will be more SHPP's connected to the grid. Fernando Ledezma (UMSS) answered that there is a map of potential sites to be shown later at the workshop. B. Pelikan explained that the three pilot sites are showcases and more could be developed following these examples, but it is expected to happen beyond the framework of the HYPOSO project.

Rodrigo Antezana, representing the private sector wanted to know how a private company can be involved in the HYPOSO project. B. Pelikan explained that it is not possible to step in to HYPOSO project at this stage but when other projects are developed following the path shown by pilot projects, private companies can be involved in them. A recommended idea was to register at the HYPOSO Platform to make contacts, find potential partners and get involved in projects.



*Figure 25: Discussion at the Workshop on Small Hydropower Framework Conditions in Bolivia*

The next question was posed by M. Villazon to Jose Luis Flores from National Committee of Electricity Dispatchment (CNDC) about legal issues and possibilities for private investors to develop SHP projects. J. Flores answered that there is an authority (Vice Minister of Energy) making decisions about grid connections by private SHP investors. N. Frosio asked if such SHPPs owners can consume electricity from their plants in their own companies and if it is possible to sell generated electricity to others. J. Flores answered that theoretically both options are possible. N. Frosio recommended a model, which he finds very effective in case of small hydro, in which electricity from SHPP is first supplied to rural areas or local companies and then delivered to the national grid. One of the participants commented that there are some models of this character where plants cover the needs of their own factories or towns and then feed the electricity grid with surpluses but these models in Bolivia are more related to biomass energy.

The next question was posed by B. Pelikan about the number of private SHP plants in Bolivia and the answer was that there are 3 or 4 companies with private plants. They also work in a

model of self-consuming electricity first and feeding the grid with surpluses. E. Malicka asked if there is any general law for these kinds of private projects or if regulatory conditions for them regarding grid connection or electricity distribution and sale are decided case by case. J. Steller added that such principles and tariffs in Europe are established and known in advance for investors. E. Malicka also asked about distinction in electricity prices paid to generators depending on the source of electricity. F. Ledezma answered that there are regulations with such distinction.

Next, N. Frosio asked about the attitude of the environmentalists towards small hydropower in Bolivia. M. Villazon answered that small hydropower projects are welcome while larger plants face protests. Oliver Saavedra from Universidad Privada Boliviana added that in case of large projects the problems are more social than environmental, and they relate to the need of compensation for people for flooding their lands.

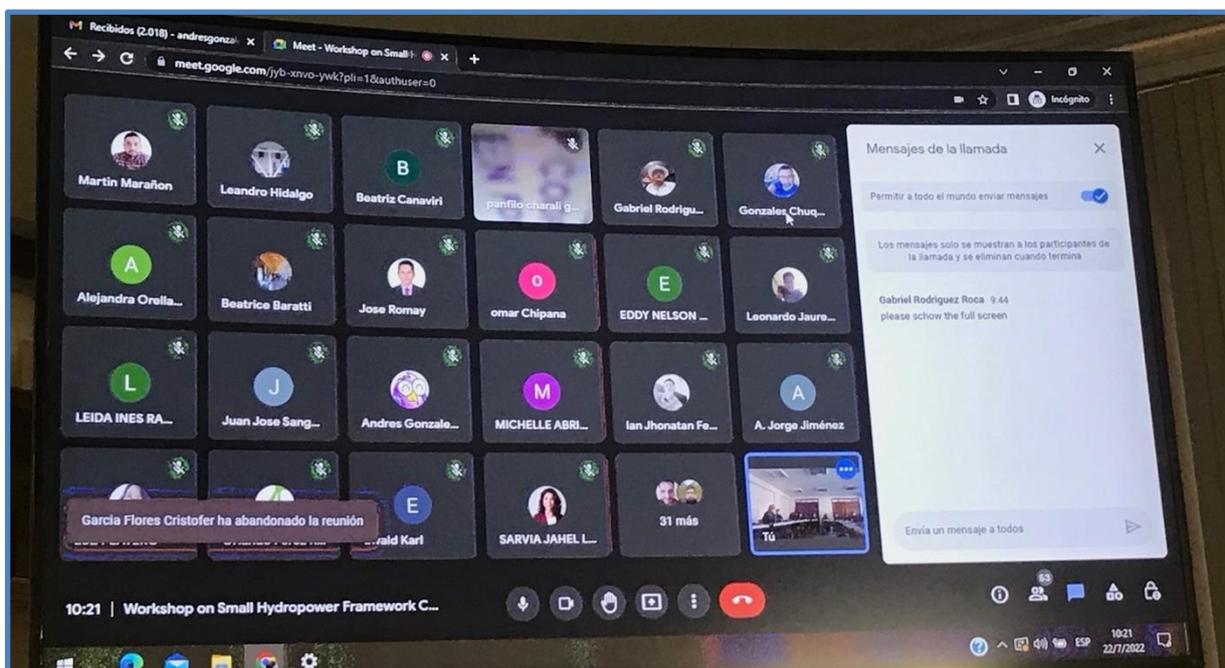


Figure 26: Online participants of the Workshop on Small Hydropower Framework Conditions in Bolivia

Other comments came online from Orlando Perez representing a private company. He expressed a need for contact details to officials who oversee new projects at state agencies permitting small hydro. He also informed about a special regulation for small generators (up to 350 kW) which is related to distributed generation. He suggested that the ministry could upgrade the capacity to which this regulation applies.

The case studies in Bolivia were of interest for the participating ENDEs. They asked about the timing (when project studies will be available) and about funding possibilities for these projects. B. Pelikan answered that prefeasibility studies should be available by April 2023. More questions were then asked about pilot sites in Bolivia and the scope of the prefeasibility studies for them. Next steps concerning pilot projects were also subjects of participants' questions.

Subsequently, N. Frosio asked if there are different regulatory approaches for different sizes of dams in Bolivia. B. Pelikan gave an example of Austria where for dams up to 15 meters high and of capacity up to 1 million cubic meters the procedures are easier. It turned out that in Bolivia it is evaluated case by case by the Ministry of the Environment.

The next speaker representing environmental consultancy agency commented about the environmental procedures in Bolivia, explaining that there are four categories of assessments need to be conducted. And both ministries (of environment and energy) reveal these studies for several months. He indicated the regulations from which these procedures come from.

Finally, some local researchers from UMSS expressed their interest in the HYPOSO Map, especially in the possibility of downloading different layers from it.

### 6.3 Conclusions and recommendations

After the debate the time came for the summary of the discussion and formulating ideas for recommendations, which was made by B. Pelikan. He concluded the meeting by mentioning the following:

- There is a lack of regulations for small hydropower even in some basic issues. Case by case regulations often applied in Bolivia for hydropower projects are not good for the sector because investors have no guarantees what decisions will be made regarding their projects, which are quite costly. This is a discouraging factor for investors.
- In cases regulations exist they often come from a few authorities. It would be recommended to have a one stop shop. Such a solution is not easy to introduce (even not working in European countries) but it would facilitate projects.
- There is little experience in private hydropower projects, only 3-4 private companies developing small hydropower projects. For comparison, in Austria or Italy there are around two thousand private small hydropower plants in each country.
- Regarding environmental aspect, it seems to be an advantage that small hydro does not cause severe problems. In some countries (like Austria) it is sometimes quite opposite since environmental organisations consider that small hydropower plants generate little electricity, and their environmental impact can still be large.
- Another advantage is the existence of tariffs for small hydropower and other renewable electricity generators in Bolivia.
- It is very important to guarantee the supply of electricity from small hydropower projects to local communities so they can benefit from these kinds of projects. This can be compared to the situation in Europe some time ago. Communities without access to national grids were supplied with electricity from small hydro with an isolated grid. With time these isolated grids were connected to national grids. Therefore, it is good model to follow - starting with isolated grids and then connecting the SHP plants to the national grid.

- The HYPOSO Platform is a useful tool for Bolivian stakeholders. ENDEs showed interest in this application, due to the need to contact companies for equipment supply. Also, the representatives of private companies showed interest since they want to represent equipment offers in Bolivia.

## 6.4 Annexes

### 6.4.1 Programme

To have an impression about the programme of the workshop an image of the distributed agenda of the event is shown in Figure 28.




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### Programme

**Workshop on Small Hydropower Framework Conditions in Bolivia**

22 July 2022, 9.00 – 13.00, UMSS

9.00 - 9.15	Introduction - general information on the HYPOSO project
9.15 – 9.45	Presentation of framework conditions for hydropower in Bolivia based on the outcomes of the HYPOSO framework analysis
9.45 – 10.00	Presentation of the selected 3 case studies in Bolivia and potential barriers for these projects' development
10.00 – 11.00	Discussion on recommendations for Bolivia to facilitate national investment - friendly climates for hydropower based on the presented case studies and outcomes of the framework analysis
11.00 – 11.15	Summary of the discussion and recommendations
11.15 – 11.30	Appendix 1 HYPOSO Map – identification of potential small hydropower sites in Bolivia
11.30 – 11.45	Appendix 2 HYPOSO Platform
11.45 – 13.00	Lunch break

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The HYPOSO Project has received funding from the European Union's H2020 research and innovation programme under grant agreement No 857851



Figure 27: Programme of Workshop on Small Hydropower Framework Conditions in Uganda

### 6.4.2 Participants

To have an impression about the participants of the workshop the list is shown in Figure 29.

Workshop Participants on Small Hydropower Framework Conditions in Bolivia JULY 22nd, 2022 - UMSS			
	Last name	Name	Institution
1	Antezana	Rodrigo	DIMARO
2	Avilés Ribera	Daniel Bernardo	LHUMSS
3	Baratti	Beatrice	FROSIO NEXT
4	Bautista Condori	Ruben	ENDE CORPORACION
5	Cardozo Rocabado	Evelyn	CUZE-FCYT
6	Chipana	Omar	Unidad de Sistema de Alerta Temprana - La Paz
7	Coca Guzmán	Rayza Bolivia	UMSS
8	Escobar	Marco	UMSS
9	Flores	Jose Luis	Comité Nacional de Despacho de Carga
10	Frosio	Nino	FrosioNext
11	Gamra	Mario Carmelo	UAJMS - Universidad Autónoma Juan Misael Saracho
12	Gonzales Amaya	Andrés Saul	LHUMSS
13	Guillén Salvador	Roxana	UMSS
14	Guzmán Peñaloza	Sergio Leonidas	LHUMSS
15	Heredia Gomez	Marcelo Waldo	LHUMSS
16	Hidalgo Rodriguez	Ariel	ENDE CORPORACION
17	Jaldin Ochoa	Gustavo	ENDE CORANI
18	Ledezma Perizza	Fernando Arturo	LHUMSS
19	Magne Sejas	Angelica Rocio	RED DE ENERGIAS
20	Malicka	Ewa	TRMEN (HYPOSO)
21	Martinez Caliva	Virgilio Efrain	ASDI
22	Mercado García	Nereida Gabriela	ENDE CORPORACION
23	Muñoz Vasquez	Galo Osvaldo	LHUMSS
24	Nina Crespo	Humberto	ENDE CORANI
25	Orellana Casazola	Maria Alejandra	ENDE CORANI
26	Pelikan	Bernhard	Frosio Next
27	Perales	Moises	UAJMS - Universidad Autónoma Juan Misael Saracho
28	Perez	Orlando	
29	Prado	Pablo	UMSS
30	Ramirez Villarroel	Leida Inés	UMSS
31	Rodriguez Roca	José Gabriel	HIDROELECTRICA KANATA
32	Rojas Zamabrana	Daniel	ENDE CORPORACION
33	Romay Bortolini	José Maria Salvador	VICEMINISTERIO DE ENERGIAS
34	Romero Mérida	Luis Mauricio	LHUMSS
35	Saavedra	Oliver	Universidad Privada Boliviana
36	Steller	Janusz	Institute of Fluid - Flow Machinery Pol Ac Sce
37	Vasquez Bazoalto	Juan Veimar	ENDE CORPORACION
38	Villazón	Mauricio	UMSS

Figure 28: List of participants of Workshop on Small Hydropower Framework Conditions in Bolivia

## 7 Workshop on the framework conditions for small hydropower in Ecuador

### 7.1 Overview

The Workshop on Small Hydropower Framework Conditions in Ecuador was held on 26 July 2022 in Quito, the capital of Ecuador. It was organised by the project partners TRMEW (Poland) and EPN (Ecuador). The workshop, taking place at Hemicycle of the Escuela Politécnica Nacional (EPN), brought together 48 participants (for the detailed list of participants see chapter 7.4.2).



Figure 29: Participants of the Workshop on Small Hydropower Framework Conditions in Ecuador

Patricia Haro, Professor at EPN opened the event and welcomed the guests, and after that Ewa Malicka (TRMEW) presented the general information on the HYPOSO project as well as on the objectives of the workshop. The latter ones were defined as:

- presentation and discussion on the framework conditions for the development of small hydropower projects in Ecuador based on the analysis performed by HYPOSO experts and examples of selected case studies of small hydropower projects,
- discussion about the actual situation and needs for hydropower in Ecuador,
- discussion about proposals of facilitating the conditions of small hydropower projects development,
- concluding and making draft proposals of recommendations.

Next, Luis Rios, Professor at EPN presented the main outcomes of the analysis of the framework conditions for hydropower in Ecuador made within the HYPOSO project together with a Lithuanian partner – VDU. He gave an overview on the electricity situation in Ecuador and described the actual situation of the small hydropower sector, including permitting procedures and financing options for small hydropower plants. Moreover, he listed the following challenges for development of small hydropower plants in Ecuador:

- Lack of technical information;
- No effective technical integration of small hydropower plants into the electricity system;

- Prioritising large hydropower plants by the government because of demand which diminishes importance of small hydropower;
- A need to define strategies for the development of small hydropower plants through public-private partnerships.



Figure 30: L. Rios presenting the main outcomes of the analysis of the framework conditions for hydropower in Ecuador

Next, Nino Frosio (FN) presented the three selected pilot sites in Ecuador (Nanegal 2, Tandayapa and Gala), for which, within the HYPOSO project, prefeasibility studies will be elaborated and presented to the European hydropower industry. These sites were planned to be visited by the project experts after the workshop. In his final remarks, N. Frosio pointed out that EPN supplied FN a very detailed analysis of possible layouts of Nanegal 2 and Tandayapa schemes. It was considered very useful for FN during the planned site visits and as a starting point for the definition of the final layout of these two schemes. About the present draft of the Gala scheme, he said that it looked like quite difficult to finance due to the very long conveying works referred to its rated capacity. N. Frosio also thanked EPN partner for its proactive and effective collaboration.

Subsequently, Fernanda Jara, representing the Ministry of Energy and Mines (MEM) presented the view of the State Policy on small hydropower in Ecuador. She spoke about regulations for electricity sector in Ecuador, particularly about those for the development of small hydropower sector. She mentioned the following regulations important for small hydro:

- REGULATION 005/2021 "Participation of Self-generators and Co-generators in the Electricity Sector" with the objective to establish the technical, operational, and commercial conditions for the participation of self-generators and co-generators in the Ecuadorian electricity sector.
- REGULATION 001/21 "Regulatory framework for Distributed Generation for self-supply of regulated electricity consumers" with the objective to establish the provisions for the process of qualification, connection, installation, and operation of distributed

generation systems based on renewable energy sources for the self-supply of regulated consumers.

- REGULATION 002/2021 "Regulatory framework for the participation in Distributed Generation of companies authorised to carry out generation activities", which is now suspended and at the review. The objective of this regulation is to establish the technical and commercial conditions to be fulfilled with respect to the development and operation of distributed generation plants owned by companies that are authorised by the Ministry to carry out the generation activity.



Figure 31: From the left: N. Frosio presenting the three selected pilot sites and F. Jara presenting the perspective of the State Policy on small hydropower in Ecuador

Two next speakers, Alexandre Barahona, General Manager at CBS Ingeniería and Antoni Villagómez, Sub-Manager of Hydroelectricity at EPMAPS – Quito, delivered presentations on barriers and experiences in the SHP plants development respectively from the point of view of private and public sector.

A. Barahona elaborating on the experiences of small hydro projects development by private companies based on the example of the project which had been recently developed by the company he represents. The capacity of the SHP is less than 1MW and it entered to commercial operation on 20 November 2022. He pointed out the time of certain stages of the project development, namely: 1 year 7 months for construction (pandemic), 1 year 6 months for obtaining a credit, 3 years for obtaining qualification, 2 years for obtaining a grid connection and 1 year for obtaining a water permit.

He listed barriers for the development of projects grouping them in three categories and elaborated in detail on each category:

- Procedures and Licences:
  - Lack of legal clarity,

- Lack of legal certainty,
- Lack of decisiveness.
- Social opposition:
  - "Environmental" groups fomenting rejection,
  - Ignorance of people,
- Funding:
  - Problems with access to credits,
  - No "Project Finance" physical collateral.

Concluding, A. Barahona stated that the laws should not be cancelled, suspended, or changed within the period which was proposed earlier. The laws should fulfil their goals and purposes. He also suggested that the tariffs should be sincere. Stating that he gave an example of his company in which the repayment of the investment of a hydroelectric plant is under threat due to very low tariffs for generated electricity. He considers that there is a need of communication about small hydropower projects operation, and it should be standardised. Finally, he recommended that the state and the governments should promote credits to SHP projects via benefits to financial institutions.

A. Villagómez presented the scope of activity of the utility he represents (EPMAPS), showed examples of energy projects they develop, in which their intention is to increase energy efficiency, water resources management optimisation and development of alternative technologies as well as implementing a circular economy model. He also elaborated on the legal framework regulating these kinds of projects.

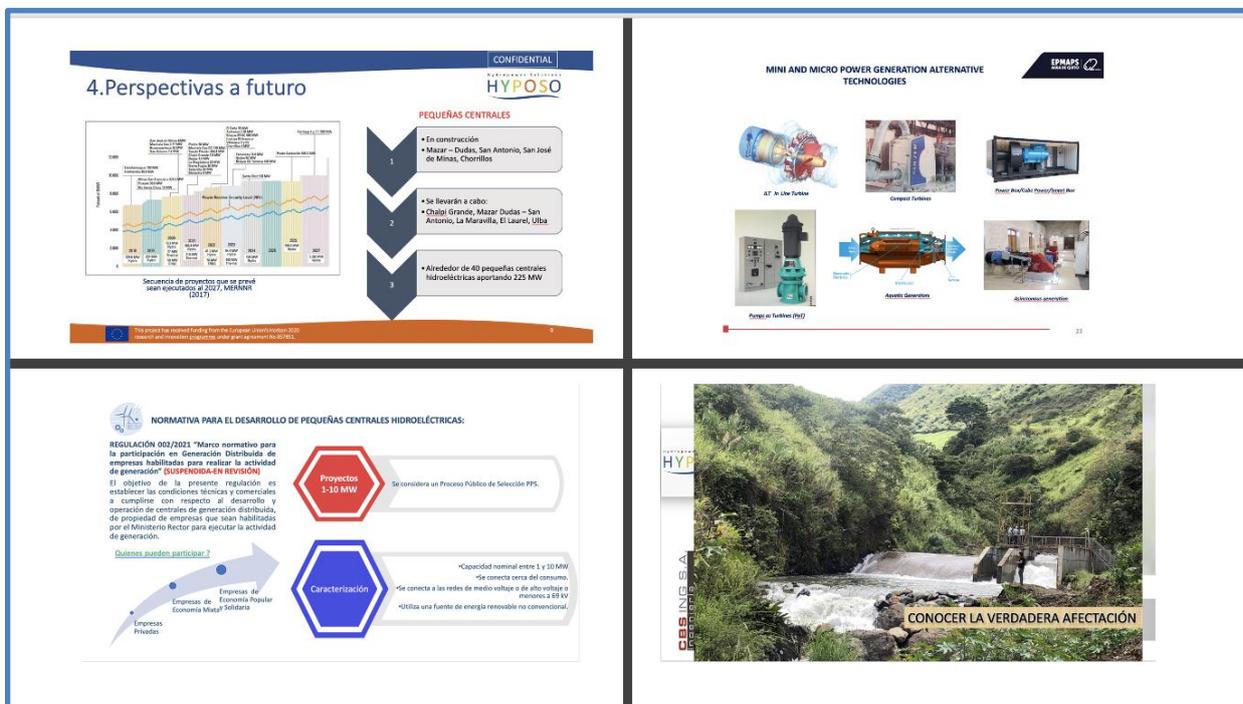


Figure 32: Image of fragments of presentations from the Workshop on Small Hydropower Framework Conditions in Ecuador

The presentations were followed by the discussion, moderated by prof. Bernhard Pelikan (FN) on the actual situation and needs for small hydropower in Ecuador as well as on the ideas how these needs can be met and how the development of small hydro projects can be facilitated. The views and ideas were discussed together with invited guests, i.e., representatives of two Ministries (the Ministry of Energy and Mine (MEM) as well as the Ministry of the Environment (MAAE)), public and private companies, scholars, and other stakeholders such as: CBS Ingenieria and CBS Energy, EPMAPS, MAATEARCERNNR, IIGE, Hidroequinoccio EP, Constructora Nacional, EEQ, CIE, Fundacion Cice, EPN, WIEN UNIVERSITAT and the HYPOSO experts. The details of the debate are described in chapter 7.2. The main points of the discussion were then summarized by prof. Pelikan and can serve as ideas for recommendations for decision makers in Ecuador on how to tackle the barriers faced by small hydro developers and investors (see chapter 7.3).



*Figure 33: Speakers of the Workshop on Small Hydropower Framework Conditions in Ecuador (from the left: A. Barahona, A. Villagomez)*

In the end of the workshop further outcomes of the HYPOSO project - the HYPOSO Map and the HYPOSO Platform - were presented by J. Steller and E. Malicka as tools made to increase the number of investments in sustainable projects in target countries as well as to stimulate the market uptake of EU technologies there.

## 7.2 Discussion

The debate on recommendations for Ecuador to facilitate national investment - friendly climates for hydropower was moderated by B. Pelikan. While opening the debate B. Pelikan explained that the aim of the meeting is to discuss legal, financial, and economical framework to increase the share of renewables, especially small hydropower, in Ecuador. Then he invited guests to ask questions and make statements.



Figure 34: Speakers and Participants at the Workshop on Small Hydropower Framework Conditions in Ecuador

The first speaker raised the problem of regulatory stability. He pointed out that it is not acceptable that the regulations which allowed investors certain calculations of electricity prices were suddenly changed for the projects which had started operation. He also underlined that obtaining an authorisation for the use of water takes very long time (years). B. Pelikan responded that within the HYPOSO project recommendations to solve these types of problems will be elaborated. He referred to the experience of European countries where there is a long history of activities promoting small hydropower, participating in legislative processes, and providing recommendations for European governments by the small hydropower sector. E. Malicka confirmed that one of the aims of the ongoing workshop is to elaborate the input for the recommendation papers which will be elaborated within the HYPOSO project and then submitted to policy makers.

J. Steller added that it is important to have appropriate arguments to be able to promote small hydro and distributed sources of electricity. And such an important argument is the quality of the electricity provided to the grid by small hydropower plants which enables avoiding transmission losses. He also underlined the importance of multipurpose use of dams – not only for the electricity generation but also for water supply, water storage etc.

The next speaker mentioned that the thought he wanted to share is that SHP projects are always related to water. So, it should be an issue of municipalities to be interested in developing SHP projects. It can give them the possibility to become self-sufficient.

The subsequent speaker wanted to comment on the electricity quality in Ecuador. His company is experienced in developing many kinds of projects and the quality of the grid has often been very bad with a lot of shutdowns. In some regions (for example around Quito) it is much better now but in some distant areas it still is a problem. He confirmed that an SHP operation can significantly increase the quality of the grid. Based on the example of one of the projects his company developed, he argued that the quality of the grid declines dramatically when the SHP they operate stops.



Figure 35: Participants discussing at the Workshop on Small Hydropower Framework Conditions in Ecuador

Then, J. Steller commented on A. Villagómez's presentation on the various technologies of energy recovery showed. He asked about the efficiency of such projects and on regulations applicable to them. A. Villagómez answered that the issue of efficiency is under tests in the lab.

The next speaker began his speech by explaining that the problem in Ecuador does not only concern technical losses in the grid but also commercial/business losses because of the threats associated with situation in every province. As for quality of service, he clarified that indicators are different for different companies providing electricity. He also mentioned a problem of projects which have obtained the enabling titles (they allow to build a project) but haven't yet started operation. The enabling titles include among others a water concession. Having this concession granted, investors are obliged to pay water fees which presents a serious problem since the power plant is not yet operational. Therefore, there is an obligation to pay for water even though it is not yet used for electricity generation.

The next problem mentioned was the tariff for electricity. Investors find the period for which it is established (15 years) too short. They find it discouraging not to be able to determine what the rate of the price will be after 15 years.

The following speaker representing the Ministry of the Environment advised that the problems faced by investors should be reported to authorities which grant concessions and then they can report about them to policymakers. She also advised stakeholders to report the issues directly to the policy makers (for example the ministry she represents). Such "teamwork" may help finding solution. She confirmed the willingness of the ministry to interact with the project developers.

Another participant, a project developer of the Palmira project, complained about the financial barriers caused by the policies that are not clear. He recalled the mentioned before problem of payment obligation even though the project is not yet operative. He also confirmed the lack of knowledge about the period when the guaranteed price time expires. He appreciated the possibility to exchange those kinds of problems between stakeholders and policy makers.



Figure 36: Participants of the discussion at the Workshop on Small Hydropower Framework Conditions in Ecuador

The following speaker wondered about the differences in length of procedures between Ecuador and other countries. E. Malicka commented that lengthy procedures constitute a problem in many countries, including Europe. She underlined the value of sectoral associations which connect stakeholders and enable them discussing problems, comparing experiences and what's more important provide opinions and statements to decision makers. She also gave an example of good practice concerning water fees that had been introduced in Poland (requiring payments calculated as a percentage of a power plant's electricity production revenues). Concluding, she encouraged to set up a small hydropower association in Ecuador. J. Steller asked about the details of water fees and ecological flow regulations. He also wanted to know what kind of opposition there is protesting small hydro.

The Ministry of the Environment's representative answered that the regulations on ecological flows depend very much on a project. A water impact assessment is requested to determine what kind of water species are present in a water body. She pointed out that ecological flows are not easy to determine because the regulations relate to large projects. She underlined that it is important to present proposals for policy makers and the Ministry is open to discuss on them.

Another participant explained the question of water fees system in Ecuador. He cleared that the way the water fee is calculated and imposed on a SHP is a cubic meter per second. Concerning fish ladders, he added that in modern projects there is an obligation in each project to include it. He mentioned that some exceptions can be made in case of public projects but not in case of private ones.

### 7.3 Conclusions and recommendations

After the debate the time has come for the summary of the discussion and formulating ideas for recommendations, which was made by B. Pelikan. He pointed out the main matters indicated by the participants which included:

- the need of severe improvement of the legislation with regards to regulations on small hydropower including simpler approach towards this kind of projects and clear distinction between small and large hydro,
- the need to improve the feasibility of small hydro projects which seemed to be closely related to better access to information on projects development procedures. In this respect a recommendation of creating a small hydropower association in Ecuador was formulated,
- the need of stability of tariffs at least for projects payback period,
- the need of improvement of water fees system,
- the need to improve the allocation of the existing “green credits”,
- the significance of energy recuperation combining portable and wastewater systems with hydropower.

## 7.4 Annexes

### 7.4.1 Programme

To have an impression about the programme of the workshop an image of the distributed agenda of the event is shown in Figure 38.





**Soluciones Hidroeléctricas para Países en Desarrollo y Emergentes.**  
**Pais Objetivo: Ecuador**

**PROGRAMME: Workshop on Small Hydropower Framework Conditions in Ecuador**

Tuesday, 26th July 2022 Hemicycle of the Escuela Politécnica Nacional,  
Address: Av. Ladrón de Guevara 253, Quito 170517

TIME	INTERVENTION
9.00-9.15	Introduction - general information on the HYPOSO project <i>Ewa Malicka (TRMEW)</i>
9.15 – 9.35	Presentation of framework conditions for small hydropower in Ecuador based on the outcomes of the HYPOSO framework analysis <i>Luis Rios (EPN).</i>
9.35 – 9.55	Presentation of the selected 3 case studies in Ecuador <i>Nino Frosio (Frosio Next)</i>
9.55 – 10.15	Small Hydropower in Ecuador from the perspective of the State Policy <i>Delegado del Ministerio de Energía y Minas (MEM)</i>
10.15 – 10.35	Barriers and experiences in the Small Hydropower Plants SHP development – the view of the private sector. <i>Alexandre Barahona – General Manager (CBS Ingeniería)</i>
10.35 -10.55	Barriers and experiences in the Small Hydropower Plants SHP development – the view of the public sector. <i>Antonio Villagómez – Sub-Manager of Hydroelectricity (EPMAPS – Quito)</i>
<b>10.50 – 11.20</b>	<b>Coffee Break</b>
11.20 – 12.20	Discussion on recommendations for Ecuador to facilitate national investment - friendly climates for small hydropower based on the presentations and outcomes of the framework analysis <b>Moderadores: Bernhard Pelikan (Frosio Next) y Luis Rios (EPN)</b>
12.20 – 12.50	Summary of the discussion and recommendations <b>Bernhard Pelikan (Frosio Next)</b>
14.45 - 15.00	Appendix 1 HYPOSO Map – identification of potential small hydropower sites in Ecuador <i>Janusz Steller (IMP PAN)</i>
15.00 - 15.15	Appendix 2 HYPOSO Platform <i>Ewa Malicka (TRMEW)</i>
<b>13:40 –14:40</b>	<b>Lunch</b>

Un proyecto financiado por la Unión Europea (Horizon 2020), Implementado por la Escuela Politécnica Nacional - EPN,  
Ladrón de Guevara E11-253. Telf. 2976300 ext.1615 / 0984832310 / 0996030826. Quito, Ecuador. E-mail:  
[patricia.haro@epn.edu.ec](mailto:patricia.haro@epn.edu.ec); [maria.guerra@epn.edu.ec](mailto:maria.guerra@epn.edu.ec).

Figure 37: Programme of Workshop on Small Hydropower Framework Conditions in Ecuador

## 7.4.2 Participants

To have an impression about the participants of the workshop the list is shown in Figure 39.

PARTICIPANTS - WORKSHOP IN FRAMEWORK CONDITIONS IN ECUADOR				
26TH, JULY 2022 HEMICICLO				
Nr.	Name and surname	Professional role	Organisation	Organisation
1	Nino Frosio	Senior Advisor	Frosio Next	Frosio Next
2	Januz Steller	Head of IMP PAN Cavitation DPT.	IMPA PAN	IMPA PAN
3	Bernhard Pelikan	Senior Advisor	Frosio Next	Frosio Next
4	Ewa Malicka	Senior Advisor	TRMEW	TRMEW
5	Luis Rios Cando	Professor		EPN
6	Patricia Lorena Haro	Professor		EPN
7	Alexandre Barahona DosSantos	General Manager	CBS Ingenieria y CBS Energy	CBS Ingenieria y CBS Energy
8	Antonio Villagómez S.	Sub Manager of Hydroelectricity		EPMAPS
9	Xavier Vera Grunauer	Minister of Energy		
10	Ing. José Medina	Subsecretario de Generación y Transmisión de Energía	Ministerio de Energía y Minas	MEM
11	Fernanda Jara	Directora de Expansión de la Generación y Transmisión de Energía		
12	Miguel Atapuma			
13	Andrea Johanna Hernández Sánchez	Directora Normativa y Control Ambiental	Ministerio del Ambiente, Agua y Transición Ecológica	MAATE
14	Nuria Valarezo	Especialista de Control de Calidad		
15	Mayra Briones	Cordinadora Proyecto PROMADEC		
16	Fabrizio Porras		Agencia de Regulación y Control de Electricidad, en la Agencia de Regulación y Control de Energía y Recursos Naturales no Renovable	ARCERNNR
17	Kervin Chunga	Director Ejecutivo		
18	Phd. Ricardo Narvaez	Subdirector Técnico del IIGE	Instituto de Investigación Geológico y Energético	IIGE
19	Javier Moltalvo			
20	Diego Almeida Bermeo	Gerente de Energía		
21	Esteban Fernandez	Jefe Administrativo-Financiero		
22	Jorge Romero		SHP Palmira - Nanegal	Constructora Nacional
23	André Proaño			
24	Oscar Stalin Guerrero Quistial			
25	Gabriela Alexandra Sánchez Vinocunga	Planificación		
26	Christian Santiago Díaz Quilumba			
27	Eugenio Carrera Recalde			
28	Geovanny Alejandro Chamorro Ruiz	Analista		EPMAPS
29	Juan Carlos Gancino Gancino			
30	Orlando Flores	Operador		
31	Juan Fernando Baño	Operador		
32	Luis Collaguazo Gómez	Unidad de Riesgos Naturales		
33	Gabriela Maldonado			
34	Francisco Javier Panchi Pomboza	Jefe del Dpto. de Centrales Hidroeléctricas	Empresa Eléctrica Quito	
35	Alfredo Mena	Director Ejecutivo	Corporación para la Investigación Energética	CIE
36	Ricardo Buitrón Aguirre	Consultor		
37	Luis Ordóñez Moncayo	Director General	Fundación CICE	Fundación CICE
38	Carlos Javier Baque Baque	External Worker - Research Assistant	Escuela Politécnica Nacional	EPN
39	Ricardo Sebastián Sandoval Garzón	External Worker - Research Assistant		
40	Patricia Lorena Haro	Professor		
41	Maria José Guerra Amán	External Worker - Research Assistant		
42	Carlos Barahona	Manager CBS Ing		CBS Ingenieria y CBS Energy
43	Fernando Barahona	Hydropower Plant Manager		
44	Dayana Duque			
45	Gabriela Lara			
46	Bernardo Pacheco			
47	Paola Villafuerte			
48	Alex Barahona			

Figure 38: List of participants of Workshop on Small Hydropower Framework Conditions in Ecuador

## 8 Workshop on the framework conditions for small hydropower in Colombia

### 8.1 Overview

The Workshop on Small Hydropower Framework Conditions in Colombia was held on 28 February 2023 in Medellín. It was organised by the project partners TRMEW (Poland) and CELAPEH (Colombia) in cooperation with Antioqueña Society of Engineers and Architects (SAI). The workshop, taking place in Medellín's well-known meeting venue - Club Unión Medellín, brought together 52 participants (for the detailed list of participants see chapter 8.4.2).



Figure 39: Participants of the Workshop on Small Hydropower Framework Conditions in Colombia

Carlos Velasquez (CELAPEH) opened the event and welcomed all participants. The opening was followed by the presentation delivered by Ingo Ball (WIP) on the general information about the HYPOSO project, on activities carried out to date in Latin America as well as on the objectives of the workshop. The latter ones were defined as:

- presentation and discussion on the framework conditions for the development of small hydropower projects in Colombia based on the analysis performed by HYPOSO experts and examples of selected case studies of small hydropower projects,
- discussion about the actual situation and needs for hydropower in Colombia,
- discussion about proposals of facilitating the conditions of small hydropower projects development,
- concluding and making draft proposals of recommendations.

Next, C. Velasquez presented the main outcomes of the analysis of the framework conditions for hydropower in Colombia made within the HYPOSO project together with a Lithuanian partner – VDU. He gave an overview on the electricity mix and energy situation in Colombia and described the actual situation of the small hydropower sector. He listed the following barriers for small hydropower development in Colombia:

- lack of political and economic incentives to SHP development,
- lack of manufacturing capacity for SHP components,
- lack of SHP specific expertise,
- poor capacity building facilities and programs for design and construction of SHP plants and associated works,

- lack of physical facilities for SHP equipment testing and applied research.



Figure 40: From the left: C. Velasquez presenting outcomes of the analysis of the framework conditions for hydropower in Colombia and I. Ball presenting general information on the HYPOSO project

In his final remarks he stated that SHP potential still mainly untapped due to lack of demand and difficult access. He appreciated HYPOSO for providing useful tools for site identification and assessment. C. Velasquez pointed out that environmental concerns about small hydropower are growing up so there is a need of work at all institutional levels. He hoped that HYPOSO project will help to improve social acceptance of SHP. In his opinion climate change, sustainable development objectives and energy transition, among other issues, will strongly foster SHP development during the coming years.

Subsequently, Beatrice Baratti (FN) in the pre-recorded presentation gave an overview on the three selected pilot sites (Aurra, Colibrí and Palace HPPs), for which prefeasibility studies are being elaborated within HYPOSO tasks. These sites were visited by the project experts in August 2022. B. Baratti concluded that:

- The preliminary chosen location of the intakes and powerhouses are proper however some improvement could be possible for the conveying works.
- The very high head of Aurra, above 1.400 m, makes this scheme very interesting from the economical point of view, but it is also demanding in managing the phenomena of water hammer and oscillation of the water column during the regulation transient.
- The Palace rentability could be affected by the relatively low head compared to the length and the complexity of the conveying works, but, on the other hand, it benefits from good access facilities.

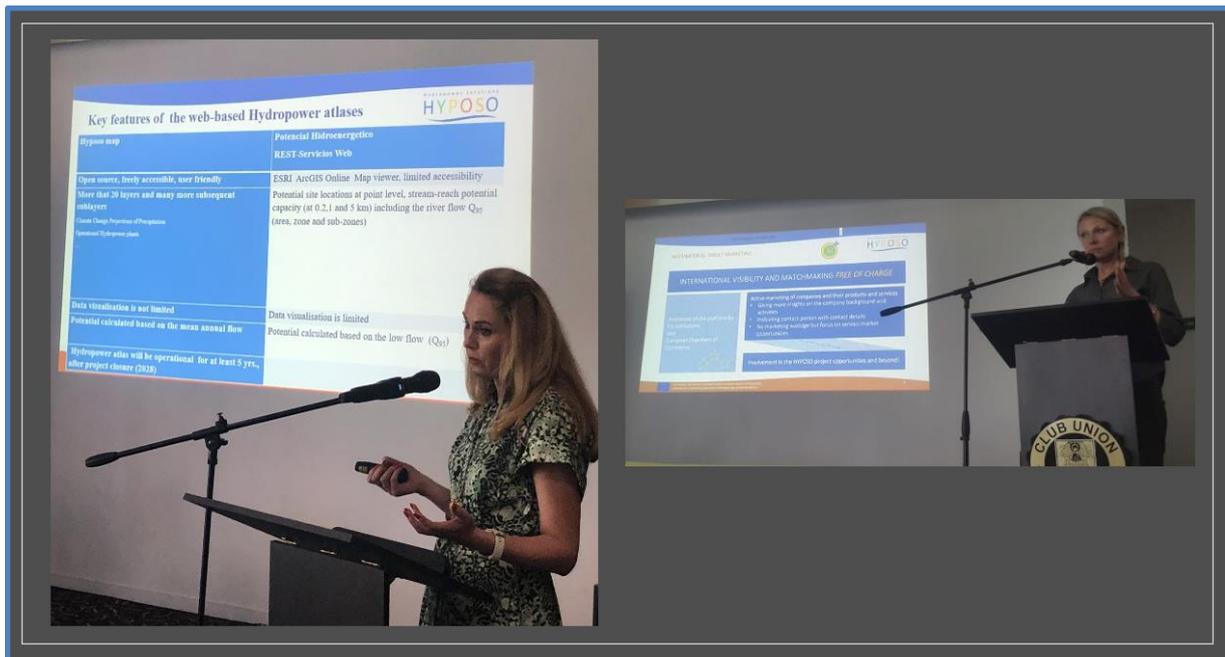


Figure 41: From the left: G. Vyčienė presenting the HYPOSO Map and E. Malicka presenting the HYPOSO Platform

In her final remarks B. Baratti stated that:

- The site visits allowed FN partners a detailed overview of the proposed schemes. Furthermore, thanks to effective collaboration with the local partners' and the proposers' technicians, the HYPOSO experts were able to collect all the basic information needed to prepare the sites evaluation at pre-feasibility level.
- The heads which had been checked by HYPOSO experts using GPS equipment and on the available maps nearly correspond to those mentioned in the sheets supplied by the proposers.
- From the point of view of the exploitable flow rates, the data available seem to be suitable to carry out a reliable evaluation of the expected production of the plants.

Next, further outcomes of the HYPOSO project were presented. The HYPOSO Map with all options for its use was shown in a presentation and a tutorial video by Gitana Vyčienė (VDU) and the HYPOSO Platform as an international promotion and partner mapping tool was presented by Ewa Malicka (TRMEW).

The introduction, which included five presentations to inform about the HYPOSO project, its objectives, tools developed, and the results of the analysis of the framework conditions, was followed by the discussion panels, moderated by C. Velasquez on the actual situation and needs for small hydropower in Colombia as well as on the ideas how these needs can be met and how the development of small hydro projects can be facilitated. Four discussion panels were organised, each one dedicated to issues related to one of the following specific stakeholders' groups:

- institutional stakeholders (government, regulatory and environmental authorities);
- project owners and developers;

- electric utilities with SHP portfolio;
- European manufacturers and suppliers.



Figure 42: Image of fragments of presentations from the Workshop on Small Hydropower Framework Conditions in Colombia

After the panel debates a plenary session, focused on barriers to SHP development and recommendations to eliminate or mitigate such barriers was organised, in which all the participants could give their ideas and comments. More details of the debates are described in chapter 8.2. The main points of the discussions and the ideas of recommendations for decision makers in Colombia on how to tackle the barriers faced by small hydro developers and investors are summarized in chapter 8.3.

## 8.2 Panel debates and plenary session

The debates on recommendations for Colombia to facilitate national investment - friendly climates for hydropower were a key part of the workshop. They were moderated by C. Velasquez. While opening the debates C. Velasquez explained that the aim of the meeting is to discuss legal, financial, and economic conditions and find the ways to increase the share of small hydropower in Colombia.

During panel debates each panellist was requested to explain spontaneously (without formal presentations) the role of their agencies and their own activities in the field of small hydropower, and the public was asked to raise questions. Similar dynamic was employed for all panels.

In the first panel panellists were selected among representatives of government, regulatory and environmental authorities. Government agencies were represented by IPSE, regulatory agencies by CREG and environmental agencies by CORANTIOQUIA and CORNARE.



Figure 43: Panellists at the Workshop on Small Hydropower Framework Conditions in Colombia

First panellist, Erica Alzate from CORNARE explained that her corporation has offices in municipalities and regional offices. They have autonomy to be an environmental authority in the territory, so any use of renewable natural resources must be authorised by the corporation (environmental licencing, use of waters etc.).

Regarding problems with SHPs, she mentioned a lawsuit filed recently by a local community against the SHP project which has been granted an environmental licence. She added that there is a lot of social pressure regarding small hydropower projects. She also stated that there are difficulties to assess a cumulative impact of an investment in many cases. She said that it was an important issue to improve some projects in terms of biology and civil works. She recalled some projects from the past which had had not fulfilled the obligations imposed and now the local communities are more suspicious about new projects. She concluded that the social perspective has become very important and communication and informative actions, like public hearings etc. are recommended.

C. Velasquez asked about the difference in the regulations for small and large hydropower projects. E. Alzate answered that the guidelines and the reference terms in CORNARE are adjusted to those provided by the Ministry of Mines and Energy. She complained that project consultants sometimes fail to determine the area of impact of an investment, and it may cause the failure in assessment of the environmental impact. However, she said, the requirements are the same for large and small projects. Regulations are applicable to all, but the area of impact may differ.

Next, a question was raised from the audience regarding the definition of an ecological flow. E. Alzate answered that an inventory of biologic species is made, and ecological flow must be adjusted to preserve them. She mentioned there are methodologies to do it.

The next panellist was Jorge Alberto Valencia a former Director of Gas and Energy Commission (CREG). He was also asked about differences in regulations for large and small hydropower. In his view, from the operational perspective, there is a big difference. Therefore, there are different regulations for run of river and reservoir hydropower plants. He explained that the difference is in the control of generation, i.e., between dispatchable and non-dispatchable generators. He also commented on the market design which must be able to absorb sources that are not reliable.

Panel 1		Government, Regulatory & Environmental Authorities	
	Name	Company /Institution	Position
P1	Jorge Alberto Valencia	CREG	Former Director
P1	Gloria Parga	IPSE	Consultant
P1	Erika Alzate	CORNARE	Head Environmental Licenses
P1	Argiro Cano	CORANTIOQUIA	Head Environmental Licenses
Panel 2		Project Owners /Developers	
P2	Luis Chavez	PCH Aurra & Colibri	Technical Manager
P2	Walter Ospina	ICATER S.A.S	Owner
P2	Andres Lopera	PI EPSILON S.A.S	Partner & Consultant
Panel 3		Electric Utilities with PCH Portfolio	
P3	Camilo Ruiz	Vatia S.A ESP	Generation Manager
P3	Victor Enciso	SP Ingenieros S.A.S	Energy Projects Manager
P3	Pedro Gomez	EPM	Planning Engineer
Panel 4		European Equipment Manufacturers	
P4	Carlos Sgro	Andritz Group	General Manager
P4	Daniel Rubinstein	Voith Hydro Ltd Colombia	Business Development Manager
P4	Leonardo Valencia	HNSA	TROYER Representative
P4		Global Hydro	

Figure 44: Groups of panellists at the Workshop on Small Hydropower Framework Conditions in Colombia

He explained that SHPs lower than 10 MW benefit from tax exemption. Additionally, he mentioned the Atlas that was published in 2016, which indicated the potential of hydropower in Colombia. J. Valencia explained that it is a useful tool showing for example national parks and protected areas and cumulative impact which can be caused by SHPs investments on rivers.

C. Velasquez asked about distributed generation regulation. J. Valencia explained that according to CREG a distributed generation concept covers the model of consuming and generating electricity without transmission and losses. If there is not consumption the concept of distributed generation does not bring effect. Therefore, plants up to 5 MW can be considered as distributed generation as such generators don't cause overloading of the grid and can be connected in lower voltage levels. There are very few examples of self-generation, however.

Then, a question from the public was raised about the rationale behind 10 MW limit. The panellist explained that from his perspective it was a matter of control from the dispatch centre,

which evolved in time (from 20 MW) and due to appearance of multiple sources of generation. He added that it is a country specific limit though.

Another question was raised from the audience about the reason why larger hydropower plants are not considered to be unconventional energy sources. They cannot confirm that their electricity comes from renewable sources. The answer came from the Ministry's side that this situation could be changed.

The next panellist, Gloria Parga, Consultant at IPSE brought the discussion back to environmental issues. Her work focuses on areas not connected to the electricity grid (remote areas in distant corners of Colombia). In such areas electricity is commonly produced by diesel generators and it is recommended to replace them by SHPs. IPSE assesses the hydropower potential of such areas. G. Parga pointed out that the costs of SHPs investments in remote areas are very high mainly due to transportation and travelling distances. She spoke about a special fund for such projects. IPSE endorses projects and the Ministry of Energy selects them. She considered it important to encourage communities to develop such projects and added that they can be fully subsidised.

C. Velasquez asked about the access to the mentioned funds. He found it quite difficult. G. Parga answered that the problem is sometimes a lack of experts in territorial entities by which they are presented. She added however that IPSE can support them by providing trainings on how to present the projects and what is the methodology of financial calculation of such projects.

Finally, Argiro Cano, Head of Environmental Licenses at CORANTIOQUIA spoke. He explained that the regulations are the same for large and small hydropower plants. He mentioned many applications which had been submitted in his corporation and had not yet been verified.

Next, a question was raised from the public about existence of any common criteria for ecological flow in different licencing authorities. A. Cano answered that in CORANTIOQUIA three types of criteria are used. E. Alzate recalled that there is a guideline of the Ministry on methodologies of ecological flow. She said that in CORNARE they follow these guidelines, but it is possible to require more in case of some projects.



Figure 45: Panellists discussing at the Workshop on Small Hydropower Framework Conditions in Colombia

C. Velasquez summarized the first panel underlining the complexity of regulations for SHPs in Colombia and thanked panellists for guiding the participants through them. His recommendation was to increase the instructional work inviting institutions to share the experiences and create a concept to be presented to EU on how to improve SHPs in Colombia. Representatives of the authorities confirmed that they are open for investors to discuss the methodologies and the prerequisites of SHP projects development.

In the second panel panellists represented project owners and developers and they were from the following companies: Energía Nacional S.A.S (developers of Aurra and Colibrí, the HYPOSO case study sites), ICATER S.A.S and PI Epsilon.

C. Velasquez asked the panellists about their experience in developing SHP projects, about difficulties they face and solutions they propose.

Walter Ospina, the owner of ICATER S.A.S, recognised that the main difficulty is the environmental part of the project due to many delays which are characteristic for this part. As a second problem he considered social issues and opposing projects by communities. His

recommendation was to develop a regulation which could indicate the density of the projects allowed in a certain river basin.

Next, Luis Chavez, Technical Manager at PCH Aurra & Colibri, the pilot projects in HYPOSO, appreciated the work done within HYPOSO for the projects he represents and thanked for providing a new look at them. He shared the same view on difficulties about developing SHPs as the previous speaker. He pointed out that as companies developing small hydro projects, they want to be in line with ecosystems, but they need to know clear regulations and guidelines. In his opinion another barrier not mentioned before is economical. He explained that at the start a project is viable but as it is proceeded situation changes due to such factors as the value of the dollar, the price of iron etc. As a result, many projects become not viable with time due to many kinds of variables which affect them.

The following speaker, Andres Lopera, Partner, and Consultant at PI EPSILON S.A.S stated that projects imply risks. He agreed that risks can be associated with economic, environmental or grid connection issues. Though, in his opinion the greatest risk is associated with social topics. This kind of risk can occur in many stages of the project, even the operational stage. He pointed out that this point is very critical because it's not manageable. But he also stressed difficulties in finding a connection point to the grid. He said that projects are often in areas where communities are very poor, and their basic needs are not satisfied. And according to the law, a certain amount of electricity produced in an SHP must be delivered to the community/territorial entity. The, there was a comment suggesting performing a comparative analysis between the process in each country of the HYPOSO project and recommend how to improve the procedures and show the best practice examples.

A participant from Bolivia responded that in Bolivia multipurpose projects are often encouraged, for example apart from electricity generation they can provide drinking water. There are also ideas for hybrid installations in Bolivia and special funds for plants not connected to the grid.

The last question in this panel was about the attractiveness of a tendering procedure for investors. An example was given of countries where auctions are differentiated according to technologies, while in Colombia there are no separate auctions, and all technologies compete. The answer given to this question by one of the panel participants was that the attractiveness of auctions for power purchase contracts depends on a project. The strength of auctions is a price guarantee which is offered. But they require waiting for the tendering procedure which is not advisable in case of many projects. Therefore, many investors choose PPAs and a flat business model.

Stakeholders in panel three came from electric utilities with SHP portfolio. Those who participated represented: Vatia S.A.S, SP Ingenieros S.A.S and Empresas Publicas de Medellin (EPM).

Answering the question of their experience with SHPs Camilo Ruiz, Generation Manager at Vatia S.A ESP, a company selling energy to end users and generating energy from renewables (operating 18 SHPs) in Cauca province, informed that they operate in a difficult area and even faced the problems of terrorist attacks on energy infrastructure. He added, though, that nowadays there is more stability. Still, they must coexist with autonomous communities which can be challenging. Some power plants in the company were built in 30ties and 50ties but there are also some modern ones in the company's portfolio. Taking all this into consideration C. Ruiz stated that social management is very important in SHP projects. In case of the company he represents, while projects are developed the local societies are consulted in the first place and the awareness is built in the community. When this is done there is a chance that a community looks forward to a project, job opportunities it offers, etc, as it happened in one of the recent projects Vatia implemented. He also mentioned the problem that project with a capacity over 10 MW don't benefit from tax exemptions so in case of a 20 MW it is considered to split projects into two projects. C. Ruiz also mentioned the problem of competition between solar and small hydro projects. He added however that SHPs must be included in the portfolio of Vatia because they are valuable for balancing generation.



Figure 46: Participants at the Workshop on Small Hydropower Framework Conditions in Colombia

C. Velasquez asked about the potential problems with operation and spare parts faced by Vatia. C. Ruiz complained about old machines in operation and difficulties in finding a good provider of machines, especially for small hydro schemes. He said that it is easier to extend the lifespan of the machine sometimes. Often the new machines must be imported.

Subsequently, Pedro Gomez, Planning Engineer at EPM, responsible for maintenance of SHPs the company owns (11 in operation) gave his opinion. He talked about a strategy established by a company of remote operation with a local assistant on site. The operation is needed 24/7

because the turbined water is used for drinking. He underlined the importance of having relevant staff on site which brings good results. Regarding the maintenance team he explained it is rotative which is also recommended. He finds more challenges about SHPs on regulatory topics, for example possible changes of the 5 MW limit of the installed capacity above which other regulations apply. Regulatory changes may cause problems with intra-daily dispatch. Now, larger power plants can be sanctioned in case they fail to produce the offered amount of electricity. If this regulation applied for smaller generators, it can be a problem for the company. As a solution optimisation of generation projections was introduced, however it still constitutes a problem in case of smaller plants.

Finally, in panel four, representatives of European manufacturers and suppliers of SHP equipment were invited to discuss issues related to their activities and achievements in Colombia. Representatives of the following companies participated in the panel: Andritz, Global Hydro, Voith, and Troyer (represented through HNSA Ingenieros).

All panellists presented their companies and reflected on their businesses in Colombia. The most important issues mentioned from their perspective included financial issues (e.g., shares of costs of different elements of the project that had changed over time and the importance of projects optimization), a choice of contracting model, Colombia's market sensitivity to costs of materials and dollar and various social issues.



Figure 47: Participants of the plenary session discussing at the Workshop on Small Hydropower Framework Conditions in Colombia

The last part of the debate was a plenary session, where each workshop participant was asked to answer a short question, namely: which is in their opinion the main barrier affecting SHP development in Colombia and what they suggest solving or mitigate it.

Plenary session was also very successful. Every participant had the opportunity to make a short comment on a specific issue, achieving a hundred percent of active participation. All participant also contributed with their knowledge and expertise to a better and more comprehensive understanding of SHP problems and corresponding solutions.

### 8.3 Conclusions and recommendations

As a result, main barriers affecting SHP potential development were identified. Most recurrent of such barriers were:

- Environmental license procedure is long and demanding (environmental authorities participants acknowledged and mentioned that reforms are under preparation).
- Regulatory norms were developed for large hydro and are difficult to fulfil by small hydro. Once again, regulatory norms are under revision.
- As a result of the above, pre-feasibility studies for SHP are relatively higher than for large hydro and many project developers are reluctant to make required pre-investments.
- Social concerns and community's opposition are growing rapidly, because of environmental and social impacts of large hydro plants, and communities hardly understand differences between large and small hydropower plants.
- SHP owners' budget for O&M capacity building is in many cases reduced or neglected, and frequent shutdowns and damages are the result of poor O&M personnel qualification.
- Manufacturing and repair facilities for spare parts are scarce, and quite often spare parts must be imported, leading to shut down periods even longer.
- As consequence of the above shutdowns and damages, electricity generation and revenues decrease, in many cases to such a point where capital debt cannot be repaid, and power stations are abandoned.
- Government authorities do not recognize the importance of SHP as a reliable and regular source of clean energy and give preference to other sources, mainly solar, wind and biomass. Therefore, fiscal incentives and financial resources are mainly allocated to such energy sources.
- Solar, wind, and biomass (also large hydropower) enjoy strong support from powerful lobbies and industries to influence government policies according to their interests. This is not the case of SHP, which is regarded as the ugly duck of renewable energies family, without a lobby or organization able to bring SHP concerns to the government.

During the workshop plenary section, participants suggested several measurements and activities intended to eliminate or mitigate above mentioned barriers including creating a guild to represent the SHP sector as it has been done for other renewable technologies' sector.

With that in mind, CELAPEH launched the idea of a Colombo-European Association for SHP, aimed to strengthening cooperation among European and Colombian SHP stakeholders (as a follow up of HYPOSO main objective) and join efforts to become a strong voice on behalf of SHP. A survey conducted among workshop participants showed that a large majority liked the idea, and CELAPEH is committed to take the lead on the efforts to shape and create the association.

## 8.4 Annexes

### 8.4.1 Programme

To have an impression about the programme of the workshop an image of the distributed agenda of the event is shown in Figure 49.

<b>Taller: Análisis del contexto general de Colombia en el campo de la pequeña hidroeléctrica, soluciones y propuestas para impulsar su desarrollo con el apoyo de la Unión Europea</b>		
<b>Fecha: Febrero 28 del 2023</b> <b>Lugar: Club Unión Medellín</b>		
09:00 - 09:10	Saludo e información general	CELAPEH
09:10 - 09:25	Introducción e Información general del proyecto HYPOSO	Ingo Ball
09:25 - 09:40	Marco General del Sector Hidroeléctrico en Colombia	Carlos Velasquez
09:45 - 10:00	Presentación de los 3 sitios seleccionados como casos de Estudio en Colombia	Nino Frosio & Bernhard Pelikan
10:05 - 10:20	Mapa HYPOSO para identificación de sitios potenciales para PCH en Colombia	Gitana Vyčienė
10:25 - 10:40	Plataforma HYPOSO	Ewa Malicka
10:40 - 11:00	<b>Descanso</b>	
11:00 - 11:40	La PCH en Colombia desde la perspectiva de la Política de Estado. Marco ambiental, regulatorio, normatividad	Panel 1
11:45 - 12:15	Experiencias prácticas de desarrolladores de PCHs	Panel 2
12:20 - 12:50	Empresas de generación con portafolio de PCHs Experiencias, resultados, expectativas	Panel 3
12:50 - 13:50	<b>Almuerzo</b>	
13:50 - 14:20	Proveedores Europeos con representación en Colombia: Experiencias, resultados, perspectivas	Panel 4
14:30 - 15:00	Discusión final: Barreras al desarrollo de la PCH, Recomendaciones para superarlas, Conclusiones	Plenaria
15:00 - 15:15	Declaración final, próximas actividades	HYPOSO

**Organizan:**





Figure 48: Programme of Workshop on Small Hydropower Framework Conditions in Colombia

## 8.4.2 Participants

To have an impression about the participants of the workshop the list is shown in Figure 50.

#	Name	Institución	Posición
1	José Jesús Arias Orozco	ACIEM - CALDAS	Presidente
2	Carlos Alberto Sgro Dorado	ANDRITZ GROUP	Gerente General
3	Nestor Hernando Lozano Forero	ANDRITZ GROUP	Líder Gestión de Proyectos
4	Alejandro Arango	AURES BAJO S.A.S. E.S.P.	Director
5	Marlon Andres Londoño Diago	CELSIA	Líder Oficina Técnica proyectos Celsia
6	Jorge León Ruiz Ruiz	CENTRAL ENERGY SAS	Representante Legal
7	Jaime Arenas Plata	CLÚSTER DE ENERGÍA SOSTENIBLE DE LA CÁMARA DE COMERCIO DE MEDELLÍN	Director
8	Argiro de Jesús Cano Valencia	CORANTIOQUIA	Profesional Adscrito al Grupo de Licencias Ambientales y Trámites Especiales
9	Erika Yuliet Alzate Amariles	CORNARE	Jefe oficina de licencias ambientales
10	Alvaro Lopez Galvis	CORNARE	Subdirector de Recursos Naturales
11	Jorge Alberto Valencia Marín	CREG	Director
12	Marie Lorena Vergara Kerguelen	CONINSA	Directora Propuestas y Presupuestos
13	Oscar Gabriel Garcia Gomez	ELECTRO HIDRAULICA S.A.	Gerente
14	Sergio Ortega Restrepo	ENERGIA DEL RIO PIEDRAS S.A.E.S.P	Responsable de Investigación de Mercados e Inteligencia Competitiva
15	Omar Hoyos Agudelo	ENERGÍA NACIONAL S.A.S E.S.P.	Gerente
16	Catalina Vásquez Gómez	EPM	Profesional Proyectos e Ingeniería
17	Pedro Gomez	EPM	Profesional Proyectos e Ingeniería
18	Alejandro Mejia Gonima	GENERADORA CANTAYUS SAS ESP	Director de planeacion y Desarrollo de nuevos negocios
19	Natalia Silvia Vera	GLOBAL HYDRO	Sales Coordinator LATAM
20	Georgios Vavaroutsos Pérez	GLOBAL HYDRO	Gerente General
21	Heber Alejandro Escobar Pineda	HIDRASED S.A.S	Director Técnico
22	Leonardo Valencia	HNSA INGENIEROS	Gerente General
23	Thomas Valencia	HNSA INGENIEROS	Ingeniero de Proyectos
24	Carlos Arturo Velasquez Restrepo	CELAPEH	HYPOSO partner
25	Catalina Navas Perez	CELAPEH	HYPOSO partner
26	Ewa Malicka	TRMEW	HYPOSO partner
27	Fernando Arturo Ledezma Perizza	UMSS	HYPOSO partner
28	Galo Oswaldo Muñoz Vásquez	UMSS	HYPOSO partner
29	Ingo Ball	WIP	HYPOSO partner
30	Juan Terrazas Lobo	UMSS	HYPOSO partner
31	Laura Nelly Velasquez Arenas	CELAPEH	HYPOSO partner
32	Petras Punys	VDU	HYPOSO partner
33	Gitana Vyciene	VDU	HYPOSO partner
34	Linus Jurevicius	VDU	HYPOSO partner
35	Walter León Ospina Ortiz	ICATER SAS	Gerente
36	Wilson Hurtado	INTEGRAL	Especialista de Energía
37	Gloria Parga	IPSE	Consultora
38	Gabriel Montoya Pelaez	O-TEK	Desarrollador de negocios
39	Luis Chavez	PCH AURRA	Director Técnico
40	Andres Julian Lopera Vieco	PI EPSILON	Fundador y Asesor
41	Luisa Fernanda Marulanda Giraldo	SAI	Directora Técnica
42	Oscar Jaramillo Hurtado	SAI	Experto en Centrales Hidroeléctricas
43	Luis Gabriel Vanegas Betancur	SEDIC S.A.	Gerente Técnico
44	Felix Barcasnegras	SOUL ENERGY SAS	Gerente
45	Dionisio Gutiérrez	SP INGENIEROS SAS	Gerente Proyectos Energéticos
46	Victor Enciso	SP INGENIEROS SAS	Ingeniero Proyectos SHP
47	Camilo Andres Ruiz Morales	VATIA S.A E.S.P - HIDROTOLIMA S.A. E.S.P.	Gerente de Generación
48	Daniel Rubinstein	VOITH HYDRO LTDA. SUCURSAL COLOMBIA	Business development director
49	Christian Alanis Siles	AGENCIA DE COOPERACIÓN INTERNACIONAL	Presidente
50	Juan Diego Villegas Lanau	AURES BAJO S.A.S. E.S.P.	Ingeniero
51	Juan Jose Patiño	GENERADORA OTU SAS ESP	Abogado
52	Sergio Cardona	IDEA	Subgerencia

Figure 49: List of participants of the Workshop on Small Hydropower Framework Conditions in Colombia