

Hydropower solutions for developing and emerging countries: The HYPOSO project

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The HYPOSO Project

Hydropower is the backbone of Europe's renewable electricity system. Already established in Europe, there is room for the hydropower market to flourish in other parts of the world. The HYPOSO project aims at supporting the European hydropower industry while fostering a sustainable development in selected target countries in Latin America and Africa, namely Bolivia, Colombia, Ecuador, Cameroon and Uganda. The HYPOSO objectives will be achieved by a combination of tools, i.e. thorough market analyses, looking into unused hydropower potentials (in a GIS Map), political and legislative frameworks, financing hydropower in a smart way, capacity building, replicable business case studies and by bringing together representatives of the European hydropower industry and their counterparts and politicians from these five countries.

The planned work is carried out by European experts and renowned experts in the selected target countries. In the following paper, the background for HYPOSO is shown, the project structure is laid down, the already existing measures are presented, and an outlook on the upcoming activities is given.

1. Background for the Project

When speaking about the European hydropower industry in the project development phase for the HYPOSO project, it was impressive to know that still in 2015, the European hydropower equipment manufacturing competence accounted for estimated two-thirds of the world market. In addition, many leading universities and research centres specialised in hydropower are located in Europe. Then, directly and indirectly, the EU-28 hydropower sector provided more than 100,000 jobs, including 50,000 jobs in generation and almost 7,000 in equipment manufacturing (Eurelectric, 2018).

New challenges for the European hydropower sector include the ability to capture the energy potential of water flows and sites with a very low height difference between the upper and lower water level (head) e.g. at irrigation dams, low head weirs and ship locks. New technologies could be installed on existing structures, constituting a big potential for future renewable and distributed, clean power generation. Business is not only made with the construction of new plants, but also with investments for maintenance and refurbishment of existing plants. Costs for other renewable energy sources keep on decreasing, however, hydropower is still leading in terms of cost-competitiveness. Despite high initial investment costs, plants have a very long lifetime (up to 80 years) and their operation and maintenance costs are relatively low. Thus, hydropower, providing sustainable and clean energy, has one of the lowest global generating costs (newly commissioned projects: 0.47 US\$/kWh in 2019, meaning less than the cheapest new fossil fuel-fired cost project (IRENA, 2020).

The economic potential of the European hydropower industry reaches out into various economic sectors. The actual gross value creation resulting from European hydropower generation companies and equipment manufacturers adds up to 38 billion €. By 2030, the hydropower sector's contribution to the European gross domestic product (GDP) may grow to a range of 75 to 90 billion €. In Europe, hydropower also brings good revenues for public budgets at national, regional and local levels, i.e. in the form of taxes. The tax revenue from the European hydropower sector amounts to more than 14 billion € in 2013, which means that more than 37% of the gross value created by hydropower in Europe is directly transferred to governmental budgets at local and regional levels helping to foster regional development (Eurelectric, 2018).

With the HYPOSO project, the business of the European hydropower industry shall be fostered, so that European know-how can add more to sustainable energy generation worldwide. The aspect of sustainable energy generation is also a main aim of HYPOSO and will be distributed by European hydropower experts in the target countries among relevant stakeholders to promote the renewable energy source.

2. Project structure

HYPOSO is organised in 7 work packages (WP) that run successively or in parallel throughout the project. As mentioned before, the work is conducted by European, African and Latin American partners with experience in the hydropower sector. Figure 1 gives an overview about the involved partners in the project, showing also the main responsibilities.

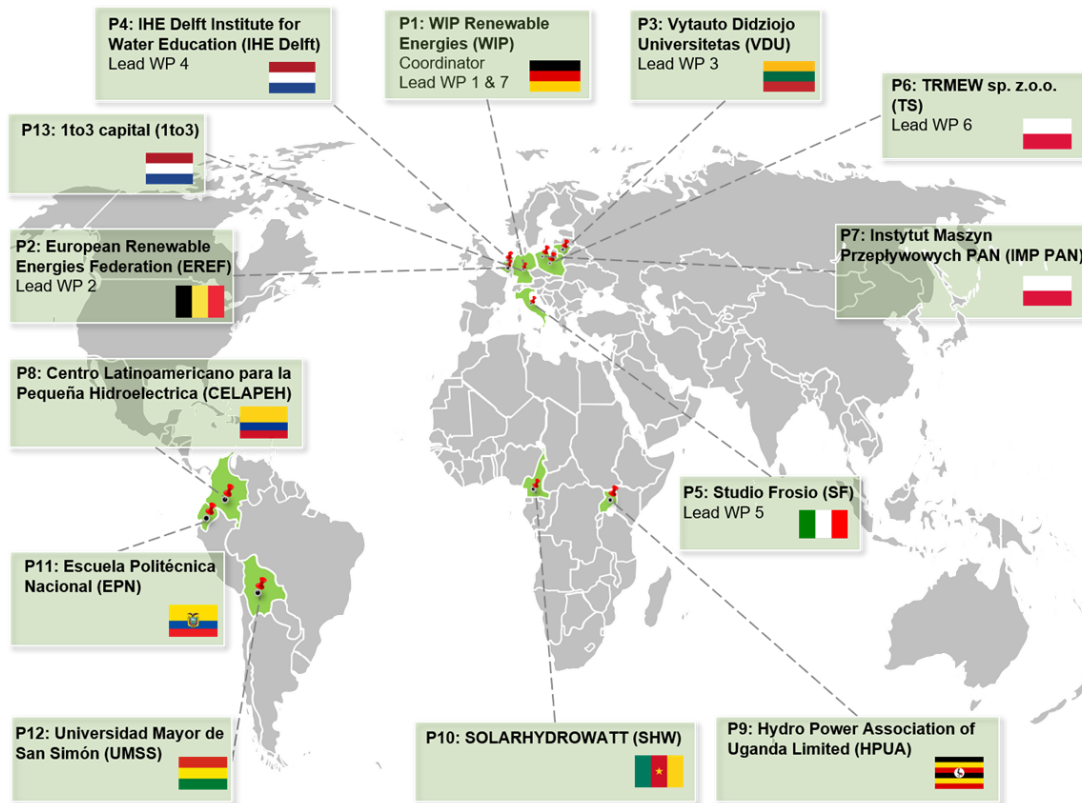


Fig. 1. Regional distribution of HYPOSO project partners

WP1 "Project management" and WP7 "Communication and dissemination" will run throughout the project. WP1 includes the classic day-to-day project management and coordination measures for a successful project implementation, including monitoring of the project progress and ensuring quality control, ensuring good communication within the consortium and with the EC. WP7 covers the project-wide communication & dissemination activities. During the project implementation appropriate tools will be developed to maximise the project's visibility and spread public information on its goals, achievements, impacts and results to the relevant stakeholders. WP 2 "EU hydropower industry cooperation" and WP3 "Framework analysis and research needs" will provide the basic tools and set up on which the following ones will build upon. As information about the European hydropower industry is scattered and only partly available, the project will provide a comprehensive list of industry players as well as an overview of European hydropower technologies and services. Partners in the five target countries (Bolivia, Cameroon, Colombia, Ecuador and Uganda) will develop comprehensive lists of key players in their respective countries as well. This will form the basis for a number of events including matchmaking sessions to facilitate the export of European know-how and goods. WP 3 will also set the framework in which the WP4 "Capacity Building" and WP5 "Case studies" will take place. The most important tool in this respect is the so-called HYPOSO Map which provides investors and project developers with an overview of potential hydropower sites in the five target countries. WP4 focusses on capacity building with the goal to strengthen key stakeholders in target countries in strategic development, design, implementation, operation and maintenance of sustainable hydropower and research needs in field of hydropower. The new experts for the local hydropower sectors, with the help of European hydropower experts, will be involved in the development of business case studies in WP5. These business

case studies will be comprehensive, including political and financial recommendation tailored for the target countries.

The results of these work packages will be, among others, highlighted within WP6 “Market uptake of EU hydropower technologies” at events and matchmaking sessions during which industry stakeholders from Europe and Africa and Latin America will be brought together to initiate new and enhance existing business relations. Figure 2 gives an overview how the work packages are inter-connected.

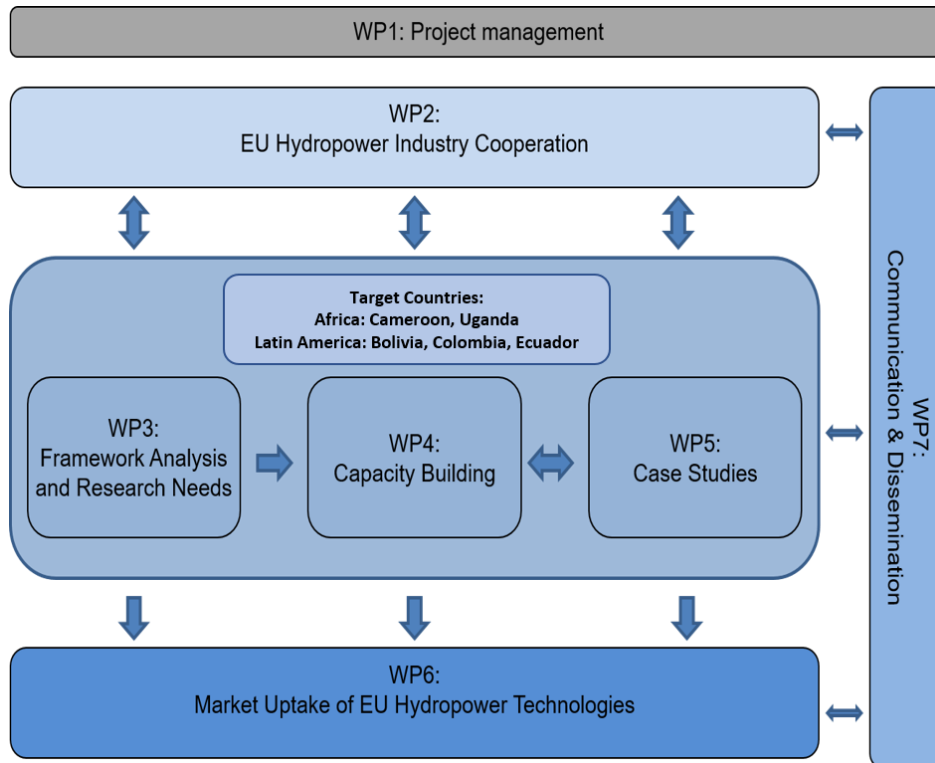


Fig. 2. Overview of the HYPOSO work packages

3. HYPOSO tools for the sector

3.1 Already established tools

The base for all HYPOSO tools is the project’s website. It can be found under www.hyposo.eu and is online since November 2019. Via the website, the latest project results are made available as fast as possible, so that interested stakeholders can benefit best of them.

Presently (in autumn 2020), the website gives interesting *background information* about the target countries, provides general *stakeholder lists* for both, the European Union and the target countries (in the category Sector information), and offers the possibility for stakeholders from the EU and the target countries to present themselves in a public online platform, the *HYPOSO Platform*, to get to know each other and to support the start of business activities. Figure 3 shows the starting screen of the website, on which the different menu categories are visible at first glance.

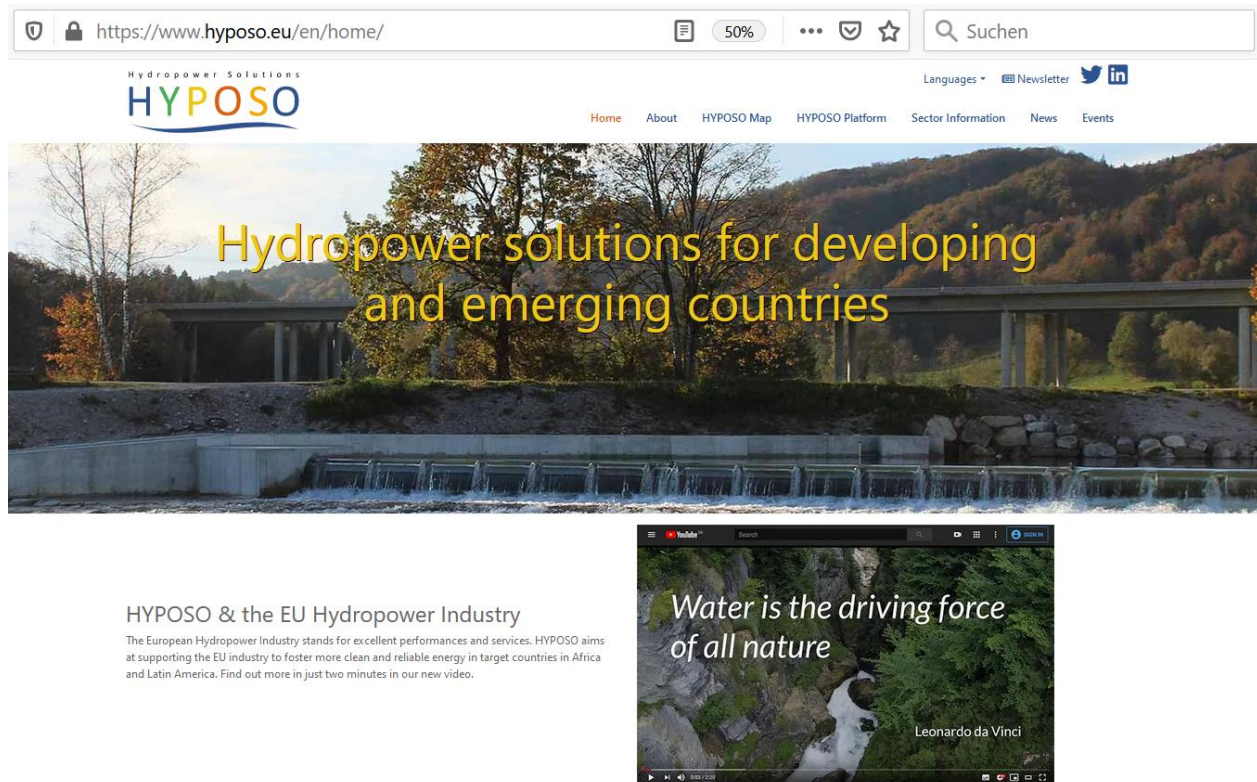


Fig. 3 Starting page of the HYPOSO website

Via the starting page, also the first project video is available, in which the excellence of the European hydropower industry is presented in a visual way and also briefly the HYPOSO objectives. Furthermore, social media channels (i.e. twitter and LinkedIn) can be accessed via the starting page. The LinkedIn group invites interested hydropower stakeholders to exchange their views and findings, and to discuss them with other experts. Interested stakeholders can also subscribe for the project's newsletter. It is planned, to publish the website also in Spanish and French in the coming months.

The website informs of course also about project events or events, in which the project is presented.

3.2 Tools in development

Further tools to support the European hydropower industry are a so-called Knowledge and Capacity Development tool (KCD) - capacity building courses in four of the target countries (in Bolivia and Ecuador in Latin America, and in Cameroon and Uganda in Africa), and project developer workshops and framework condition workshops in all five target countries. Furthermore, a GIS tool to map existing and potential hydropower sites, the HYPOSO Map, will be developed for further exploitation of the sites.

To make best use of the identified framework analysis and potential hydropower sites, HYPOSO will execute the *Knowledge and Capacity Development tool (KCD)* in the target countries, for which in some cases, new tools will be elaborated. The new tools will be elaborated together with local experts and these local experts will be included in the lecturing, especially in the topics that need the local knowledge, such as hydrology or geology and hydrogeology, but also in the environmental and social specifics. It is known already, that the results of KCD need to be seen as mid- to long-term outcome. It is important that new experts are available for the sector, as in the hydropower sector the recent developments of the European hydro industry focus on environmentally friendly concepts. Thus, the new experts will contribute to an increase of sustainable energy generation, benefitting from the new KCD tools that allow reduced planning costs and reduction in time needed for SHP projects. Experiences from senior hydropower experts have shown that participants of capacity building activities that were carried out in the past are now relevant players in the sector. HYPOSO project partner from Cameroon, Joseph Kenfack (Solarhydrowatt), can be regarded as example for capacity-building success. He participated in 2011 at a hydropower course in Vienna, headed by Bernhard Pelikan (who is also involved in the HYPOSO project), and is now a renowned actor on the hydropower market in Cameroon.

The resulting knowledge of the already performed framework analysis will be used in altogether *15 business case studies* (three per target country), which will be carried out using established tools as published in the standard reference “Small Hydroelectric Engineering Practice” by Leyland (2014). All business case studies will include an in-depth analysis of economic viability and opportunities for financing as well as environmental and socio-economic impact assessments (as required by Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the Assessment of the Effects of Certain Plans and Programmes on the Environment). The three business case studies per target country are selected by ten promising sites which were identified by the local project partners. The business case studies shall cover typical natural framework conditions and, as they will be published, can be used as base for replica studies. To avoid, that a foreign investor would benefit more than national stakeholders, a financial expert informs about tailored financial approaches, enabling more national stakeholders to participate than in the normal investment approach.

The *workshops on the framework conditions* for hydropower in the target countries aim at policy makers, local authorities, private and public financing institutions, project developers and investors. In these workshops, framework analysis and recommendations for each target country will be presented by project experts (who have been performing tasks in relevant work packages) and discussed in order to facilitate national investment-friendly climates for hydropower. The identified and selected potential projects that were elaborated into case studies will be used as specific discussion material. If the Covid-19 pandemic allows larger events in the beginning of 2021, matchmaking events in Uganda and Colombia are planned, in which stakeholders from the target countries will be given the opportunity to meet with representatives from the European hydropower industry to discuss business possibilities.

The tools described above will be accompanied by a web-based GIS tool, named the *HYPOSO Map*. On this map, relevant hydropower information will be provided for interested stakeholders. The map will be freely available and show different layers, such as hydrology in the target countries, existing hydropower plants and will map in addition more than 2,000 potential hydropower sites in Bolivia, Colombia, Ecuador and Cameroon and Uganda for further exploitation. This tool is planned to be ready in spring 2021.

For bringing together potential business partners with the European hydropower industry in person, a (7-10 days) *study tour* will be organized in the final phase of the project, in which selected African and Latin American stakeholders, especially project developers, investors and multipliers will visit various European manufacturers, research institutes and reference hydropower plants to get information on latest European hydropower technologies. It is planned to visit major manufacturers as well as providers of hydropower solutions in Austria, the Czech Republic, Germany and Poland, alternatively France and Italy. The countries and places to visit will be selected after results of the business case studies are available, as the manufacturers and sites will be chosen to suit the size and type of sites selected as case studies.

4. Conclusion, objectives beyond the project

With all the mentioned tools or measures being implemented, HYPOSO aims to contribute to more hydropower experts in the target countries and to initiate the construction of altogether 90 MW in the target countries. According to rough estimates, this would mean an investment of 136 million US\$ (ESHA, 2012).

Table 1 gives an overview about the potentials of small hydropower in the target countries (LIU, D., LIU, H., WANG, X., and Kremere, E., eds., 2019) and the quantitative objectives as per country that shall be reached with the support of the HYPOSO project.

Tab. 1. Overview of HYPOSO objectives

Country		Bolivia	Cameroon	Colombia	Ecuador	Uganda	Total
Potential of Small Hydropower (SHP)	Total [MW]	50	615	25,000	296	210	26,258
	Remaining %	57	>99	>99	>75	>90	
Defined capacity limit of SHP [P]		0.5 to 30 MW	< 10 MW	< 20 MW	10 - 20 MW	< 10 MW	
Cost per installed kW (approximate, IRENA 2012)		1,300 -8,000 US \$/kW					
Goal for installed MW per target country as consequence of HYPOSO (only SHP)		5	10	50	20	5	90
Amount of additional EU investment in target countries through project activities, million US \$ (roughly 50% of installed cost)		8	15	75	30	8	136

5. Acknowledgement

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I. Ball graduated in Sports Sciences (gaining economic knowledge as Dipl. Sports Economist) and holds a B.Sc. in Management of Renewable Energies. He is a Project Manager for WIP Renewable Energies since 2016, and the coordinator of the HYPOSO project. He is also involved in the H2020 Project Hydropower Europe, contributing to the Research & Innovation Agenda (RIA) and the Strategic Industry Roadmap (SIR) for the European hydropower sector, while he is supporting the work of other WIP projects on issues like market uptake, stakeholder engagement, communication and dissemination activities as well as the organisation of international workshops. Previously, he worked in the RESTOR Hydro project, where he was involved in the communication work and in the building of the project's database where he identified for Germany more than 5,000 historic potential hydropower sites. Moreover, Ingo Ball has written his B.Sc. thesis about hydropower in Germany (Hydropower – background and perspectives).

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