



Leveraging Private Sector Solutions in Large Hydropower Projects



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This report was designed by Victoria Adams-Kotsch.





Abbreviations & Acronyms

| | |
|-------|------------------------------------------------------|
| CAPEX | Capital Expenditure |
| CBI | Climate Bonds Initiative |
| DFI | Development Finance Institution |
| E&S | Environmental and Social |
| ESMAP | Energy Sector Management Assistance Program |
| GHG | Greenhouse Gas |
| GW | Gigawatt |
| IBRD | International Bank of Reconstruction and Development |
| IEA | International Energy Agency |
| IFC | International Finance Corporation |
| IHA | International Hydropower Association |
| KW | Kilowatt |
| kWh | Kilowatt-hour |
| LCOE | Levelized Cost of Energy |
| LEG | Liquidity Extension Guarantee |
| LMIC | Low- and Middle-Income Country |
| MIGA | Multilateral Investment Guarantee Agency |
| MW | Megawatt |
| MWh | Megawatt-hour |
| NZE | Net-Zero Emissions |
| PPA | Power Purchase Agreement |
| PPIAF | Public-Private Infrastructure Advisory Facility |
| PPP | Public-Private Partnership |
| PSH | Pumped Storage Hydropower |
| TW | Terawatt |
| VRE | Variable Renewable Energy |

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Executive Summary



Sustainably developed hydropower is a mainstay technology that has an important role in achieving climate and development goals. Hydropower is a source of low-cost, low-carbon electricity, which also supports the integration of variable renewable energy. It is essential to ensure access to affordable, reliable, sustainable, and modern energy for all by 2030, as outlined in the United Nations Sustainable Development Goal 7. Hydropower met the majority of the electricity demand across 28 emerging and developing economies in 2020 and is a key feature in the least-cost generation expansion plans of many countries.

Investments in hydropower, both to rehabilitate the existing infrastructure and to increase the installed capacity, need to be scaled up significantly. Substantial investments are needed to scale up hydropower generating capacity, with the International Energy Agency estimating that at least 2,500 GW of new capacity needs to be added by 2050 to meet the Net Zero targets. Current investments fall short of this requirement, with an estimated annual investment of \$138 billion needed between now and 2050, against an average of \$9.7 billion per year committed between 2013 and 2020. Additionally, the existing hydropower infrastructure requires rehabilitation and upgrading, with an estimated need for about \$300 billion in investment between now and 2030 on rehabilitation.

Private sector participation has mostly been in greenfield small hydropower projects and concentrated in middle-income countries (MICs). While the private sector owns almost 70 percent of plants commissioned between 2000 and 2020, publicly owned plants account for over 70 percent of the global installed capacity. Private participation is highest in plants with less than 10 MW of capacity, at 74 percent, while large plants with over 2,500 MW capacity have only 8 percent private participation. Investments have been focused on MICs with favorable economic and policy environments. Upper-middle-income countries (UMICs), where competitive bidding is the most common award method, receive over half of private investments. The private sector is primarily involved in greenfield hydropower projects with limited engagement in brownfield projects. Additionally, the private sector tends to favor run-of-river projects over reservoir storage projects, and there are significant regional differences in project financing, with multilateral funding primarily directed towards lower-middle-income countries (LMICs). Mobilizing private sector investment in hydropower is therefore critical, especially in LMICs. Understanding and addressing the barriers to attracting private investment is essential to do this.

The survey of 23 stakeholders confirmed interest in hydropower development, with a preference for small-scale, low-impact projects. The survey respondents included developers, lenders, development finance institutions (DFIs), service providers, and government officials with past or current

involvement in large hydropower transactions to gauge the private sector's perception of hydropower projects. Some developers expressed interest in large hydropower projects but highlighted the barriers faced by the industry in bringing these projects to fruition. Regulatory and policy uncertainty around brownfield projects has limited private sector involvement in the past, resulting in a lack of a successful track record in this market segment. Respondents also showed interest in non-conventional hydropower, particularly in pumped storage hydropower and the ancillary services it offers to grid operators. However, this sub-segment of the market faces investment barriers such as high initial costs and uncertainties in electricity pricing and market conditions, especially in low-income countries.

The survey respondents identified political change, environmental and social issues, technical issues, and financial issues as the key risks for hydropower projects. The respondents highlighted government political change, environmental and social (E&S) risks related to resettlement and biodiversity, technical risks associated with geotechnical and hydrological conditions, and finally, financial risks, including offtaker risks, market risks, and foreign exchange risks as the main barriers to private sector participation in large hydropower. The extended maturation period required for the successful development of hydropower projects further compounds these risks.

In addition to securing a conducive policy and regulatory environment, the survey respondents highlighted the important role of project preparation, the role of de-risking instruments, and the need for innovative solutions to attract local financing. Adequate project preparation, including feasibility and environmental and social studies, is essential to boost developer confidence and reduce technical risks associated with projects. Financial support for these studies is necessary at the onset of the project development. Effective de-risking mechanisms embedded in the financial structuring of the project were seen as essential to guaranteeing offtaker contractual obligations and a corresponding reliable revenue stream for the project. The respondents, however, indicated the need for more clarity on the available risk mitigation instruments from DFIs. Innovative solutions to allow local lenders' participation despite the mismatch in loan tenors and the durations of hydropower power purchase agreements were seen as essential to reduce foreign exchange risk, together with other mechanisms to reduce foreign exchange risks in these projects.

Respondents also highlighted the need for the early involvement of developers to lower costs and improve the viability of hydropower projects. The respondents questioned the rationale for applying the traditional public-private partnership development model to large hydropower, as it promotes late-stage involvement of developers and requires a lengthy selection process before development activities can start. These development timelines become less attractive due to misalignment with political and economic cycles; governments often lack the capacity to manage such projects in the long run. The respondents suggested a shift towards early involvement of the developer to foster innovation, align stakeholders, manage risks better, and integrate E&S considerations from the beginning, which could lower costs and improve project viability and acceptance. This could be done following the "Specialist Developer Model," where a specialized firm is tasked with project development without equity investment, focusing on value and expertise to ensure bankability, or through a development platform backed by DFIs to pool resources for thorough, bankable project preparation. These approaches would focus on commercial principles and resolving "dealbreakers" early, leading to efficient tendering and the attraction of credible sponsors, thereby reducing the extended timeline for preparation and the correlated exposure to the development risks highlighted above.

The respondents also discussed the need for capital recycling to enable larger capital mobilization for large hydropower project financing. To accelerate hydropower development and private investment, capital from the operational phase could be reinvested into new projects more quickly. Refinancing post-construction can help reinvest capital and attract new investors with lower risk tolerance. Public projects could benefit from replacing public capital with private capital post-construction, thus conserving public funds. Respondents highlighted Yield Companies (YieldCos), Infrastructure Investment Trusts (INVITs), and green bonds as suitable instruments that could be deployed in large hydropower

projects. YieldCos are companies created to own operating assets that produce a predictable cash flow, INVITs are investment vehicles that allow direct investment in infrastructure, and green bonds are bonds specifically earmarked to be used for climate and environmental projects.

DFIs have a key role in supporting governments in creating a conducive enabling environment, de-risking project preparation and development, and capital recycling. DFIs can support governments in establishing an enabling ecosystem, including power sector planning, development, and financing of project transmission lines and, when relevant, creating regional power markets. They can play a crucial role in raising awareness of their instruments that address financing and refinancing risks, provide solutions to manage currency mismatches, and ensure the affordability of hydropower projects. DFIs could promote financial solutions, for example, by piloting demonstration projects and offering technical assistance to scale up private investments. This includes incentivizing the accessibility of green bonds for project debt refinancing post-commissioning and unlocking the potential of YieldCo structures to refinance equity for hydropower assets. In contexts where private mobilization is still challenging or where necessary reforms have yet to materialize, DFIs could leverage their available public lending resources to bring projects to fruition and allow refinancing within 7–10 years of operation. Additionally, DFIs could consider, in certain contexts, lowering the lending terms of their loans in the first 7–10 years of the repayment period before stepping up at a later stage, maintaining the same average net present value of the cost of financing over the loan tenure. This approach would allow client countries to seek private refinancing of public resources once the project is commissioned, significantly de-risked, and after implementing critical reforms to ensure bankability.

DFIs could also support the establishment of a dedicated project development platform to expedite the development of a portfolio of viable projects. This approach could be initially tested by DFIs in a specific region, concentrating on countries with significant untapped potential for large hydropower. The platform would prioritize commercial principles and early resolution of dealbreakers, resulting in efficient tendering and the attraction of credible sponsors.



Introduction

Sustainably developed hydropower is a mainstay technology that has an important role in achieving climate and development goals. Hydropower is critical for access to affordable, reliable, sustainable, and modern energy for all by 2030 (United Nations Sustainable Development Goal 7). Sustainably developed hydropower is a source of low-cost, low-carbon electricity. In 2020, hydropower met the majority of the electricity demand across 28 emerging and developing economies, which have a total population of 800 million.¹ It also features in the least-cost generation expansion plans of many countries. Investment in hydropower provides more than 2 million direct jobs² and significantly more indirect jobs, driven by improved electricity access and the associated economic opportunities. In addition to being a low-carbon source of energy, hydropower is a dispatchable and flexible technology that supports the integration of variable renewable energy. Hydropower with storage, even with small storage capacities in run-of-the-river plants, is one of the few cost-effective, low-carbon solutions for integrating large-scale variable renewable energy capacity, at least until other storage options become economically viable on a large scale.

Investments in hydropower, both to rehabilitate the existing infrastructure and to increase the installed capacity, need to be scaled up significantly. The International Energy Agency's (IEA) Net Zero Scenario³ estimates that at least 2,500 GW of new hydropower capacity—double the existing capacity—needs to be added by 2050 to decarbonize the power sector while achieving universal access. This is necessary to achieve the 1.5°C temperature rise limit set by the NZE plan, with an estimated annual investment requirement of \$138 billion between now and 2050 in greenfield hydropower (excluding pumped storage hydropower). Current investments fall substantially short of the required investments, with average annual hydropower investments over the period 2013–2020 totaling \$9.7 billion per year.⁴ In addition to adding a significant amount of new hydropower capacity, the existing hydropower infrastructure needs rehabilitation and upgrading. By 2030, more than 20 percent of the global hydropower infrastructure will be more than 55 years old,⁵ the age at which major electro-mechanical equipment requires rehabilitation and upgrading. Moreover, the global storage loss caused by reservoir sedimentation is currently greater than the reservoir volume added through the construction

1 IEA, *Hydropower Special Market Report*, 17.

2 IRENA and ILO. 2021. *Renewable Energy and Jobs*, 28.

3 IEA. 2021. *Net Zero by 2050*, 114.

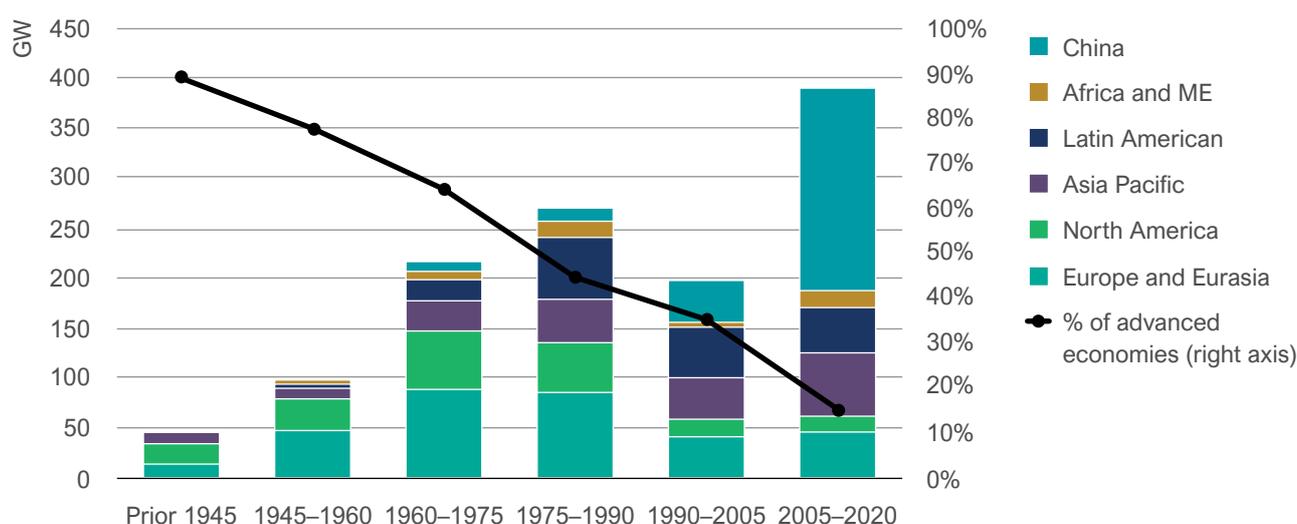
4 IRENA. 2023. *World Energy Transitions Outlook 2023*.

5 IEA. 2021. *Hydropower Special Market Report*, 11.

of new water storage projects. This creates a need for not only additional storage capacity but also for updating reservoir operation procedures and sediment management plans for existing reservoirs. This will create a need for about \$300 billion in investment between now and 2030 for rehabilitation alone—more than double the amount currently spent on rehabilitation.

Mobilizing private sector investment in hydropower is critical, especially considering the financial constraints faced by governments in lower-middle-income countries (LMICs). However, private sector participation in the sector has been limited. Understanding and addressing the barriers to attracting private investment is essential for harnessing hydropower’s potential to contribute to global energy access and transition objectives.

Figure 1: Hydropower Gross Capacity Additions by Region



Notes: ME = Middle East. “Advanced economies” refers to OECD member countries and non-OECD EU members states. Source: *Age of Installed Hydropower Capacity as of 2020* (IEA). Graphic colors modified from original source.

This report aims to enhance the understanding of energy sector regulators and policymakers, government agencies, developers, and banks of the status of private sector solutions available to develop large hydropower projects. To that end, the report first looks at (a) past investment trends and (b) findings from the interviews carried out with key stakeholders to provide (c) recommendations drawn from this consultative exercise together with actionable initiatives for DFIs to improve private sector solutions in large hydropower.

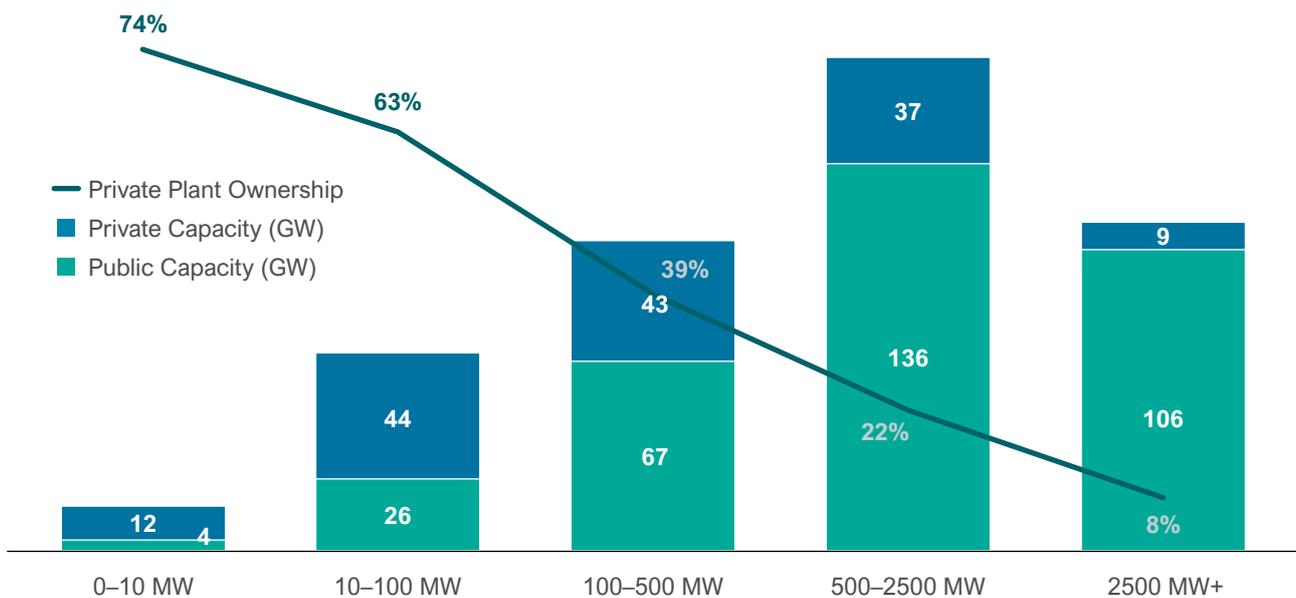
The report summarizes the literature review, desk research on past investment trends, and interviews with a sample of 23 key stakeholders in LMICs—project developers, government officials, private investors, representatives from development financial institutions, commercial lenders, service providers, and export credit agencies. Interviews were carried out between July and October 2023. The interview topics included (a) drivers of private sector interest in large hydropower projects, (b) key risks and corresponding mitigation strategies, (c) emerging financing practices of interest for large hydropower financing, and (d) how Multilateral Development Banks (MDBs) and Development Finance Institutions (DFIs), such as the World Bank Group, can facilitate private sector participation in large hydropower projects.



Private Sector Participation in Hydropower

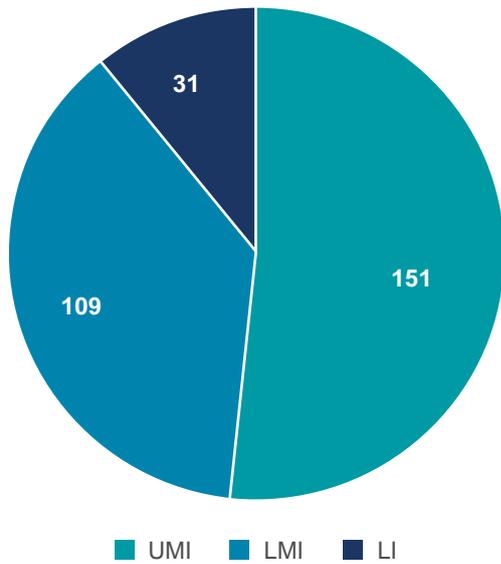
Private sector participation is mostly in small hydropower projects and concentrated in middle-income countries. Although the private sector owns almost 70 percent of the plants commissioned between 2000 and 2020, over 70 percent of the global installed capacity is publicly owned. For plants with less than 10 MW of capacity, private participation is highest, accounting for 74 percent of existing plants. For large plants with over 2,500 MW capacity, private participation is only 8 percent. Private investments in hydropower have been largely in MICs that have more favorable economic and policy environments and financially stronger offtakers, with upper-middle-income countries receiving over half of the funding support for 100 percent of privately owned projects.

Figure 2: Share of Hydropower Ownership by Plant Size (for Plants Commissioned Between 2000 and 2020)



Source: World Bank, extracted from the PPI database

Figure 3: Funding Support for Privately-owned Hydropower PPI Projects by Region (2010–2020); US\$, millions

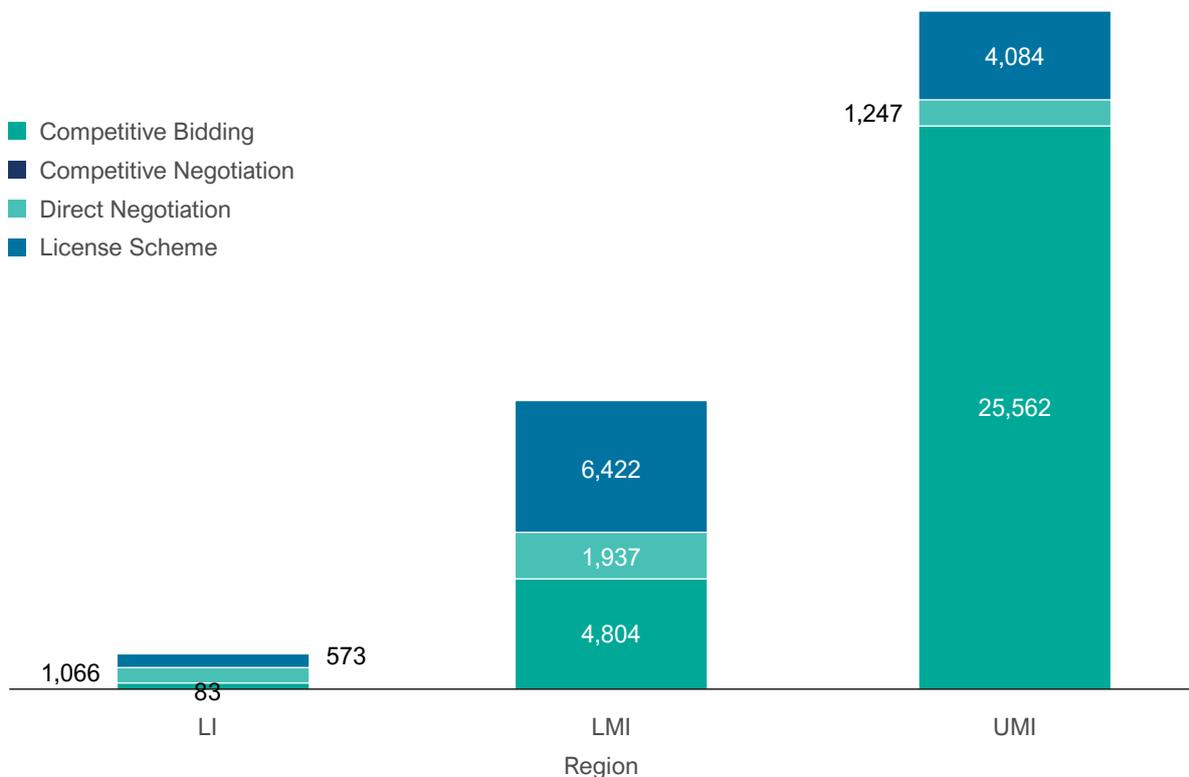


Source: World Bank, extracted from the PPI database

Competitive bidding is the most prominent award method for hydropower projects in UMICs.

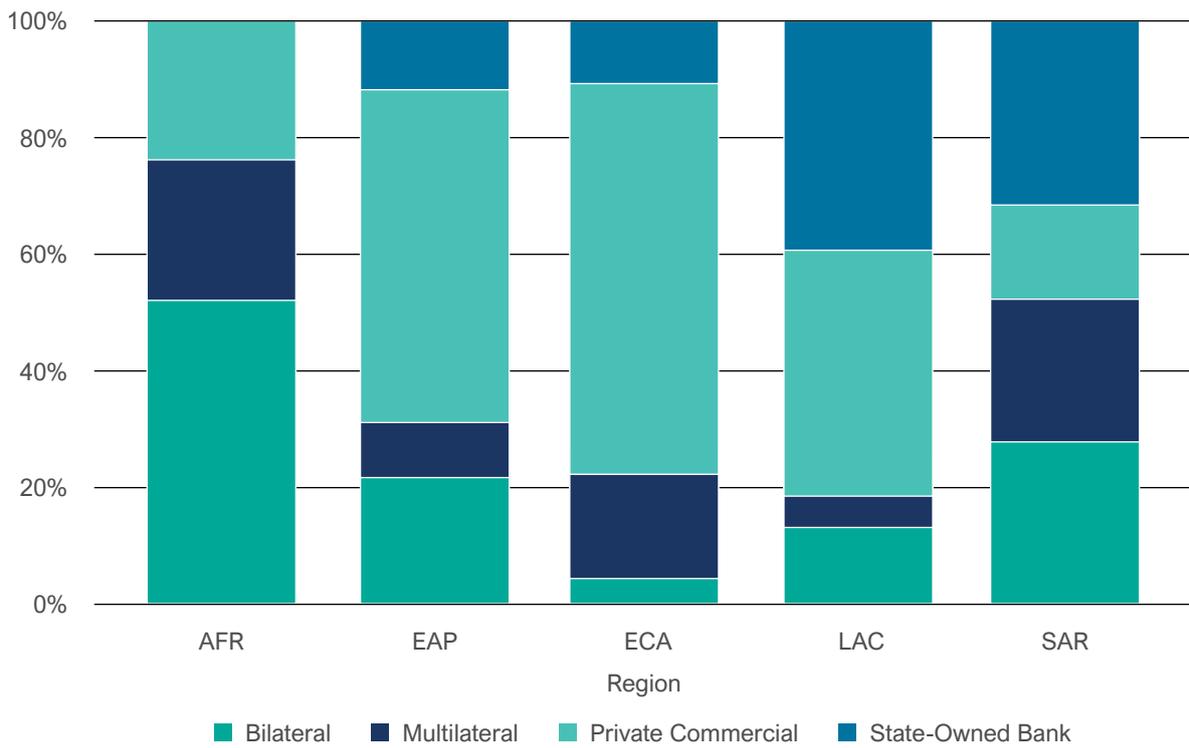
The private sector is involved primarily in greenfield hydropower projects despite the risks associated with projects at the early stages of development. The lack of engagement in brownfield projects could be driven by the reluctance of governments to divest their hydropower assets after they have been commissioned. The private sector also tends to favor run-of-river projects over reservoir storage projects.

Figure 4: Government Award Methods for Private Hydropower Projects (MW) by Income Group (2010–2020)



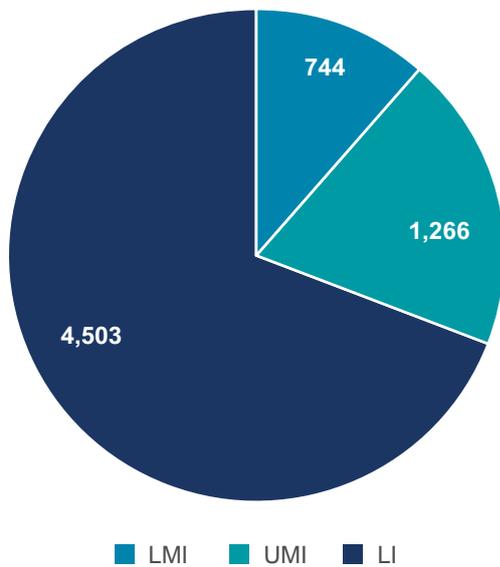
Source: World Bank, extracted from the PPI database

Figure 5: Distribution of Bank Types Supporting PPI Hydropower Projects over 50 MW by Region (2010–2020)



Source: World Bank, extracted from the PPI database

Figure 6: Multilateral Funding Support for Hydropower PPI Projects by Region (2010–2020); US\$, millions



Source: World Bank, extracted from the PPI database

Significant regional differences exist in how hydropower projects are financed. Most of the multilateral funding for privately developed projects has so far been channeled toward LMICs.



Survey on Private Sector Participation in Hydropower

This section summarizes survey results with stakeholders involved in private hydropower development.

Survey Sample

The survey sample was selected to reach out to all key stakeholders involved in various stages of the hydropower project life cycle, particularly in emerging markets (see Box 1). The survey targeted international stakeholders with a broad geographic reach and local stakeholders from priority countries relevant to DFIs' operations. Stakeholders included developers, lenders, DFIs, service providers, and governments selected for their past or current involvement in large hydropower transactions, geographic diversity, and their experience with pioneering or challenging projects. At least two international stakeholders from each category were included, along with efforts to incorporate local stakeholders to capture regional differences. Twelve countries with significant hydropower potential were identified, and a subset of representative countries was prioritized based on private sector involvement in hydropower development in these geographies. Out of 59 stakeholders identified, 23 high-priority ones were interviewed based on contact availability, responsiveness, and willingness to participate. The interviews, conducted from July to October 2023, each lasted for approximately one hour. Details on the survey sample selection process are available in Annex 1, and a sample survey questionnaire is available in Annex 2.

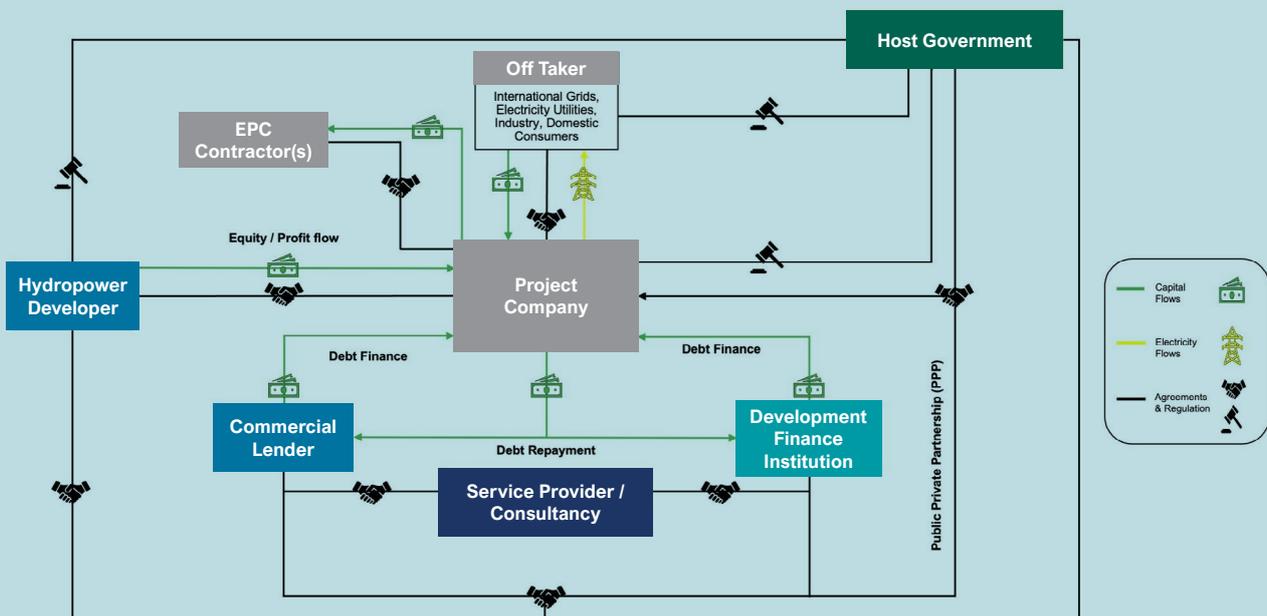
BOX 1

Stakeholder Mapping for Private Hydropower Projects

In a typical PPP for a large hydropower project, multiple stakeholders play different roles and contribute to the project's success. Here is a breakdown that illustrates the roles played by each party:

- 1. Host Government:** The government plays a crucial role in creating an enabling environment for private sector participation in hydropower projects. This includes developing policies, regulations, and institutions that attract private sector investment. The government usually identifies priority investment projects based on an approved national infrastructure plan or sector program. The government can also support project preparation, including feasibility studies and environmental and social impact assessments. Additionally, the government may provide equity financing, enter into power purchase agreements (PPAs), and ensure the reliability and bankability of the offtaker. It may also be involved in international agreements if the project uses transboundary water resources or aims to export electricity to a foreign offtaker.
- 2. Hydropower Developer:** The private sector developer is responsible for developing and implementing hydropower projects. It invests capital, conducts additional studies, secures financing, and manages the construction and operation of the project. The developer also takes on the technical, financial, and operational risks associated with the project, working closely with the government to ensure compliance with regulations and PPP agreements.
- 3. Development Finance Institutions:** DFIs, such as the World Bank, provide financial support and technical assistance to both the government and the private sector developers. They can offer funding for project preparation, including feasibility studies and environmental and social impact assessments. DFIs may also provide loans, guarantees, and risk mitigation instruments to attract private sector investment. They play a critical role in de-risking projects and mobilizing private capital.
- 4. Commercial Lenders:** Commercial lenders, such as banks, provide debt financing to private-sector developers. They assess the project's financial viability, evaluate risks, and provide loans based on its cash flow and collateral. Commercial lenders may require guarantees, such as political or partial risk guarantees, to mitigate their exposure to risks associated with the project.
- 5. Offtaker:** The offtaker is typically a government-owned utility or power purchaser who enters into a long-term power PPA with the private sector developer. The offtaker commits to purchasing the electricity generated by the hydropower project at an agreed-upon price. The offtaker's creditworthiness and ability to honor the PPA are crucial for attracting private sector investment.
- 6. Service Providers:** Various service providers, such as legal, technical, environmental, and social consultants, support the development and operation of the hydropower project. They provide expertise in areas such as project design, environmental impact assessment, community engagement, and legal compliance.

Figure 7: Stakeholders Involved in Private Hydropower Projects



Stakeholder Perspectives of Risks and Opportunities in Large Hydropower

In addition to the overall energy sector risks that can potentially impact any generation project development, risks associated with large hydropower project development can be classified under four main categories (see Figure 8):

- 1. Technical Risks:** These include geotechnical, seismic, and hydrological risks. Geotechnical and seismic risks can significantly affect project schedules and costs, while hydrological factors can impact generation and revenues.
- 2. Financial Risks:** These include risks related to financing packages, electricity markets, foreign exchange, and general lender requirements.
- 3. Environmental and Social Risks:** These include risks related to land acquisition and resettlement, biodiversity and ecology, and land and water use conflicts. Resettlement issues, disputes involving NGOs, and conflicts with local communities can pose significant challenges to hydropower projects.
- 4. Political Risks:** Political change and government responsiveness are significant risks to hydropower projects. Political instability, changes in concessions and tax regimes, and government response time can impact project timelines and success.

Figure 8: Top Risks in Developing Large Hydropower Projects

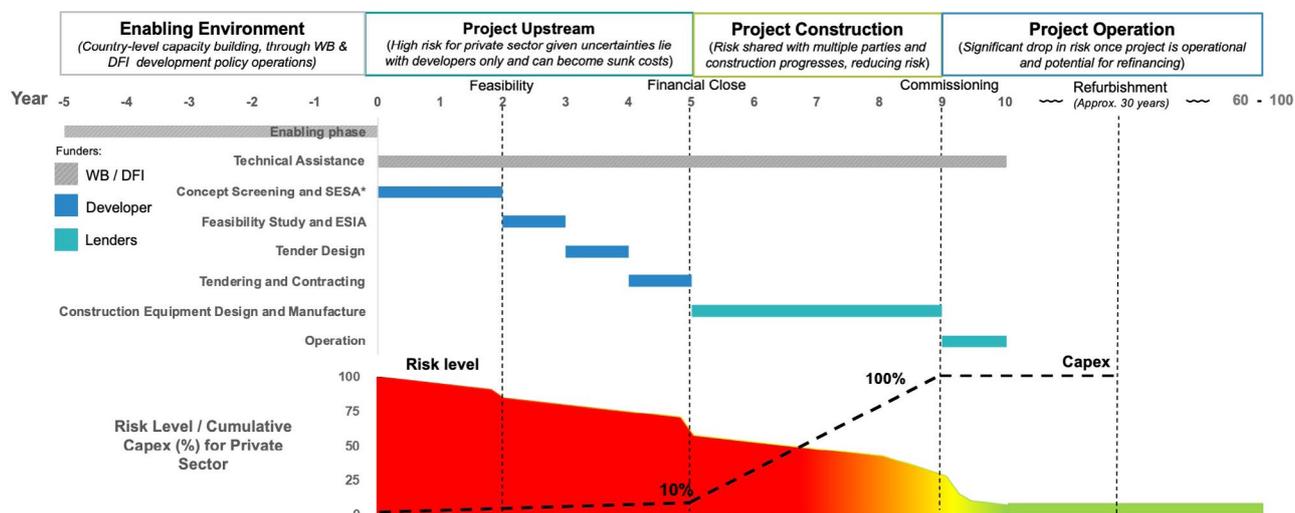


Source: J. Plummer Braeckman et al., "Financiers' Perceptions of Risk in Relation to Large Hydropower Projects," 6.

Large hydropower development timelines are often significantly longer than other renewable energy sources, typically extending easily beyond eight to ten years from project initiation to the commercial operation date. This extended duration creates additional risks, making it challenging for some private investors to participate. Delays and uncertainties during long development and construction phases, coupled with potential changes in government or regulatory regimes, further compound these risks. Additionally, when projects have a multipurpose component important to the country or regional economy (such as water supply or irrigation), the complexity of the arbitrage mechanism between different water uses is a major deterrent to private sector participation.

The typical risk profile for a large hydropower project is presented in Figure 9. The figure clearly highlights the change in risk level along the project cycle, with a significant reduction in overall risks during the operation phase. Conversely, the figure shows that a large hydropower project is CAPEX intensive during the limited period of construction, while steady revenue streams come at a later stage after commissioning (9–10 years of development).

Figure 9: Typical Hydropower Project Timeline, Risk, Stages and CAPEX



Note: SESAs = Strategic Environmental and Social Assessments and ESIA = Environmental and Social Impact Assessment

Source: Adapted World Bank Position Paper on Hydropower Development. 2022 (internal).

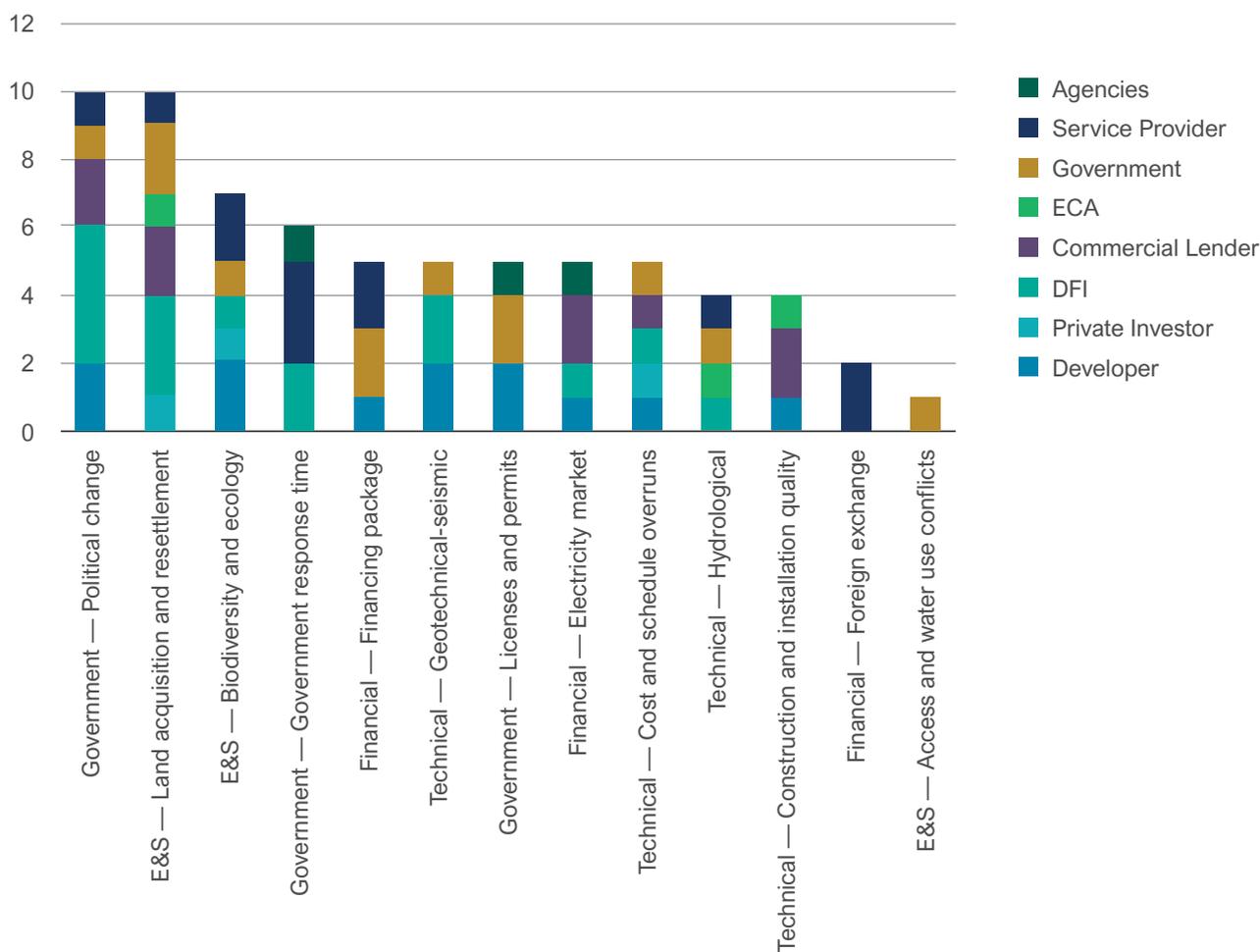
Within the top risks identified in the list presented in Figure 8, government political change was perceived to be one of the biggest risk factors for large hydropower projects. Stability, government buy-in, and supportive policy were considered critical enabling factors for successfully commissioning a private project. Environmental and Social (E&S) risks related to resettlement and biodiversity were highlighted as critical in project selection; technical risks associated with geotechnical and hydrological conditions were among the most significant factors affecting project viability, along with the associated risks of cost overruns and delays during construction. Finally, financial risks, including off-taker risks, market risks, foreign exchange risks, and the overall risks associated with reaching financial close, were highlighted as particularly concerning for project stakeholders. Figure 10 presents the key risks identified by survey respondents.

Government Risks

Stakeholders identified political change, lack of government responsiveness, and issues related to licenses and permits as the largest government risks in developing large hydropower projects. The lengthy development phase of large hydropower projects, which can last up to 10 years, makes it highly likely that political change will occur during this period, making the risk of decisions or policy reversals

negatively impacting project development high. Slow government response times, often due to lack of capacity and adequately trained personnel, contribute to major project delays and budget overruns. The complex permitting process for hydro projects, exacerbated by internal coordination issues and lack of experience in developing hydropower projects, further hinders project progress. Additionally, the lack of ancillary infrastructure, such as transmission lines and grid-related upgrades, often presents a key barrier to achieving commercial operation date and evacuating power, resulting in significant deemed energy claims and burdening offtakers. These government risks highlight the need for streamlined processes, improved capacity, and coordinated efforts to mitigate their impact on hydropower projects.

Figure 10: Key Risks in Successful Large Hydropower Development (Survey Results)



Source: Mott McDonald, *Drivers of Private Sector Interest in Large Hydropower* (2023).

Technical Risks

Geotechnical and seismic risks were identified as the most significant technical issues in large hydropower projects, posing significant risks to schedule and cost. This was partly due to the extensive amount of civil and underground work required. While these risks cannot be fully eliminated before construction, they can be mitigated through comprehensive geotechnical and geological investigation campaigns and the involvement of competent designers and contractors.

Hydrology uncertainties were seen as significantly impacting generation and revenues, making rigorous assessment necessary, especially due to the risks of climate change impacts on water

flows. This risk is typically partly or fully transferred to the government, representing a major liability should actual flows deviate significantly from design assumptions.

Construction and installation quality was highlighted as a key technical risk for the project. Since hydropower projects are custom-designed, “one-off” projects, they are more complex to design and implement than solar or wind projects, making developers heavily reliant on contractors to ensure expected performance. Terminating a contract for underperformance is both expensive and time-consuming. Therefore, thorough contractor due diligence during procurement is crucial, including comprehensive technical specifications, robust performance guarantees in contracts, and sufficient supervision during construction to maintain quality.

Cost and time overruns were seen as significant risks, as long timelines can erode stakeholder confidence. The inherent unpredictability of the cost of construction materials has been exacerbated by post-COVID volatility. In addition, construction delays significantly impact contractors’ costs, including site operation, standby time, additional design, and rework. Such delays severely test the financing structure of the project.

Environmental and Social Risks

Land acquisition was highlighted as a significant legal and social risk, as people with customary ownership often contest land ownership due to land use. Resettlement is a challenging hurdle, as determining who is entitled to payments can be difficult, and issues with Non-Governmental Organizations (NGOs) can lead to reputational damage. Flooding areas previously used by local communities also have the potential to cause hostility between the local community and the project. Biodiversity and ecology are also significant risks, as some projects can be in areas hosting vulnerable species needing specific care to avoid or mitigate potential impacts. Land and water use conflicts are also a concern for stakeholders, as hydropower projects often take up a considerable amount of land in areas, leading to potential conflicts over water access/water use.

Financial Risks

Electricity Market: Offtaker risk was highlighted as a major financial risk for most stakeholders. As many utilities in emerging markets are not commercially viable, their ability to honor payments under PPAs, especially long-term PPAs, was flagged as a major concern for financiers and developers. Additionally, political interference on an agreed price to appease the end-user, especially during periods of political change, was considered a potential risk.

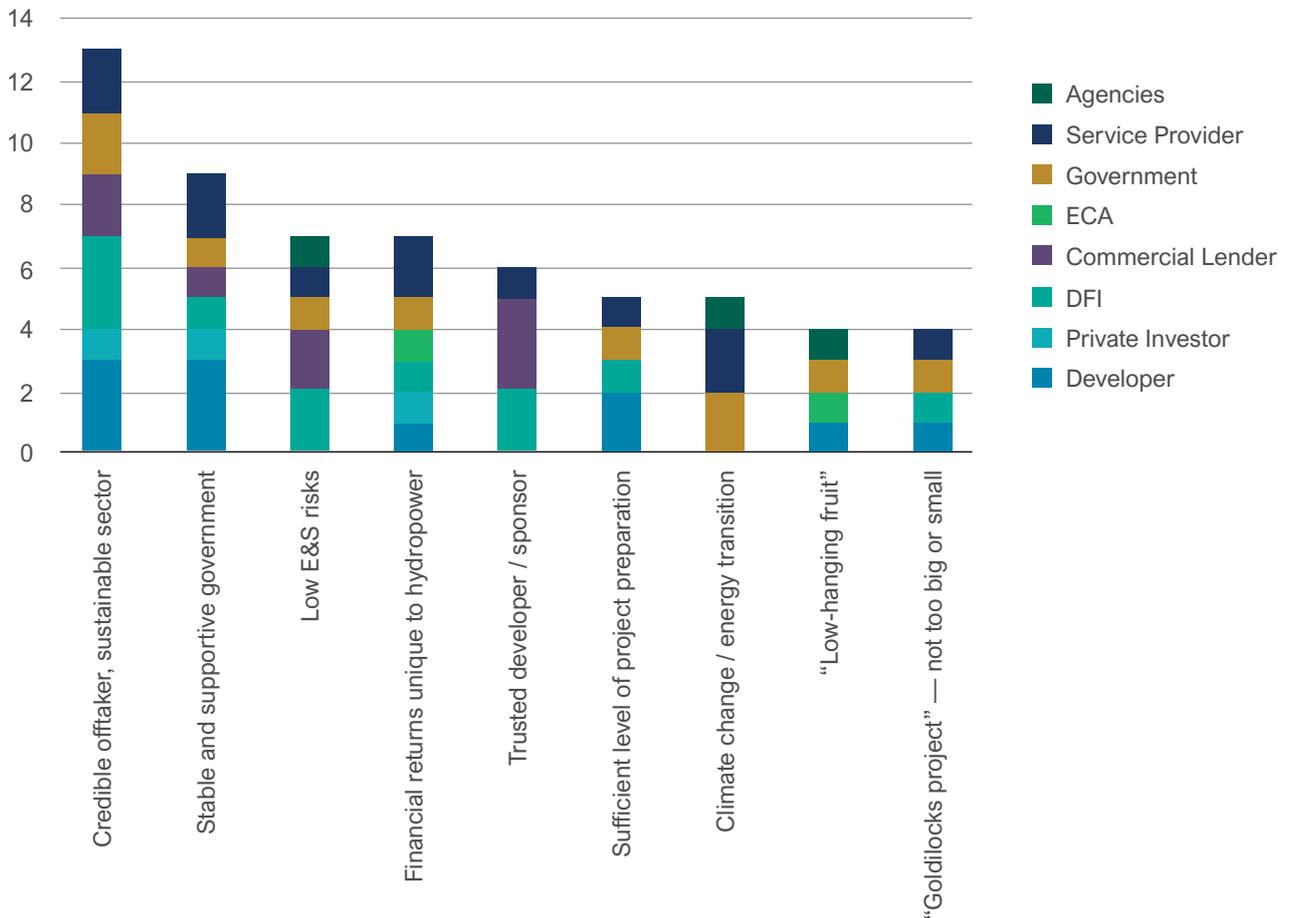
Financing Package (including general lender requirements): Securing financing packages is a complex process, given that lenders often have differing requirements, which could increase barriers for smaller or less experienced market entrants. Meeting heterogeneous lender requirements could entail multiple rounds of studies and due diligence, which elongate development timelines considerably. Delays increase the risk of “moving the goalposts” through changing standards and market conditions, which could also cause a loss of confidence and interest amongst financiers, contractors, and other stakeholders.

Foreign Exchange: There is usually a currency mismatch between the financing package and the revenue stream—international capital providers lend in hard currencies while revenues generated are in local currency. This, coupled with potential exchange rate fluctuations during the project life cycle, can cause repayment challenges. Moreover, even if the foreign exchange risk can be absorbed, developing countries may find it difficult to access hard currencies (convertibility issue) to repay debt in hard currency, further exacerbating the project repayment risk. As such, there is a growing interest in accessing at least some portion of financing in local currency to mitigate these risks. However, local financiers have highlighted regulatory capital requirements that allow only short loan tenors that do not match the project and PPA timelines.

Private Sector Interest in Large Hydropower

The survey questions asked participants to identify the critical factors that would incentivize private sector interest in large hydropower projects. Figure 11 highlights the main parameters that would provide private sector comfort in supporting a specific large hydropower project.

Figure 11: Key Drivers of Private Sector Interest in Large Hydropower (Survey Results)*



* "Low-Hanging Fruit" refers to low-risk, high technical potential projects in LMIC with high electricity demand and low electricity supply. "Goldilocks projects" are typically around 100 MW with small or no reservoir, avoiding E&S impacts at the outset.

Government interviewees acknowledged the role of hydropower potential in realizing energy access and transition targets. Government interviewees noted that corporate commitments to clean energy often drove private investors' interest in large hydropower projects. Worldwide, companies and countries have strong incentives to develop clean energy, and there is an ongoing interest in large hydropower. However, the pool of experienced developers able to develop large hydropower projects is limited. Hydropower projects are a good option for delivering large volumes of renewable energy at scale and increasing the capacity of non-dispatchable renewables.

Securing a credible offtaker and reliable revenue stream for the project has been highlighted as crucial in all markets. Key considerations include the commercial viability of utilities, electricity demand, the adequacy of power distribution infrastructure, the affordability of tariffs, regional power interconnection to mitigate offtaker risk, and the presence of sovereign guarantees and ring-fenced struc-

tures to pay project revenues.⁶ All parties recognized the importance of holistic support to improve the financial health of the offtakers through a comprehensive sectorial approach. Such support should be part of a coordinated approach to drive investment in the power sector and send positive signals to market participants.

Projects with lower E&S risks, such as minimal resettlement needs, strong local community support, low likelihood of disputes with NGOs, and compliance with international E&S standards set by the International Finance Corporation (IFC) and other development finance institutions, were said to be more attractive by private stakeholders. Run-of-river projects, which are perceived to have inherently lower E&S risks due to the limited storage capacity, were mentioned to be of particular interest. However, given the renewed emphasis on storage required to allow better integration of variable renewable on power system grids, this might change in the future.

Government respondents underscored the importance of adequate project preparation, including feasibility and E&S studies, to boost prospective developers' confidence. Such preparation should include resource mapping, appropriate upfront site selection, and de-risking activities to encourage private sector interest. Developers and governments emphasized the need for financial support to conduct high-quality feasibility and E&S studies necessary to ensure project viability. Lenders also stressed that project sponsors should have good reputations and strong track records for developing large projects in similar markets.

Finally, developers and lenders emphasized the importance of a stable and supportive government, especially during the pre-construction phase of a hydropower project where development costs are high, leading to significant investment risks. Positive government indicators for private developers include the capacity for government counterparts to engage in public-private partnerships (PPPs), their experience in developing large hydropower projects, the mobilization of reputable advisors on the government side, transparent and competitive tender processes, streamlined acquisition of permits and licenses, and inclusion of hydropower in the government's least-cost generation expansion plan.

A small pool of experienced developers indicated they prefer large hydropower projects despite high upfront costs, largely because of economies of scale. Typically, these projects have lower levelized cost of electricity (LCOEs)⁷ that enable developers to capture margins across the value chain. Developers also indicated that financing constraints, rather than technical ones, define their upper limit for a project's size. In addition, developers noted that they are interested in refurbishing already-built hydropower projects but have seen few viable opportunities offered on the market and no viable business model being developed for the moment.

Lenders, including export credit agencies and commercial banks, expressed little appetite for large hydropower projects due to concerns over reputation-damaging E&S risks. However, DFIs remain open to participating in well-designed, low-risk hydropower projects or in high-risk projects with significant development rewards, provided they are prepared according to international best practices and demonstrate a transformational impact. Lenders stressed that they prefer projects where the government has a stake, provides regulatory support, and is committed to moving projects forward and expediting approvals and permits. Government involvement also spurs the development of necessary public infrastructure, such as transmission lines.

Consultations with lenders led to the development of a typology of lending terms specific to large hydropower projects. Local financiers confirmed that only providing limited loan tenors does not fully align with

⁶ A ring-fenced structure is a legal and financial arrangement designed to separate a particular project's finances and operations from those of the parent company or other project.

⁷ IRENA, *Renewable Power Generation Costs in 2022*.

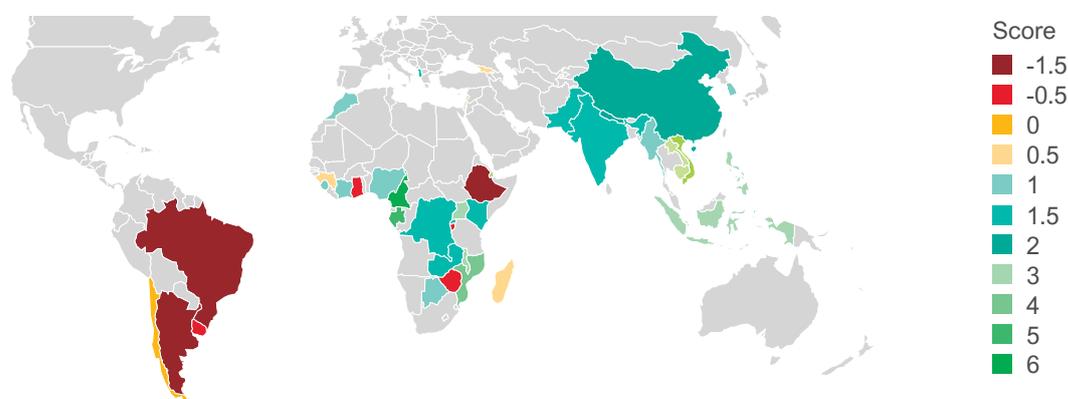
the long-term revenue stream of hydropower PPAs. This mismatch was highlighted as a major financial risk in attracting private lenders to large hydropower financing.

Preferred Geographies for Private Sector Involvement in Large Hydropower

There is a large untapped hydropower capacity worldwide, with the most potential in the East Asia & Pacific Region. Estimates for gross theoretical hydropower potential vary widely from 31,000 to 127,000 TWh annually. In contrast, global electricity consumption in 2022 was 26,800 TWh.⁸ However, not all potential hydropower sites can be developed due to various environmental and economic constraints.

Respondents from the private sector, government bodies, and DFIs identified several countries with the most potential for large hydropower development, including Cameroon, Gabon, Malawi, Mozambique, Uganda, and Zambia in Africa; India, Indonesia, Nepal, the People's Republic of China, and the Philippines in Asia; and Chile in Latin America. These countries were chosen due to their favorable geography, underdeveloped generation infrastructure, and potential attractiveness for DFIs to support hydropower development. Additionally, Albania, Georgia, and Uzbekistan in Europe and Central Asia were also of interest to the interviewees. However, there were general reservations about the potential future development of hydropower in Latin America due to strong public opposition to new hydropower projects and political sensitivities around the development of large hydropower projects. In more advanced economies such as Bulgaria and Poland, as well as countries in the Western Balkans, respondents highlighted the need for dispatchable capacity and energy storage due to the substantial development of variable renewable energy projects.

Figure 12: Results from Stakeholder Interviews on Private Sector Potential for Large Hydropower



Source: Mott McDonald, *Drivers of Private Sector Interest in Large Hydropower* (2023), 29.

Private Sector and Non-Conventional Hydropower

Pumped Storage Hydropower

Pumped Storage Hydropower (PSH) currently accounts for over 90 percent of the world's total electricity storage capacity and has experienced a consistent annual capacity increase, reaching 160 GW in 2021

⁸ Adapted from Xu et al., *Nature Water* 2023.

from 92.4 GW in 1994. Projections indicate a capacity of 225 GW by 2030 and a necessary increase to 420 GW by 2050 to meet NZE objectives.

Given its energy capacity and duration, PSH provides grid reliability and ancillary services such as inertia, frequency regulation, and load-shifting, offering additional benefits. Respondents emphasized PSH's appeal as an energy storage solution and its ability to address baseload issues. PSH encounters investment barriers similar to those in hydropower, including inadequate infrastructure, high initial costs, limited long-term financial incentives, low compensation for flexibility services, and uncertainties in electricity pricing and market conditions, particularly in LMICs. Additionally, without a regulatory framework to compensate for storage and ancillary services provided to the grid by PSPs, this technology may not be financially viable and may attract little interest from the private sector. However, examples of large PSPs being developed by private developers in established markets demonstrate that, despite the substantial capital expenditure requirements, these projects are appealing to the private sector when developed in a favorable regulatory environment. This was confirmed by some survey respondents.

Brownfield hydropower development

Optimizing existing hydropower infrastructure and non-powered dams (for example, those built for irrigation, flood control, and household water supply) can significantly boost hydropower capacity without the need for new dams. Almost 40 percent of global hydropower assets are at least 40 years old, and the average age is 33.⁹ Hydropower plants that are between 45 and 60 years old typically require major rehabilitation and upgrades, providing opportunities to incorporate new technologies that can increase efficiency and operational capacity. E&S risks are also lower for existing infrastructures—respondents noted that these represent the biggest risks in developing new hydropower systems. Also, by usually deriving more electricity production from an existing site, the rehabilitation and upgrade of existing hydropower systems reduces the overall GHG emissions per kWh of hydropower compared to building new dams.

By 2030, 172 GW of brownfield hydropower capacity is expected to be added through refurbishment (96 percent) and retrofitting (4 percent),¹⁰ mostly in high-income countries.¹¹ In Africa, 60 percent of screened hydropower facilities have a high or medium need for refurbishment, requiring investments of \$6.8 billion.¹² This represents 14.7 GW of capacity. Globally, about 45 percent of the hydropower additions required to achieve the NZE 2050 goal¹³ are expected to come from refurbishment and upgrading.

While some respondents clearly identified rehabilitation projects as attractive, the lack of track records for successful privately financed projects and significant regulatory and policy uncertainty (for example, ownership, valuation of asset base, and tariff calculations) surrounding existing hydropower assets, which are primarily owned by public utilities, has limited private sector involvement in brownfield development. This is an area that needs further assessment in terms of risk-sharing mechanisms, contractual arrangements, and ownership models (possibly through asset recycling) that would make rehabilitation projects bankable for the private sector while also making them acceptable for the governments and public utilities.

Private Project Development Approaches

As highlighted earlier, due to the inherent complexity of large hydropower projects, public financing may be the only feasible route to develop these complex infrastructure projects in many instances, particular-

9 IEA, "Hydroelectricity."

10 IEA, *Hydropower Special Market Report*.

11 IHA, *2023 World Hydropower Outlook*.

12 IHA, *Africa Hydropower Modernisation Programme*.

13 IEA, *Hydropower Special Market Report*.

ly in challenging regulatory and political environments. However, in some contexts, governments have attempted to outsource project development to private entities applying the typical PPP approach used for large infrastructure projects.

Respondents discussed the validity of the current PPP development model as applied to large hydropower. They highlighted some of the limitations of the traditional process, presented in Figure 13 below, where the project developer is involved at a late stage of project development, following a sequence of activities aimed at selecting the right strategic partner for the government.

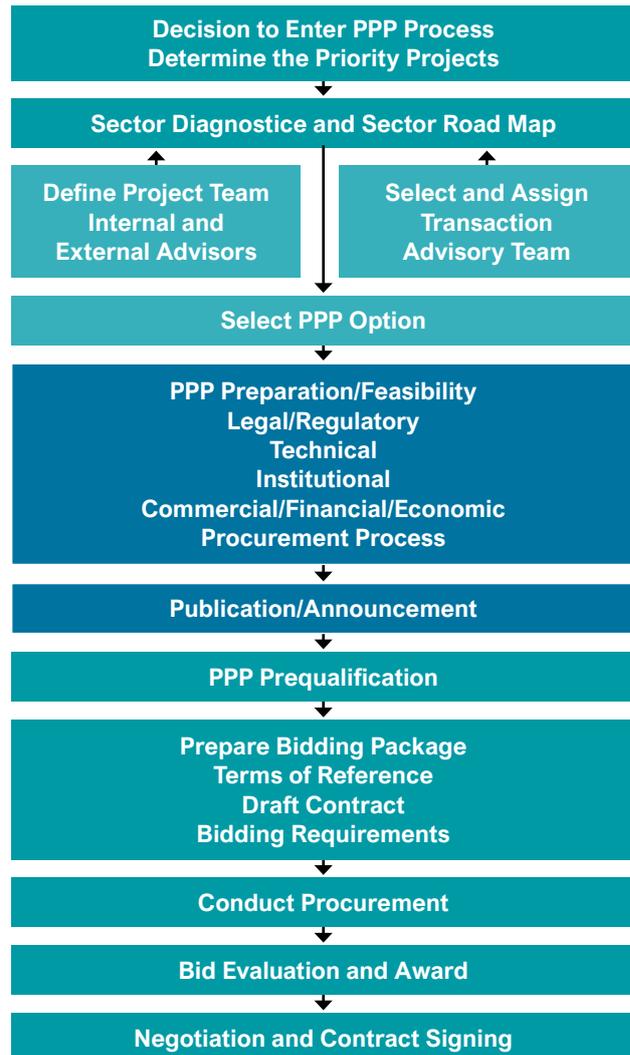
Developing large hydropower projects presents several challenges, including environmental and social impacts, complex regulatory frameworks, and significant upfront capital investments. These projects often affect local ecosystems and communities, requiring careful planning and management to mitigate adverse effects. Additionally, navigating the regulatory environment can be time-consuming and requires compliance with various local and international standards. The capital-intensive nature of hydropower also poses financial risks, especially given the long lead times before projects become operational and start generating returns.

The traditional approach to developing large hydropower under PPP format projects can be slow, challenging, and expensive for the following reasons:

- **Political Engagement:** The long development lead times of hydropower projects do not align with the shorter electoral, budget, and macroeconomic cycles, making hydropower less politically appealing for the governments and utilities seeking a quick solution to an energy shortfall.
- **Public Sector Capacity:** Governments and utilities often lack the capacity to execute transactions and the budget to pay for advisors.
- **DFI Appetite or Interest:** Historically, donor and DFI interest in hydropower has fluctuated, primarily due to the perceived E&S risks.
- **E&S Risks:** Hydropower projects typically involve greater E&S risks. While many of these can be addressed through professional project development, this takes time and costs money. Confidence and competence are also needed to cope with interactions from NGOs and civil society groups concerned about a particular project and communicate effectively with them.

This traditional approach, while geared towards ensuring robust project design, requires strong capacity from the public sector entity and close oversight of this sequential process. Respondents highlighted that a paradigm shift is needed in the current development model for private investors in hydropower, emphasizing the early involvement of project developers in project design rather than the current practice

Figure 13: Generic PPP Project Sequence



Source: Heather Skilling and Nils Janson, "Models for Private-Public Partnerships" 2006.

of engagement after a long selection process. This early engagement can lead to more innovative and sustainable solutions, better stakeholder alignment, and improved risk management. By participating from the outset, investors can inform project outcomes more effectively, ensuring that environmental and social considerations are integrated into the design, potentially reducing future costs and enhancing the project's overall feasibility and acceptance.

Several respondents highlighted the Specialist Developer Model as an improvement to a traditionally lengthier development model. In this model, a specialized firm (specialist developer) is recruited and remunerated to take on the role of early-stage developer but will not necessarily invest in the project's equity. These types of firms are selected to ensure the best value for money and adequate development and project structuring qualifications beyond technical skills. The entity that serves as the specialist developer provides additional studies and due diligence reports required to make the project bankable. This attempts to overcome the challenges of financing early-stage development of hydropower projects. It enables governments to identify and resolve the key factors that discourage investors and bring more bankable projects to market. By streamlining traditionally inefficient, lengthy project development cycles, this approach can reduce the likelihood of stakeholders' withdrawal. The model also optimizes private sector projects by de-risking them through strong upstream preparation work, which ensures project viability. This model aims to bring more bankable projects to the market. However, due to the limited pool of qualified firms interested in being exposed to large hydropower projects and taking on this specialist developer role, this model presents the risk of the specialist developer being ultimately interested in bidding for the developer role in the PPP, which creates a conflict of interest if the firm was involved in the design of the PPP contractual conditions. This was highlighted by survey respondents.

An alternative model is to create an independent development platform under the umbrella of a group of DFIs to complete the project preparation work in partnership with governments. This model includes a strong co-developer, such as an independent development platform supported by DFIs, serving as a technical and commercial partner to the relevant government in early-stage project preparation. This platform includes a dedicated team selected competitively with relevant experience in large hydropower development, leading project preparation with government collaboration. This approach avoids potential conflicts of interest during the project preparation phase from developers interested in bidding for projects, as it does not mobilize potential developers but a set of qualified individuals without an affiliation to the specific development company. This model ensures continued advisory support to the government, allowing it to act as an empowered co-developer who can make the necessary decisions to advance the project. The platform could pool concessional resources for early project development, minimizing the cost impact of early-stage studies and analyses. It could also involve potential lenders in the early stages of the development process to ensure that projects are prepared to be bankable. The preparation phase will need to emphasize commercial principles and address fatal flaws to resolve deal-breakers, allowing the project to be quickly tendered with fully defined parameters. This platform would enable the pooling of resources from various DFIs through agreed collaborations, ensuring realistic and sufficient funding for project preparation, which can be easily accessed (while providing the required governance) to complete upfront work efficiently and with the appropriate detail. This will ensure that credible sponsors are interested in bidding for the project when it is eventually tendered.

Capital Recycling as a Means to Unlock More Capital for the Construction Phase

Respondents acknowledged that large hydropower demands significant efforts and capital during the development and construction phases while presenting a favorable cash flow profile post-construction once the project has been significantly de-risked, apart from sectoral and political risks, typical of emerging countries, which remain during the project life. The long-term perspectives provided by operational

hydropower assets are attractive to financiers looking for a secure stream of revenues with reasonable risk levels. One of the key issues identified by stakeholders is the very limited number of lenders interested and involved in early-stage development and construction, particularly for projects above 50 MW. At this stage, when asked for ways to scale up large hydropower development and private involvement in developing and financing large hydropower, the fastest and most efficient way identified by respondents was to recycle capital from the post-construction phase (once the project is commissioned) back into new projects at a faster pace than currently observed in the market.

The ease of refinancing post-construction (both equity and debt) of private assets not only allows the recirculation of scarce existing capital into the development of new projects but also opens the possibility of unlocking currently untapped market capital with a lower appetite for risk aligned with the post-commissioning risk profile of large hydropower projects. For large publicly developed projects, which represent the highest market share, refinancing of public capital (such as IBRD lending, for example) with private capital post-construction may provide more alternatives to and make the best use of scarce public capital.



Two asset classes in the capital structure are particularly suitable for capital recycling: equity through Yield Companies (YieldCos) or Infrastructure Investment Trusts (INVITs) and debt through green bonds.

A Yieldco is a publicly traded company that is formed to own operating assets that produce a predictable cash flow, primarily through long-term contracts. YieldCos are often associated with renewable energy projects like wind farms or solar parks. Investors in YieldCos expect to receive a steady stream of dividends from the income these assets generate, which are usually attractive to investors looking for regular income and a lower-risk investment. An INVIT is a similar concept, primarily in India, where it functions as a collective investment scheme similar to a mutual fund, designed to pool money from investors to invest in infrastructure projects such as highways or energy projects. They are regulated entities that offer investors the opportunity to invest in infrastructure projects without having to own the project directly.

Bonds are debt products typically issued for a fixed term during which the issuer pays interest to the bondholders, usually at a fixed interest rate. When the term is up, the bond reaches its maturity date, and the issuer pays back the bond's face value to the bondholders. A green bond is a fixed-income debt instrument for which the proceeds are allocated to clean energy projects or projects with demonstrated environmental benefits.^{14,15} These recycling mechanisms are effective in public and private placements and have succeeded in emerging markets.

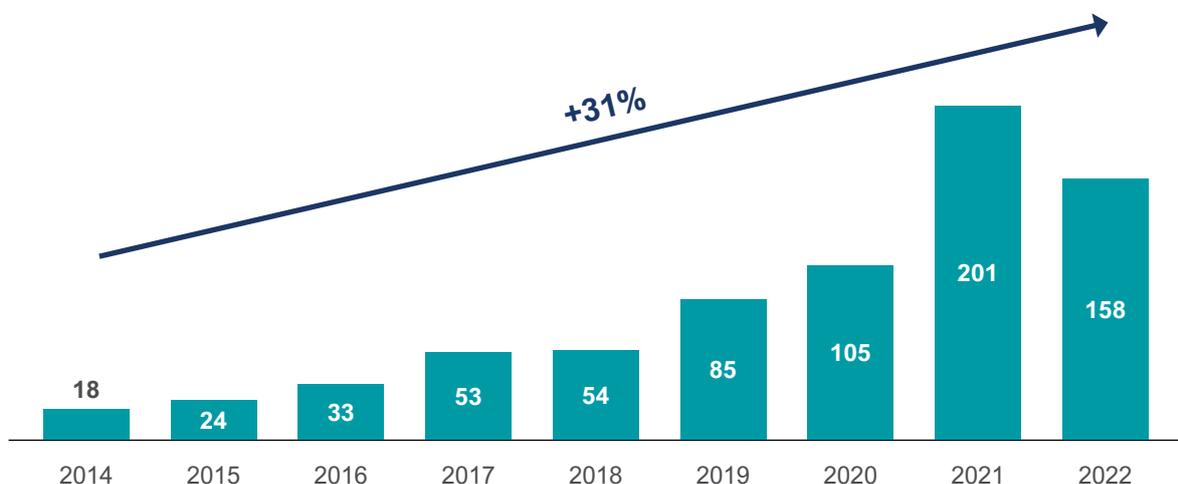
The private sector has increasingly used green bonds as a subset of bond raising to finance and/or re-finance clean energy projects. These attract developers as they allow access to capital markets, sometimes at a lower cost, due to their long tenure and support for good environmental, social, and governance practices. Since 2014, \$742 billion has been raised for clean energy projects through green bonds. Green

14 U.S. Department of Energy, "Green Bonds," *Better Buildings Solution Center*, accessed November 3, 2023, <https://betterbuildingssolutioncenter.energy.gov/financing-navigator/option/green-bonds>.

15 Clean energy comes from generation systems that do not produce any kind of pollution, notably greenhouse gases such as carbon dioxide that cause climate change. Therefore, clean energy—in full development—drives advances to conserve the environment and palliate the crisis with non-renewable fuels, such as gas and oil.

bonds can be used to enable issuers to keep their market access while engaging in transition-related activities, such as hydropower, and/or enlarge their investor base, in addition to the potential to provide better debt terms.

Figure 14: Green Bonds Issued for Energy-related Investments (US\$, billions)



Source: Climate Bonds

Hydropower assets are well-suited to financing with green bonds. As green bonds tend to have long terms, they usually align well with the 60 to 100-year lifespan¹⁶ of hydropower projects. Once hydropower projects with a reliable water supply are operational, they have long-term, foreseeable costs and predictable revenues,¹⁷ which makes them an ideal asset for pension funds or other long-term investors seeking annuity payments. Large dams typically involve substantial investment needs, often exceeding \$1 billion. In 2022, green bond transactions valued at \$500 million or more accounted for 69 percent of the total volume of green bonds.¹⁸ As hydropower plants age, rehabilitation works present a significantly lower risk level than greenfield construction risk, which also makes green bonds a valuable tool for financing the rehabilitation of hydropower projects.

However, the risk level associated with E&S impacts of some large hydropower projects concerns both public and private investors. Hydropower projects have a potential negative impact on biodiverse areas during construction, potential displacement of people, and lack of experience in hydropower projects have limited the issuing of green bonds for these projects. Thus, very limited green bond issuance has been seen for large greenfield hydropower projects. In some contexts, projects defined as anything exceeding 25 MW are currently excluded from the green bond market (such as within the India framework).¹⁹

16 Indiana Office of Energy Development, "Fuel Facts: Hydroelectric Power," *Indiana Office of Energy Development*, accessed November 3, 2023, <https://www.in.gov/oed/about-oed/newsroom/fact-sheets/fuel-facts-hydroelectric-power/>.

17 Downing LLP, "Flowing Forward: A 101 of Hydropower Technology," *Downing LLP*, accessed November 3, 2023, <https://institutional.downing.co.uk/insights-and-case-studies/flowing-forward-a-101-of-hydropower-technology>.

18 Climate Bonds Initiative, "Market Data," *Climate Bonds Initiative*, accessed November 3, 2023, <https://www.climatebonds.net/market/data>.

19 S&P Global Market Intelligence, "Hydropower Largely Excluded from Burgeoning Green Bond Market," *S&P Global Market Intelligence*, accessed November 3, 2023, <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/hydropower-largely-excluded-from-burgeoning-green-bond-market-46923041>.

BOX 2

Climate Bond Initiative (CBI) and Hydropower: Example of Costa Rica's Reventazon Hydropower Plant

In March 2021, the CBI created a comprehensive framework defining the requirements for hydropower project eligibility for climate bond certification. This certification framework applies to run-of-river, impoundment, pumped storage, in-stream technology, and infrastructure dedicated to eligible facilities, such as transmission lines. Key elements of the CBI criteria are low greenhouse gas (GHG)-generating infrastructure, adaptation to climate change, and greater climate resilience.

Issuance snapshot



The Costa Rican Electricity Institute (ICE) Has become the world's first hydropower operator to obtain green bond certification using the newly released criteria



| | | |
|--------------------------------|-------------------------|-------------------------------------|
| \$150M Issuance Size | 7 years Tenor | August 2021 Issuance Date |
|--------------------------------|-------------------------|-------------------------------------|

 **The proceeds of the issuance went to refinance the 330MW Reventazón hydropower plant**, which has a generation of 1,465 GWh/Year and supplies energy for 12% of Costa Rica's population

The project proved to meet key principles included in the assessment

| | |
|-------------------------------------------------|---------------------------|
| 1. Use of proceeds | 3. Management of Proceeds |
| 2. Process for Project Evaluation and Selection | 4. Reporting |

Note: This project was the first and only one to be refinanced using CIB Hydropower criteria.

The Climate Bonds Initiative (CBI) Hydropower Criteria²⁰ have been adopted as a green certification method for hydropower projects (see box 2). This development is driving investors' interest, as expressed during several interviews. However, the various green bond indexes and certifying agencies use different considerations when assessing hydropower as a green asset, leading to inconsistencies. For example, the Bloomberg Barclays MSCI Global Green Bond Index limits the inclusion of large hydropower projects to those that achieve a 3+ score on the Hydropower Assessment Protocol of the Hydropower Sustainability Alliance²¹ or that have committed to meeting the eight performance standards of the International Finance Corporation.²²

20 Climate Bonds Initiative, Hydropower Criteria Background Paper; Climate Bonds Initiative; The Hydropower Criteria.

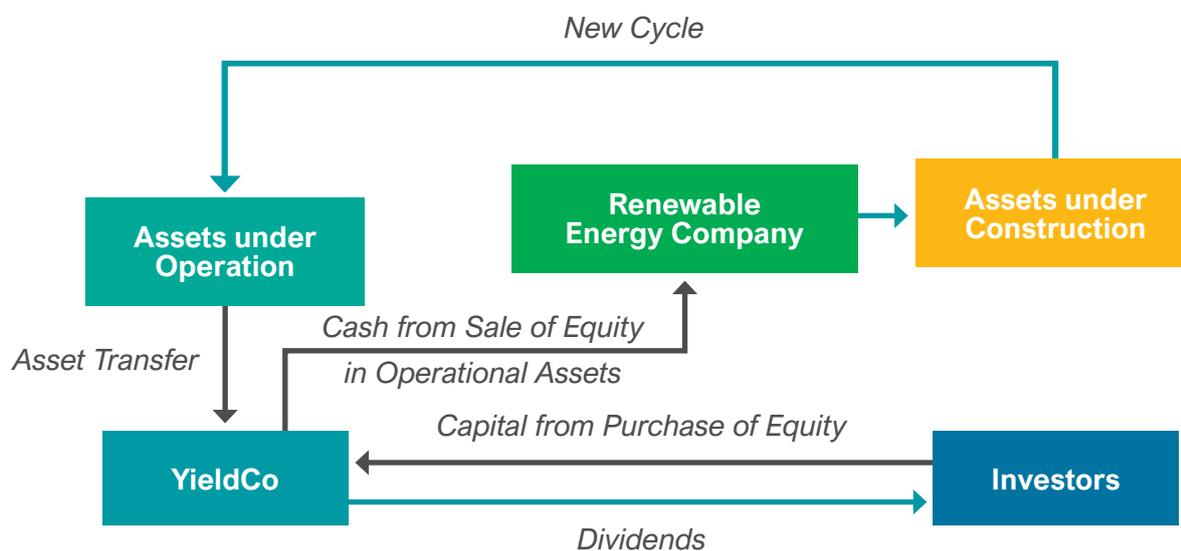
21 Hydropower Sustainability Alliance, accessed November 3, 2023, <https://www.hs-alliance.org/>.

22 International Finance Corporation, "IFC Performance Standards," accessed November 3, 2023, <https://www.ifc.org/en/insights-reports/2012/ifc-performance-standards>.

According to the International Hydropower Association (IHA), there is a strong interest in using green bonds in the hydropower sector.²³ In a recent IHA survey,²⁴ more than 100 heads of organizations and senior decision-makers in the power sector said that in the next five years, they expect to finance or refinance a hydropower project through the green bond market. However, more than three-quarters of these respondents said they need greater clarity about the eligibility criteria for hydropower. Survey respondents also highlighted this point as a major roadblock to accessing green bonds for hydropower project financing or refinancing.

A YieldCo is a financial vehicle that houses the equity stake of operational energy projects. By isolating the operational assets and reducing the risk profile, the YieldCo would likely be more attractive to retail and institutional investors unwilling to take on the development and construction risk of projects that are not yet operational. As an alternative to conventional funds, YieldCos provide a range of benefits for large capital pools, including insurance and pension funds, and they have proven to be an effective way to invest in infrastructure projects.

Figure 15: YieldCos as a Recycling Tool for Equity



Investors have used YieldCos to finance infrastructure assets through capital markets, including taking equity stakes in operational hydropower projects. By isolating operational assets, YieldCos reduce the risk profile of assets and make them more attractive to retail and institutional investors who are averse to the risks of non-operational project development and construction.²⁵ YieldCos also serve as practical financing mechanisms for operational hydropower plants, as well as investment in brownfield hydropower projects.

YieldCos can be listed on stock exchanges, which provides access to private capital from investors interested in long-term assets, which also favors liquidity. The YieldCo structure enables developers to sell their equity stake, in whole or in part, including the asset's future cash flows. This process allows developers to free up capital for developing other projects. This is particularly valuable for large hydropower projects that require considerable upfront capital.

23 S&P Global Market Intelligence, "Hydropower Largely Excluded from Burgeoning Green Bond Market."

24 Ibid.

25 Mitidieri, *The Evolution of the YieldCo Structure*.

Survey respondents highlighted the value of the exit opportunity that YieldCos provide to investors, especially in Africa, where the lack of a secondary market, including development funds, is challenging for investors. Despite their benefits, YieldCos have had limited traction in emerging markets so far; these opportunities need to be explored further.

From the developer's perspective, hydropower assets, with lifespans often exceeding 60 years, require them to commit their equity capital for extended periods. This, along with a limited pool of investors ready for large hydropower development in emerging markets, underscores the significance of recycling capital for institutions with the necessary investment expertise to sustain and increase hydropower investments. YieldCo structures, publicly traded as INVITs in capital markets, are effective for recycling equity, and they offer considerable benefits for developers as they provide a faster and easier way to raise funding for a renewable energy portfolio. Regulations for publicly traded INVITs in emerging markets, such as in India, limit exposure to debt, ensure that assets are already built (limiting construction costs), and offer tax benefits. In addition, INVITs allow small investors to participate in the fundraising process; they minimize transactional costs and ensure instant liquidity for a significant portion of project equity; they secure lower-cost financing as there is less expectation of quick returns in comparison to private infrastructure funds. They allow developers to deconsolidate assets from their balance sheets, which minimizes their exposure.

For these reasons, the developers interviewed showed interest in exploring YieldCos. A global DFI interviewed for this study indicated they would support certain market players in establishing YieldCo structures. This was seen as a viable avenue for refinancing operational hydropower projects in the near future.



Development Finance Institutions Role in Promoting Private Sector Participation in Large Hydropower

As discussed in earlier sections, attracting private capital, knowledge, and expertise is important for developing hydropower potential consistent with development and climate goals. Leveraging the private sector in hydropower requires a paradigm shift from traditional methods of developing and financing large hydropower projects. The survey revealed significant private sector interest in hydropower. Applying the new technical and financing avenues outlined above could mitigate many of the major risks highlighted by the stakeholders interviewed, thereby enhancing hydropower’s market appeal to private sector developers and investors.

DFIs have considerable experience in the hydropower sector and in attracting private sector participation to develop renewable energy and large infrastructure projects. They are well-placed to address several of the key barriers that respondents identified. By working together, they can leverage their collective strengths and expertise to deliver more cohesive solutions that are better tailored to the needs of client countries. This collaborative approach includes coordinating efforts, sharing knowledge, and streamlining processes to improve efficiency and impact.

DFIs offer a range of tools that can support hydropower projects at each stage of the project life cycle. Specifically, stakeholders are expecting DFIs to play a significant role in (a) supporting government efforts to improve the enabling environment for private investments in the hydropower sector, (b) de-risking project preparation and project development, (c) de-risking project financing, and (d) promoting financial mechanisms to scale up private investments in hydropower. These measures can be applied to large hydropower projects—both greenfield and brownfield—as well as non-conventional technologies.

Support Government Efforts to Improve the Enabling Environment

There is a need for a stable enabling environment at the country level, one that provides appropriate incentives and support mechanisms to attract private investment. With decades of combined experience, DFIs have assisted client governments in establishing business-enabling environments conducive to private sector participation, for example, through PPPs. A supportive enabling environment includes

policies, regulations, and institutions that encourage private investment and developer involvement while ensuring competitive, transparent, and equitable bidding processes.

Specifically to hydropower development, DFI support could include assisting governments by (a) institutionalizing least-cost and low-carbon development planning in the context of a country and/or regional integration, and defining the role of hydropower in these plans, (b) improving the regulatory framework allowing adequate remuneration for storage and other ancillary services provided to the grid by storage hydropower and pumped storage projects, (c) preparing hydropower project prefeasibility studies, including integrated water resource development (including focusing on multipurpose benefits of hydropower) and river basin management plans, cumulative impact assessments, early incorporation of environmental and social considerations in hydropower projects (consultations, benefit sharing, and due consideration and mitigation of social impacts), (d) evaluating the various development models available for hydropower projects in a given country (available financing and operating structure, the specific roles/timing for public and private sectors, selection processes to recruit private partners), (e) improving the financial situation of the offtaker, including leveraging regional dialogue for export PPAs, (f) designing contractual arrangements and evaluating the adequacy of normative frameworks, and (g) building the institutional capacity of the country for hydropower development, including on development of PPPs, contract negotiation and management, E&S issues, and safety assurance.

These initiatives would need to be anchored in the overall sectorial dialogue carried out by DFIs in-country on issues such as access to electricity, energy transition, structural reforms, improvement of operational efficiencies, financial restructuring, tariff reforms, and compensation from the government. Some proposed DFI interventions are compiled in Table 1.

Table 1. Possible DFI Engagements with Governments

| Barriers | Broader Sectoral Engagements | Upstream Engagements |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Governance/Institutional | | |
| Lack of political commitment and institutional support, political interference | Institutionalizing least-cost planning for expansion of generation | Defining the role of hydropower in least-cost, low-carbon generation expansion plans and NDCs |
| Lack of a regulatory framework or its enforcement | Establishing and implementing a transparent methodology for licensing, and for setting the revenue requirements of power sector companies | Designing licensing and contractual arrangements for hydropower projects |
| Limited regional cooperation | Facilitating the establishment and strengthening of “soft” infrastructure – the operational, commercial, and institutional frameworks for regional electricity trade | Regional dialogue on water resource use for hydropower with upstream and downstream riparian states; collaboration with regional power pools on storage, flexibility in generation, and interconnection |
| Lack of institutional capacity | Building the capacity of key sector institutions and companies on planning, system operations, contracts, regulation, valuation of non-power aspects of multipurpose projects, and supervision of operations | Hydropower-specific capacity building on regulation, design of infrastructure and concession agreements, inventory, valuation of services, E&S due diligence, operation of power systems with hydro-power, safety assurance and maximization of benefits |

Table 1. Possible DFI Engagements with Governments, continued

| Barriers | Broader Sectoral Engagements | Upstream Engagements |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Technical | | |
| Inadequate transmission networks | Institutionalizing transmission expansion planning and integrating it with generation expansion planning | Holistically developing electricity grids parallel to increasing installed hydro-power capacity to ensure that generated electricity reaches end-users |
| Inadequate site selection, scale and design optimization | Assessing multipurpose reservoir development options through integrated water resources planning and screening of options | Ensuring the quality of pre-feasibility studies including site selection, optimal scale and design, and require mitigation measures |
| Lack of cross-sectoral planning around multipurpose water storage and infrastructure projects | | Capacity building for harnessing the multipurpose nature of projects, arbitrate conflicting uses of water and coordinate uses of water at the basin or regional level |
| Insufficient base data of key variables such as hydrological flows, geological mapping, or seismic hazard assessment | Assisting intra/intersectoral initiatives to incorporate management information and collect/share key data for integrated water resources development and options assessments | Capacity building and supporting data collection and sharing of specific datasets and institutions (such as hydromet monitoring, geological survey, geotechnical investigation, and seismic hazard assessment) |
| Financial | | |
| Lack of financially sustainable offtakers | Improving the financial situation of the offtaker, usually through comprehensive performance improvement plans, accompanied by policy and regulatory reforms | |
| Difficulty in valuing the risk and return profiles of multipurpose hydropower projects, pumped storage projects, or projects involving new technologies for the country | Ensuring that economic benefits and costs are adequately captured in the least-cost planning and feasibility studies, facilitating coordination between government agencies on use of natural resources | Optimizing hydropower planning to ensure that economic benefits are fully captured (e.g., creation of upstream storage to enhance the operation of cascade stations) |

Source: Adapted World Bank Position Paper on Hydropower Development. 2022 (internal).

De-risking Project Preparation and Development

Project preparation support, or upstream work, plays a critical role in increasing the appeal of hydropower projects to the private sector. It helps identify, assess, and mitigate potential risks early in the project lifecycle, including E&S, technical, market, and financial risks. Detailed feasibility studies and project viability assessments provide critical information on potential returns on investment. This data helps the private sector make informed decisions regarding its participation. Addressing these risks upfront makes projects less uncertain and more predictable, which is critical for the private sector.

Conducting comprehensive studies is both costly and time-consuming. Without certainty about a project's prospects, the private sector is reluctant to pay for them. Often, governments do not have the capacity or resources to carry out extensive studies at the required standards, and project developers are reluctant to finance these development costs at such an early stage of project development. In this context, the ability of DFIs to provide concessional financing for early-stage project preparation has been recognized

as a solution for providing capital at the early high-risk stage of projects, thereby keeping overall project financing costs low. Respondents highlighted challenges in managing E&S risks and developing ancillary infrastructure, which remain partially unaddressed in the current market. DFIs should highlight the importance of these issues when supporting the development of a project.

DFIs could leverage available sources of concessional financing to support projects through targeted technical assistance during project preparation:

- **Enhancing Project Bankability:** By facilitating regional planning and interconnectivity, DFI support can mitigate and diversify offtake risks, a major concern for private sector stakeholders. This issue is an obstacle to raising private sector financing for hydropower projects when unaddressed. Technical and financial support for developing regional power planning and interconnection can help mitigate offtake risks.
- **Financing Expert Advisory Services:** DFIs can fund transaction advisors and safeguard advisors to assist governments in co-developing projects with the private sector. This will boost the capacity of governments to support large hydropower projects in their preparation phases and move them forward.
- **Establishing Task Forces:** DFIs, through technical assistance, can incentivize the creation of specific task forces within the government stakeholders to enhance government capacity for coordinating the numerous ministries involved in large hydropower projects. This approach can reduce complexity, streamline project management, and improve response time from the government.
- **Streamlining the Project Development Process:** By improving governments' understanding of the hydropower project development process, DFIs can enable quicker and more effective decision-making and reduce project implementation timelines. An additional benefit is realizing more fair and transparent procurement processes.
- **Facilitating E&S Compliance:** By providing clear guidance on E&S requirements in the regional context, focusing on biodiversity and resettlement, DFIs can help governments ensure that large hydropower projects adhere to best practices in sustainability and social responsibility.
- **Supporting Ancillary Infrastructure:** DFIs can help governments plan for and potentially finance ancillary infrastructure essential to the project, such as grid extensions, transmission lines, and access roads—preferably in advance of project construction. These efforts can significantly improve a project's bankability.
- **Support Capacity Building Initiatives of Key Governmental Institutions:** DFIs are best placed to provide technical assistance and capacity building programs to government counterparts to enhance understanding of the processes related to implementation of large PPPs, contract negotiation and management and overall hydropower development, including E&S management.

Additionally, to address the long gestation period often required to develop large hydropower projects, an early involvement model could be promoted to accelerate the development of a portfolio of bankable projects through a dedicated project development platform backed by DFIs. This alternative to the traditional development model necessitates a strong co-developer who acts as both a technical and a commercial partner for the government during the early stage of project preparation. This would be in the form of a dedicated platform supported by DFIs to pool expertise and streamline processes, which would possess substantial, relevant, real-world project development experience. This platform could be regional, for example, starting with regions/countries with the most potential and need for a strong pipeline of bankable large hydropower projects. Responsible for competitively engaging independent experts and consultants to complete the project preparation stage in collaboration with the government, the platform

would provide strong advisory support to the government and facilitate government decision-making on critical issues in a timely manner to advance the project.

The preparation phase should adhere to commercial principles and address any flaws that could impede the project's progress. Subsequently, the project could be tendered in a timely manner to avoid unnecessary detailed preparatory studies or rework. Crucial to this approach is ensuring sufficient, accessible funding for project preparation, supported by robust governance, and providing sufficient detail to interest credible bidders. DFIs are well-positioned to provide affordable resources to cover these development costs.

The benefits of this approach include the ability to bring larger hydropower projects to market more quickly and to reduce disputes between competing developers.

DFIs could play an influential role in the paradigm shift needed regarding project development processes by:

- Endorsing the proposed approach and further developing a model that drives more interest in private sector participation in developing large hydro projects, focusing on an early involvement of key strategic partners. A global consultation within DFIs could be the basis for establishing and funding an independent development platform. This could be done at the regional level, prioritizing underserved regions such as sub-Saharan Africa. DFIs would provide clear guidance and support on implementing the model to ensure sufficient project preparation but not introduce conflict of interest issues.
- Securing sufficient access to funding and developing a portfolio approach to allow multiple projects to progress in parallel at a portfolio level and reallocating funds based on how each project progresses. This would include dedicated support to governments and the independent development platform to efficiently access this funding, including understanding and implementing DFI procurement rules and systems.

De-risking Project Financing

DFIs can provide equity investments, loans, and guarantees through multiple channels, demonstrating their complementary roles in facilitating project finance. Market outreach spotlighted several critical points regarding the MDBs role in supporting large hydropower projects:

- **Raising Awareness of DFI Instruments:** Respondents acknowledged the value of some DFI instruments, particularly partial risk (loan and payment) guarantees. It was highlighted as the most popular tool that private sector players were aware of. However, awareness of the full suite of guarantee tools available from some DFIs remains limited. Participants were interested in learning more about available tools and the processes to qualify and access them. DFIs need to make their de-risking tools more easily understood and approachable to both government counterparts and interested developers. In that regard, the World Bank Group recently launched the Unified Guarantee Platform (UGP), which will provide a one-stop shop for IFC, MIGA, and IBRD/IDA guarantee products. With ambitious volume objectives and an easier way for the private sector and governments to reach out for support needs, this initiative will enhance the use of guarantees use.
- **Addressing Financing Risk and Refinancing Risk:** The challenge of financing due to tenor constraints for domestic commercial lenders was noted, with commercial banks often unable to extend loan tenors beyond 5–7 years due to local regulatory restrictions and the high cost of extending them. This has led to mismatches with extended hydropower development timelines. Liquidity Extension Guarantees (LEGs) were identified as a potential solution to extend loan tenors

and manage offtaker risk. Some of the DFIs providing these types of instruments could better communicate the availability of LEGs to enable financiers to participate in hydropower projects.

- **Currency Mismatch Solutions:** The issue of currency mismatches between funding from international capital providers and hydropower project revenue stream will remain acute, given the limited foreign exchange reserves of some economies for such capital-intensive investments. This could be addressed by putting mechanisms in place that address foreign exchange risks to cover both exchange rate fluctuations and currency convertibility risks. DFIs can address this risk by (a) supporting with guarantees the use of local lending, which is usually short in tenor and with limited volumes, and (b) providing foreign exchange risk facilities, thus securing foreign exchange revenues for these large projects for foreign investors.
- **Blended Finance for Tariff Reductions:** Stakeholders highlighted the possibility of using concessional funding strategically in the form of concessional capital or grants to reduce the final tariff of hydropower projects and ensure their affordability. High end user tariff is often a key constraint in government buy-in for private projects. DFIs can strategically support certain projects that have a significant transformational impact or demonstration effect.

Promoting Financial Mechanisms to Scale Up Private Investments

Difficulties in accessing capital market tools present a significant challenge faced by most respondents when developing large hydropower projects, constraining their access to liquid, long-term, high-volume capital. DFIs could address this challenge by facilitating discussions to unlock new mechanisms to scale up hydropower financing. One promising approach is to incentivize the accessibility of green bonds for large hydropower project financing, tapping into a renewed, expanded pool of capital. To that end, it is important to leverage the efforts of the Climate Bond Initiative to develop hydropower-specific criteria and clarify the eligibility of large hydropower to the green bond mechanism. This approach would allow more institutional investors to participate in refinancing operational hydropower projects post-construction when the risk level is more acceptable. This, in turn, would free some of the scarce private capital mobilized by a few private players willing to support project development and allow it to be re-invested in new projects.

Specifically, DFIs can:

- **Promote the wider use of the Climate Bonds Initiative Hydropower Criteria**, validating the framework. Notable institutions like Africa Energy Portal and The International Hydropower Association have acknowledged its significance, generating considerable interest, but more is needed on the financing side.
- **Encourage governments to explore green bond issuance for hydropower projects**, validating it as a financing mechanism for technology and mitigating environmental and social controversies. DFIs can endorse and encourage the use of this refinancing mechanism through green bonds by supporting its issuance and potentially securing a portion of the bond.
- **Encourage their private sector arms to take on a more private capital-enabling role**, for example, by selling/transferring their debt in hydropower projects as part of this refinancing process after the construction stage, to crowd in further private capital in the sector through green bonds.
- **Leverage their available public lending resources to bring projects to fruition and allow refinancing within 7–10 years of operation** in contexts where private mobilization is still

challenging or where necessary reforms are yet to materialize. This would enable the unlocking of scarce public resources to be rechannelled towards other project development. DFIs could consider, in certain contexts, lowering the lending terms of their loans in the first 7–10 years of the repayment period before stepping up at a later stage, keeping the same average net present value of the cost of financing along the loan tenure. This would allow the client countries to seek private refinancing of public resources once the project is commissioned, significantly de-risked, and after implementing critical reforms to ensure bankability. The ultimate decision to refinance will need to be determined by comparing existing loan conditions with the market offer at the time of refinancing, with the expectation that a lower risk profile would attract cheaper financing than the proposed step-up, ultimately benefiting the end-user tariff.

Another issue highlighted by stakeholders is the need to unlock the potential of YieldCo structures to finance equity for hydropower assets. In this regard, DFIs could:

- **Pilot Demonstration Projects:** DFIs can proactively engage with post-construction projects and their developers to promote pilot programs to achieve refinancing through YieldCo structures. To achieve this, DFIs can evaluate existing operational assets and formulate a refinancing mechanism, resulting in a future-ready step-by-step procedure. Additionally, the fees of financial advisors or investment banks may need to be covered to facilitate the process of attracting diverse pools of capital to the project and structuring the vehicle.
- **Establish a Technical Assistance Facility:** DFIs can establish a technical assistance facility based on insights gained in both developed and underdeveloped markets. This initiative would aid infrastructure developers and public entities in understanding the details of a YieldCo structure and its benefits for both parties. To provide comprehensive support, the technical assistance facility could potentially facilitate listing YieldCo structures on the stock market, aiming to tap into the market's enhanced liquidity to appeal to stakeholders. Additionally, this technical assistance facility can help governments formulate policies to regulate and promote the establishment of YieldCos.
- **Provide Public Promotion and Support:** DFIs can promote the establishment of these structures by providing market intelligence on the specific locations where YieldCo structures have the potential to succeed for large hydropower projects. Additionally, DFIs can publicly support these initiatives by participating in the capital structure of these assets, thus creating a positive halo effect and potentially driving further investment in the sector. DFIs can also promote the creation of a comprehensive toolkit that can function as a step-by-step procedure for hydropower developers.

Overall, building up a series of successful PPPs for the large hydropower sector will have a demonstration effect—it will reduce the perception of risk from the market and scale up the development of projects—thereby unlocking vital funding for large-scale hydropower development and setting a precedent for sustainable financing of renewable energy.

Conclusion

Transitioning to a sustainable and renewable energy future is essential for achieving NZE by 2050. It is vital for mitigating climate change impacts and central to the global sustainability agenda. Large hydropower is positioned to form the backbone of reliable, safe, and decarbonized power systems. It can provide stable, clean, and reliable energy that complements other renewable sources and enhances the resilience of energy systems.

However, doubling the current hydropower capacity is a monumental task. A collaborative effort among international development institutions, governments, and the private sector is crucial to bridge the investment gap. The study provides a roadmap, reflecting on past experiences and outlining strategies to leverage hydropower's full potential.

The sector is attractive to a focused but small segment of the private sector that recognizes the unique advantages of this well-established generation technology. To fully harness this potential, barriers such as financial, regulatory, and project-specific risks must be overcome. The stakeholder consultation exercise conducted in the study also shows that financial innovations, used effectively, can potentially mitigate the key risks that discourage greater private sector participation in large hydropower, thereby widening the sector's attractiveness to the market.

DFIs are already recognized for their role in developing large, sustainable hydropower projects and are aligned in their approaches toward achieving NZE. They can expand their role and increase interest in the sector by offering robust project preparation support, introducing more de-risking tools, and expanding the availability of capital. Their experience and strategic involvement in building enabling environments, preparing bankable projects, and facilitating investment and financing provide a clear pathway for stimulating private investment and realizing the goal of NZE.

Their support is invaluable for mobilizing private capital and expertise in the sector. In doing so, large hydropower will make it possible to progress toward NZE and realize the promise of a cleaner, more secure energy future.



ANNEX 1

Approach to Identifying the Survey Sample

The selection criteria aimed to cover entities involved at different stages of a project's life cycle and across global emerging markets.

The survey targeted relevant international stakeholders with broad geographic coverage and local stakeholders from a sample of prioritized countries selected from relevant geographies for the World Bank Group. Stakeholder groups included developers, lenders, service providers (commercial, legal, and technical), governments, and other relevant agencies. These stakeholders were selected based on the size and geographic diversity of their transactions, their coverage across emerging and frontier markets, and, where possible, their involvement in pioneer projects or experience in successfully developing projects despite long lead times.

An effort was made to include at least two international stakeholders from each of the following categories:

- Developers
- International lenders
- DFIs
- Service providers (legal, technical, commercial)
- Relevant agencies or think tanks

Local stakeholders selected include the following:

- Government entities (for example, ministries of energy, renewable energy, or water)
- Local capital providers
- Local legal advisors

Given the regional differences in stakeholders regarding regulatory environments and private sector participation, the analysis captured three regions—Latin America, Africa, and Asia. Within these regions, 12 countries with the most considerable hydropower potential were identified. Two or three countries within each region were then prioritized—including at least one country where hydropower projects have been successfully developed with private sector participation and one that has lagged in developing their resources.

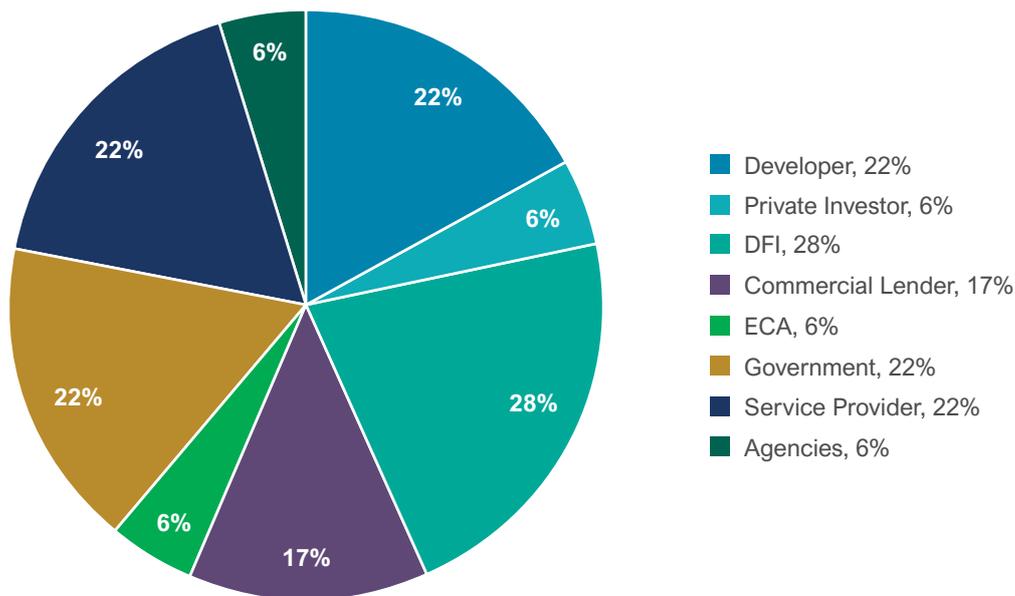
Figure 16: Approach to Identifying the Survey Sample



From the list of 59 stakeholders across priority geographies and involvement in different project stages, 23 high-priority stakeholders were interviewed based on identified contacts, their responsiveness, and willingness to participate. The interviews were conducted between July and October 2023 and lasted about one hour each.

The following graph indicates the split of participants and type of respondents:

Figure 17: Interview Sample Composition



ANNEX 2

Survey Questionnaire

A. All Stakeholders — general

1. What are the top 3 factors (service provider / government) that drive private sector interest and participation in large hydro projects / (developer or investor) that drive your decision to enter a geography /project? e.g.
 - 1.1 Size of projects
 - 1.2 Local lending capacity
 - 1.3 Local presence
 - 1.4 Government award process / Government strength as a counterparty
 - 1.5 Utility/off-taker health
 - 1.6 Power sector policy / regulation
 - 1.7 Etc.
2. Which geographies are you seeing greatest private sector participation and why?
Any new geographies becoming of interest?
3. What are the top 3 risks in the successful development of hydro projects?
 - 3.1 Government
 - 3.2 E&S
 - 3.3 Financial
 - 3.4 Technical
4. What are the main drivers of cost and time overruns?
 - 4.1 Structuring
 - 4.2 Risk allocation
 - 4.3 Regulatory
5. Are there any innovative models you have seen in terms of:
 - 5.1 Technology (pumped Hydro?)
 - 5.2 Development models to increase efficiency and reduce risk (clustering, specialist developer model)
 - 5.3 Financing structures (syndications, green bonds)
6. Have you witnessed a reduction in the pipeline of hydro projects?
What do you see as the reason behind this?
7. What is your understanding of the tools that the World Bank has to offer?

8. What World Bank tools/support have you utilised (financial/ technical)?
 - 8.1 What support/assistance from the World Bank have you found to be the most useful?
 - 8.2 What support/assistance from the World Bank have you found to be the least useful?
9. Do you have any recommendations for new tools the World Bank could use to encourage private sector participation in large hydro projects, and/or to support the growth of more nascent technologies / geographies / instruments highlighted earlier?
10. What has your experience working with the World Bank been like? / Did you face any challenges in working with the World Bank?

B. Developers

1. What financing options are available to you and what are the challenges in accessing finance
 - 1.1 Instruments / type of lender
 - 1.2 Volume (in \$M)
 - 1.3 Ticket size (in \$M)
 - 1.4 Tenor
 - 1.5 Leverage
 - 1.6 Pricing
 - 1.7 Spreads
2. Who are the main lenders to your projects?
3. Do you have a preference for hydro projects in terms of:
 - 3.1 Size (If not large-scale Hydro what is the main issue in pursuing large scale hydro?)
 - 3.2 Technology (run of the river, hydropower with large multi-purpose reservoir with and without pumped storage, etc.)
4. Has there been an evolution of your interest in and risk appetite for the Hydropower sector as a whole and why?

C. Lenders

1. What financing options are you able to provide?
 - 1.1 Instruments
 - 1.2 Volume (in \$M)
 - 1.3 Ticket size (in \$M)
 - 1.4 Tenor
 - 1.5 Leverage
 - 1.6 Pricing
 - 1.7 Spreads
2. Do you have a preference for hydro projects in terms of:
 - 2.1 Size (If not large scale Hydro what is the main issue in pursuing large scale hydro?)
 - 2.2 Technology (run of the river, hydropower with large multi-purpose reservoir with and without pumped storage, etc.)
 - 2.3 Developer type (public/ private/ projects/ corporate funders)

3. Do you have a risk management framework for assessing hydropower deals?
4. Has there been an evolution of your interest in and risk appetite for the Hydropower sector as a whole and why?
5. Do you have the requisite technical capacity in-house to assess a hydropower deal?
6. What challenges do you face in deploying capital into hydro projects?
 - 6.1 Pipeline identification
 - 6.2 Regulatory
 - 6.3 Systemic
 - 6.4 Country/ Political risks
 - 6.5 Past Performance (NPLs/Recovery rates)
 - 6.6 Currency (for local lenders)
 - 6.7 Ticket sizes needed are too large and inability to syndicate
 - 6.8 Tenor need is too long

D. Government

1. Have you developed any hydropower projects as PPPs?
 - 1.1 What were the barriers in attracting private sector participation?
 - 1.2 Do you see any challenges in working with the private sector?
2. Do you have the requisite technical capacity in-house to execute hydropower projects?
3. What policy and regulatory frameworks are in place to encourage the development of hydropower projects?
 - 3.1 Are there any single window approvals?
 - 3.2 Are there any regulatory bodies to oversee E&S compliance?
 - 3.3 How are you navigating transboundary disputes?
4. Would you be open to divesting assets to the private sector after the commissioning stage?

E. Service providers — Legal / Commercial

1. Where do you perceive gaps in legal and commercial capacity in the project development cycle?

F. Service providers — Technical

1. Where do you perceive gaps in technical capacity in the project development cycle?

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