

FINANCING HYDRO - TECHNICAL AND FINANCIAL RISK

Hydropower financing training

November 2018



IFC At a Glance

Hydro/power
Investment Experience
&
Screening Criteria for
Hydro

IFC
&
Nepal Hydro and
Challenge

Key Takeaways - the
Hard Lessons of IFC
Experience



What is IFC?

History of IFC

- IFC, part of the World Bank Group which consists of five organizations
- Launched in 1956: mandated to support development by encouraging private investment.
- Owned by 184 member countries
- Today: IFC is the world's largest, multilateral institution focused on private sector development
- Global: Headquartered in Washington, DC
- IFC drives private sector development in the World Bank Group in collaboration with IBRD, IDA and MIGA
- In FY14, IFC made total investment of \$22 billion to the private sector across the world.

The World Bank Group



1945
International
Bank for
Reconstruction &
Development



1956
International
Finance
Corporation



1960
International
Development
Association



1966
International
Center for the
Settlement of
Investment
Disputes



1988
Multilateral
Investment
Guarantee
Agency

PROVIDING DEVELOPMENT SOLUTIONS ...

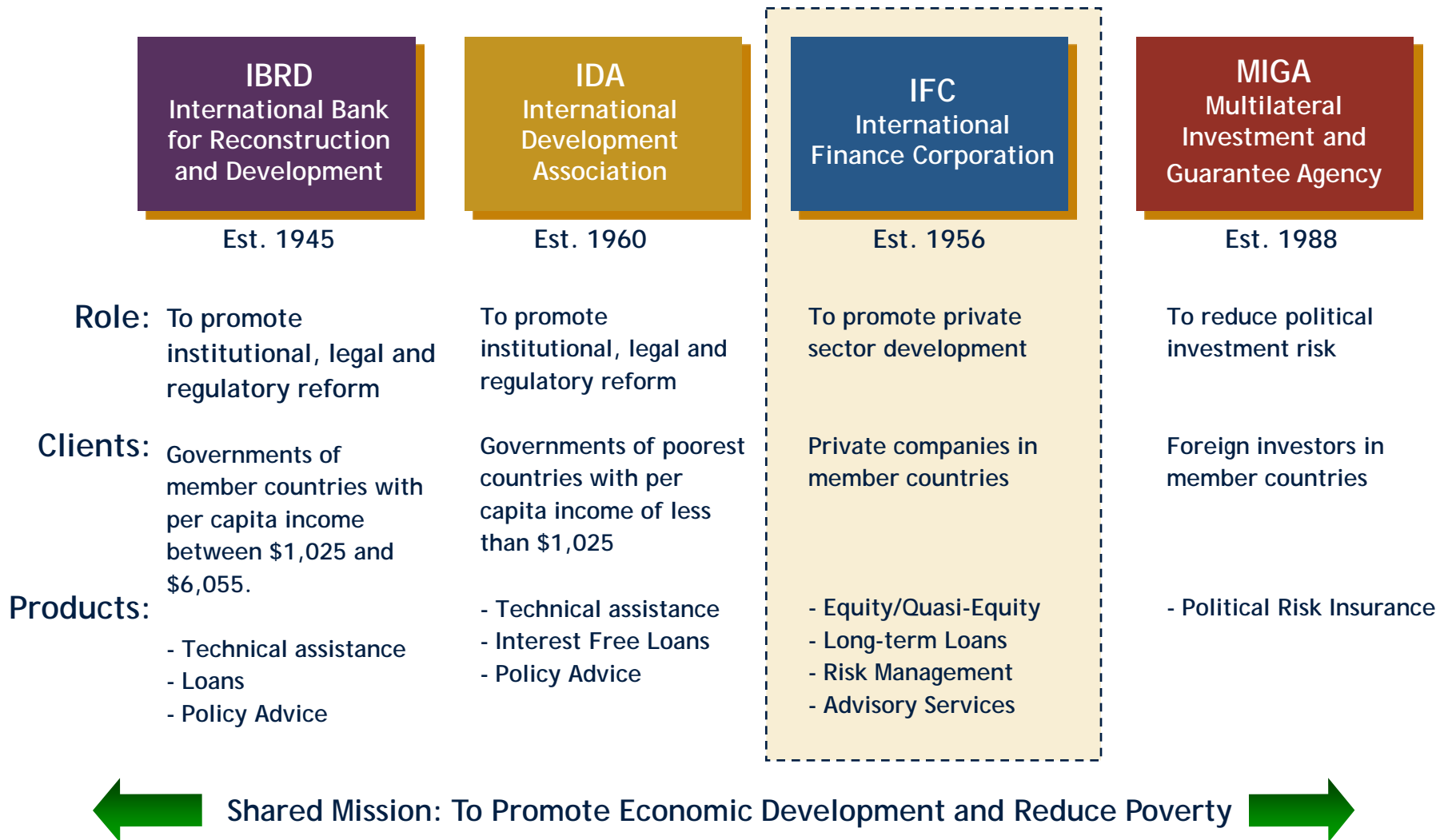
Customized To Meet Client Needs



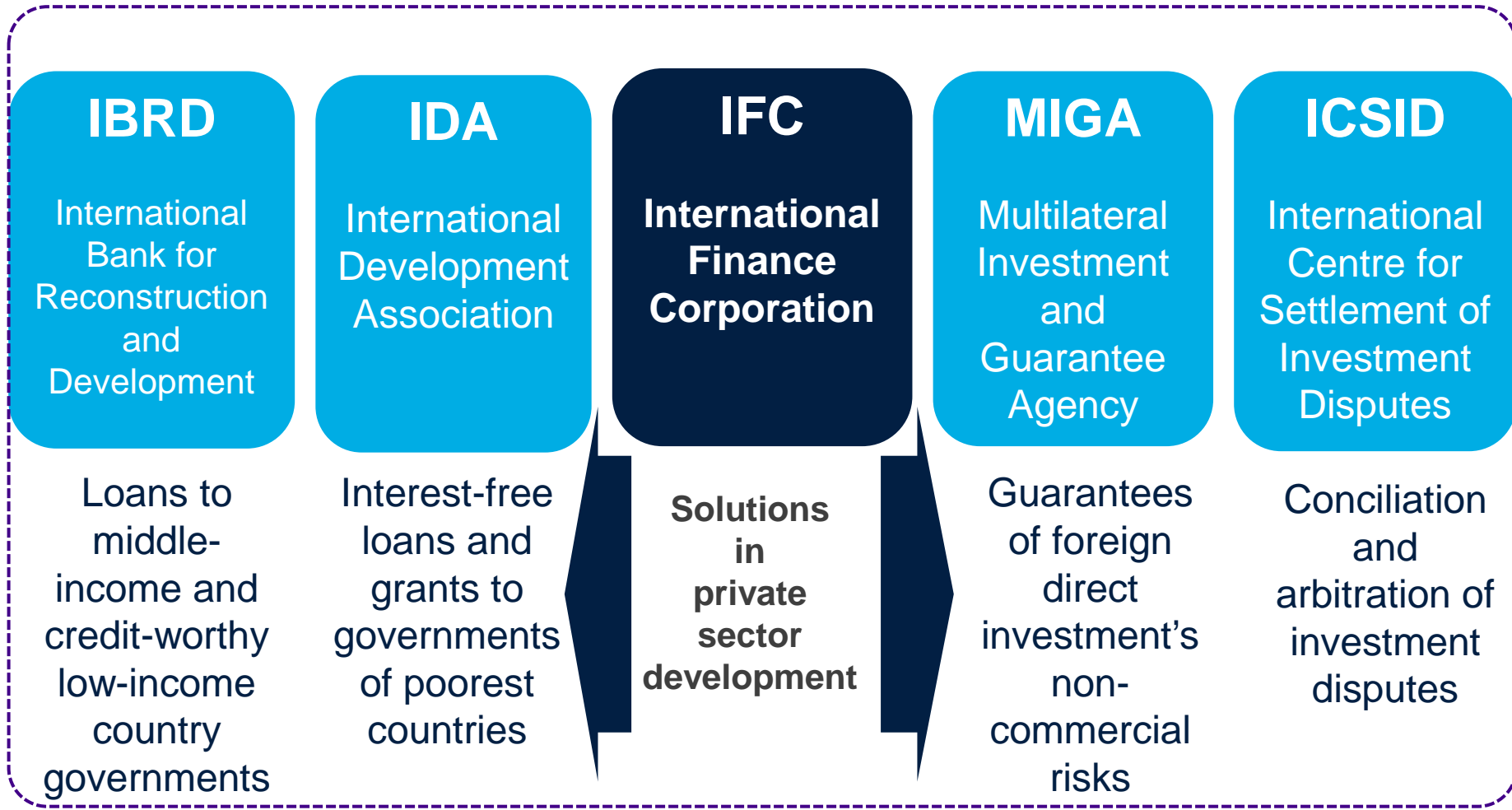
- A member of the World Bank Group
- Provides investment, advice & resource mobilization
- AAA credit rating; nearly 60-year history in emerging markets

IFC is the largest global development institution focused exclusively on the private sector in developing countries.

IFC is a Member of the World Bank Group



IFC: A MEMBER OF THE WORLD BANK GROUP



Providing Development Solutions ...

Broad Product Range in Investment Services

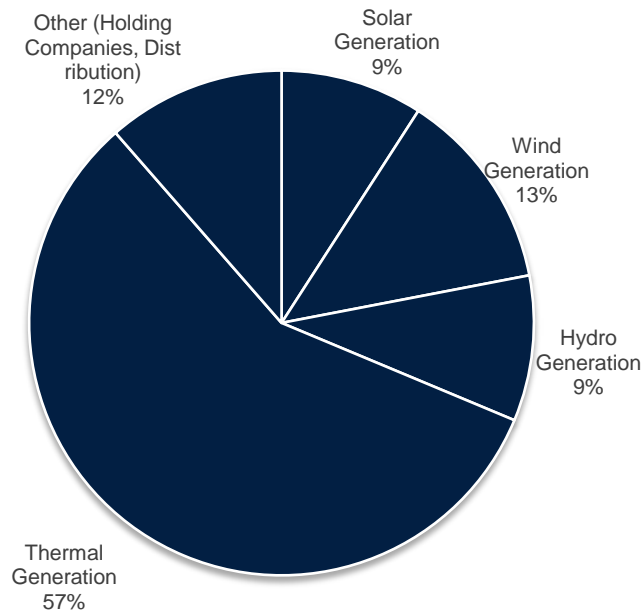
Loans	<ul style="list-style-type: none"> - Project and Corporate Financing - On-lending through intermediary institutions 	FY 2015: US\$7.0 billion committed
Equity	<ul style="list-style-type: none"> - Direct equity investments (up to 20% of company's equity) - Private equity funds 	FY 2015: US\$3.2 billion committed
Trade Finance	<ul style="list-style-type: none"> - Guarantee of trade-related payment obligations of approved financial institutions 	FY 2015: Average outstanding balance of US\$2.8 billion
Syndications	<ul style="list-style-type: none"> - Capital mobilization to serve developmental needs - Over 60 co-financiers: commercial banks, fund and DFIs 	FY 2015: US\$7.1 billion syndicated
Derivatives & Structured Finance	<ul style="list-style-type: none"> - Interest rate, Currency or Commodity-price hedges provided to clients - Credit guarantees and Structuring Advice 	FY 2015: US\$330 million
Blended Finance	<ul style="list-style-type: none"> - Concessional funds are blended with IFC's own resources to finance initiatives & achieve impact that would otherwise be unattainable 	FY 2015: US\$148 million committed

FY2016 Power Highlights

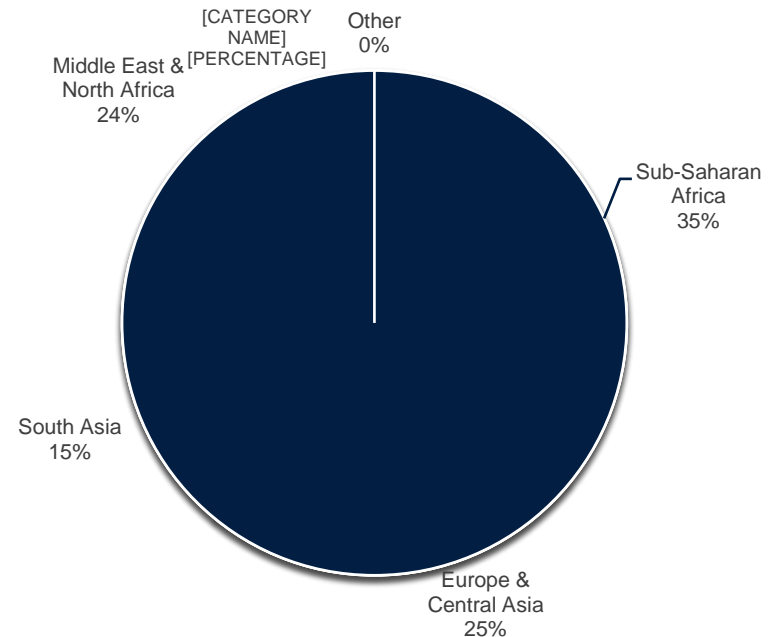
IFC Gross Commitments of US\$2.0 Billion

FY2016 Commitment Activity: US\$2.0 billion invested, including US\$850 million for IFC's own account and US\$1.1 billion of mobilization

FY2016 Power Commitment Activity by Sector
(incl. mobilization)



FY2016 Power Commitment Activity by Region
(incl. mobilization)



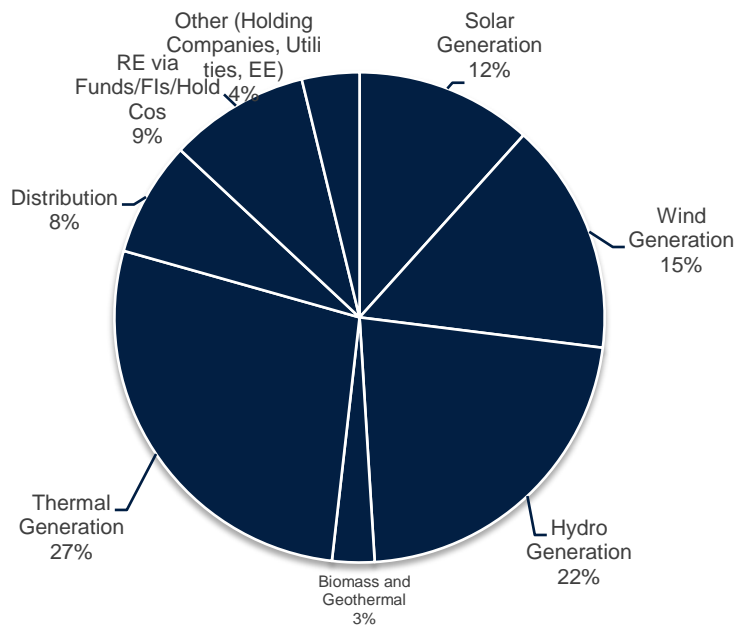
Note: IFC year-end is June 30th

FY2016 Power Highlights

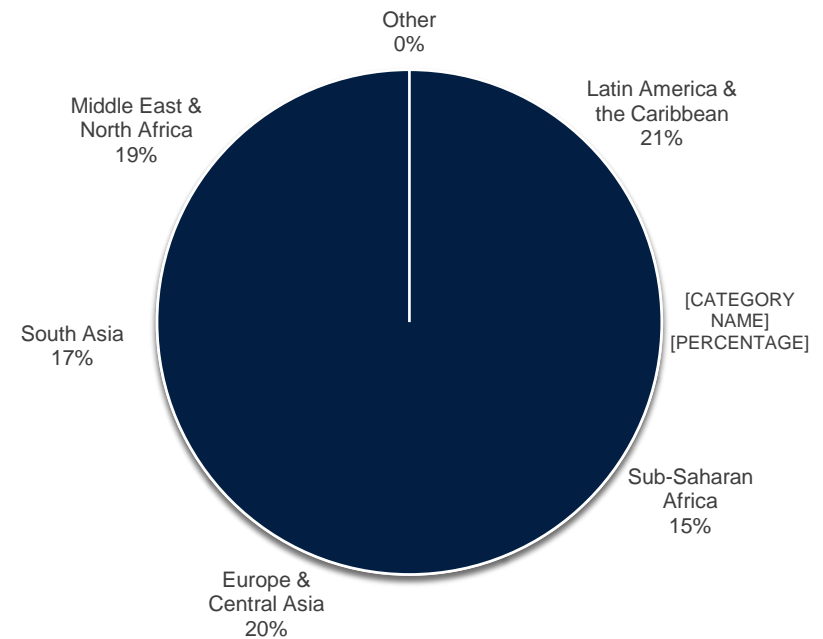
IFC Committed Balance of US\$5.8 Billion

FY2016 Committed Portfolio: US\$5.8 billion of committed debt and equity as of June 2016. Power represents 43% of US\$13.4 billion committed debt and equity in all Infrastructure

Total Committed Balance by Sector
IFC Power



Total Committed Balance by Region
IFC Power



Note: IFC year-end is June 30th

IFC's Value-Add in Power Transactions

From Patient Equity to Long Term Debt

EQUITY

- Up to 20% in project or company
- Start-up equity / co-developer (IFC Infra Ventures)

SUB-DEBT

- Terms tailored to meet project needs

DEBT

- Long Maturities Tailored to Project Needs
- Fixed/Floating Rates, Local Currencies
- Flexible Amortization Profile
- Syndication/Mobilization from commercial banks and DFIs

Sector Expertise

- Deep sector knowledge gained from experience
- In-house Engineers:
- In-house Market Expertise
- In-house Regulatory Expertise

Country Risk Mitigation

- Government Relations
- Neutral broker Role
- World Bank Synergies
- Partial Credit Guarantees (PCG)
- MIGA
- Coordinated approach across WBG services
 - MIGA PRI
 - IDA PCG

Environmental & Social Risk Management

- Environmental and Social Best Practices
- Equator Principles Modeled after IFC Standards
- Governance

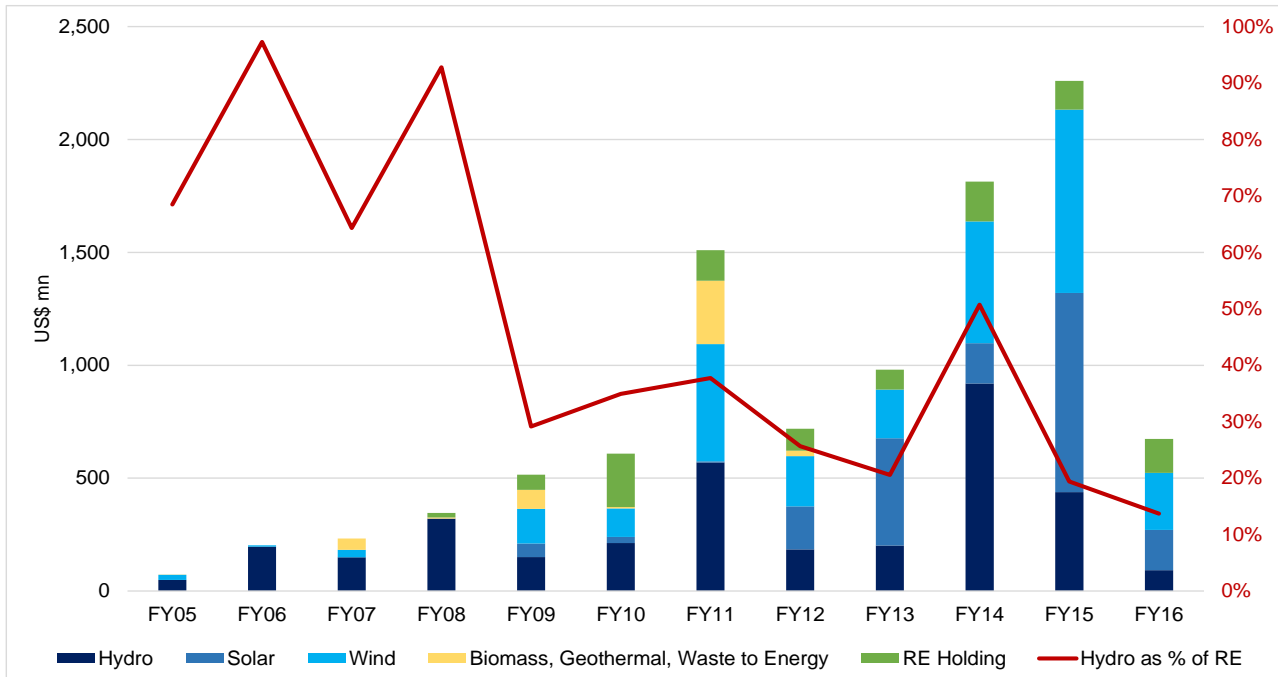
Advisory Services

- Private sector perspective to governments
- Introductions + matchmaking
- Cross-border support + Sector knowledge
- Access to Donor Funding/Concessionary Support Coordination/Carbon Finance
- Programs to assist client, including: Local Supplier Development, Corporate Governance, Community Development Funding

Hydro's at IFC

US\$3.5 billion commitments since FY05, US\$1.3 billion current exposure

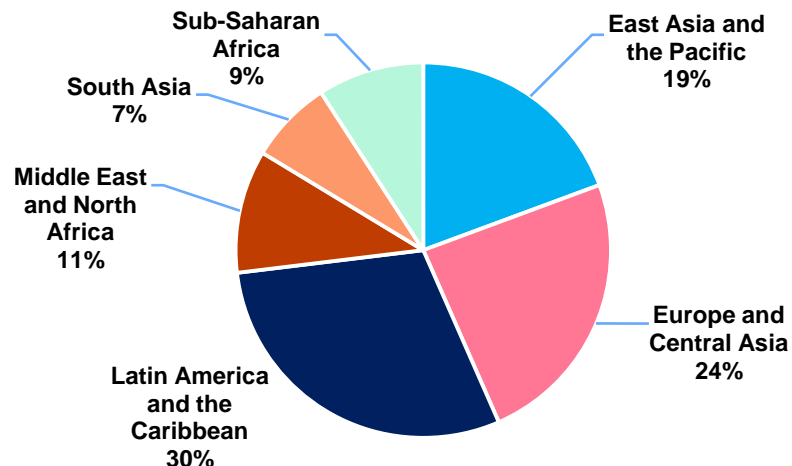
IFC Renewable Energy - Gross Commitments (US\$mm) - FY05 to FY16



- Since the 1990s, IFC has invested around US\$2.3 billion on its own-account to finance over 7 GW of hydros, including greenfield, corporate, privatization and rehabilitation transactions
- While the % contribution of hydros to IFC's renewable energy business has declined with the rapid growth in solar and wind investments, hydros continue to be an important contributor to the RE business
- FY14 was a particularly strong year with the closing of four large hydros: 180MW Asahan (Indonesia), 185MW CEI (Georgia), 531MW Alto Maipo (Chile) and 306MW Reventazon (Cost Rica)
- As a "lumpy" business, IFC's hydro volumes have been cyclical
- In recent years, IFC has invested in hydro platform companies – CSAIL (Pakistan – large hydros) and GEC (Vietnam – small hydros)

IFC Portfolio:

- US\$1.3 billion outstanding exposure as of end of FY16
- LAC and ECA accounted for over 50% of the exposure



IFC's Value-Add in Power Transactions

IFC Infra Ventures as Project Co-Developer

IFC Infra Ventures Approach:

- US\$150 million fund to provide development capital to infrastructure projects, mainly in IDA (low-income) countries (*)
- Up to US\$8 million in cash and “sweat” for projects in early stages of development
- Act as co-developer for such projects, adding value by:
 - experienced staff working alongside the sponsor, helping structure the project and increase bankability and equity investors' appetite
 - giving access to the World Bank's global presence and knowledge of local environments

IFC Experience:

Nigeria



MBSO 120MW Solar
US\$240 mn
Project cost 2015

Senegal



Tobene 96MW HFO fired
US\$165 mn
Project cost 2014

Kenya



Kipeto 100MW Wind
US\$320 mn
Project cost 2013

Nepal



Upper Trishuli-1 216MW Hydro
US\$500 mn
Project cost 2012

Georgia



CEI 400MW Hydro
US\$700 mn
Project cost 2011

(*) For a list of IDA countries, see <http://www.worldbank.org/ida/borrowing-countries.html>

IFC Infra Ventures: objectives, structure and working

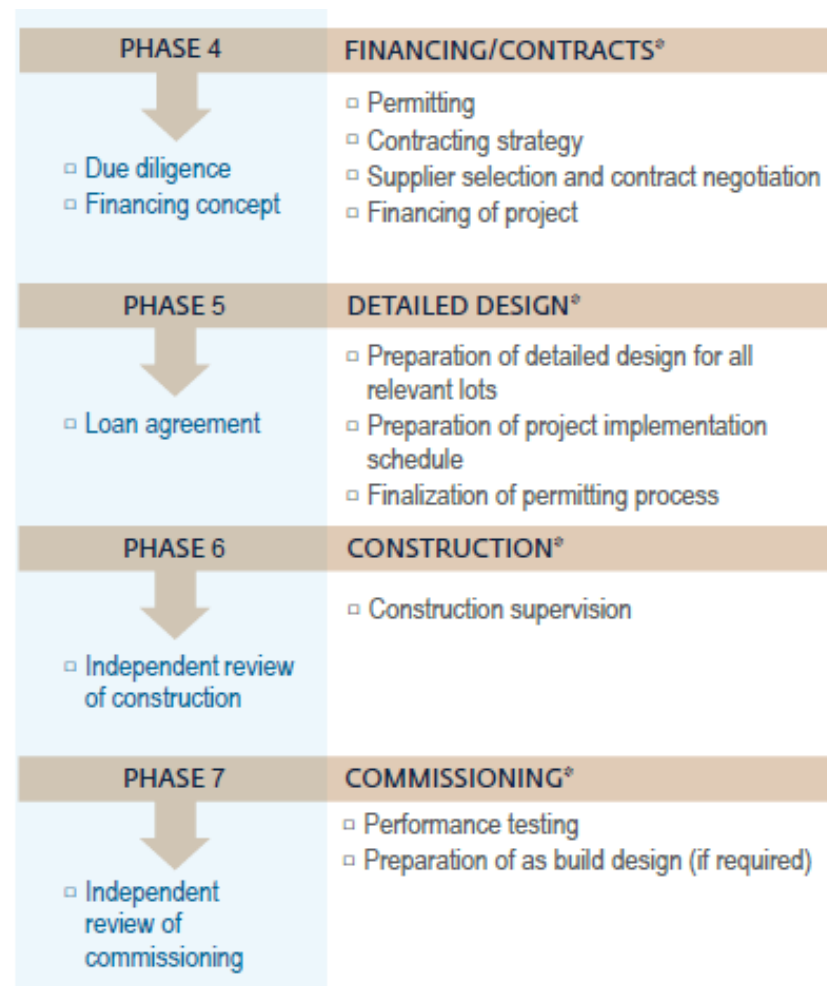
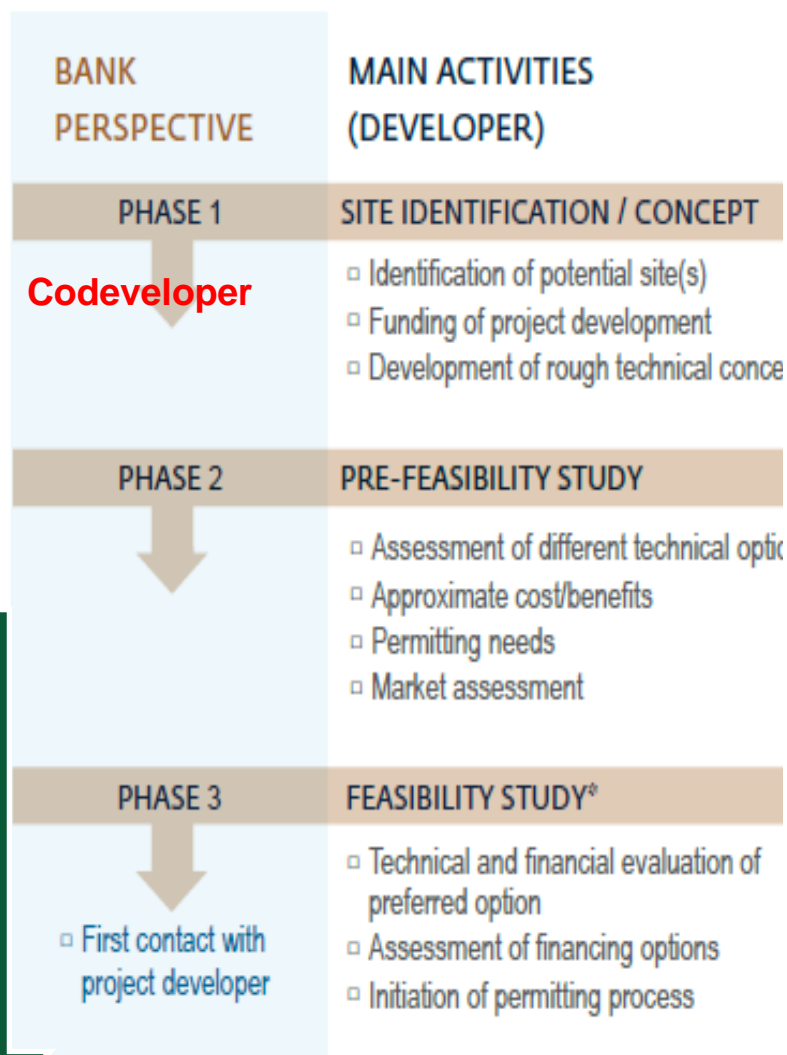
- IFC Infra Ventures is a global infrastructure project development fund
- \$150 million fund with five-year fund life
- Mandate to invest in infrastructure projects in IDA borrowing countries* and selectively in Middle Income countries (MICs)
- For each project, IFC Infra Ventures can fund up to US\$ 8 million of project development expenses at an early stage. Typically, this would be 20-30% of the early-stage financing required to bring the project to financial close.
 - In selected situations, IFC Infra Ventures may take a larger stake or even lead project development as a “surrogate” sponsor
- In return, IFC Infra Ventures will take a stake in the equity of the project at financial close
 - This is not grant funding
 - Additional debt and equity to fund construction could come from other parts of IFC’s balance sheet (would be subject of a separate agreement)
- Fund staff work proactively as co-developers of the project, alongside the lead sponsor. Dedicated, experienced senior professionals are deployed

IFC's Track Record in Greenfield Hydro's

- Since 2005, IFC has project financed 18 greenfield hydropower projects (“HPPs”) for a total installed capacity of 2,740MW and IFC’s own-account investment of US\$1.2 billion. Of the 18 HPPs, 13 are currently operational and the remaining are under construction – it does not include recent ones – Pakistan, Cameroun, etc.
- **Of the 18 HPPs, 9 are in LAC (50%), 3 in Asia (Philippines, India, Nepal), 3 in MENA (all Pakistan), 2 in Europe (both in Georgia) and 1 in Africa (Uganda). All of them are run-of-river types.**
- **Reviewing the sub-set of 9 HPPs** which have achieved commercial operation and had capped sponsor support, average ex-ante contingency equaled **17% (a range of 5% to 39%)** whereas ex-post contingency **averaged 35% (a range of 0% to 119%).**

- IFC has had to face significant cost overruns from underground works (tunnel collapse, repairs, slow tunneling progress, etc.). Underground geological works expose projects to higher risk primarily, even when there was extensive investigation and analysis
- Tunnels are not to be wholly blamed. Increase in commodity prices (steel, cement) to labor cost, E&S challenges, delays in building access roads and many other factors have also contributed to hydro cost overruns
- Despite experiencing significant cost overruns, sponsors have completed their HPPs. In some cases, additional debt financing to support cost overrun was made possible by ex-ante lower project cost per MW and/or ex-post higher power prices.
- It is noteworthy that the average ex-post cost of HPPs with cost overruns exceeding 20% and the ex-ante cost of HPPs with actual cost overruns below 20% were both US\$2.8 million per MW, suggesting a significant cost overrun does not automatically render a HPP uneconomical (Nepal feasibility studies always around 1.5 million per MW -skepticism !!)
- It means there is a need to carefully evaluate ex-ante project cost and risk allocation (e.g. low EPC price may just mean risks mostly transferred to the project company and/or poor understanding of the sub-surface geology)

Figure 1-1: HPP project development process



**Involvement of financing institution begins with Phase 3.
Source: FICHTNER*

Hydropower Pant requirements during the Project cycle

Phase	Check by bank	Data/study requirements
1. Initial screening	Check plausibility of main project parameters; check developer financial standing/ integrity	Project data sheet or pre-feasibility study (PFS) Financial statements Basic information about developer
2. Screening	Check technical/ economic project feasibility Check status of permits and licenses Check for completeness of required documentation for Phase 3	Minimum pre-feasibility for technical/economic check; better feasibility study Information about permits and licenses obtained/outstanding Other studies, in case of PFS gaps
3. Due diligence	Detailed technical, environmental and social, financial, legal due diligence of project	Minimum feasibility study (FS) Information about permits and licenses obtained/outstanding Other design documents in case of FS gaps Supplier price quotations

Source: FICHTNER

Screening Criteria for Hydro

Key Factors		Areas for Assessment for Hydro with Extensive Underground Works
Project Rationale	•	Strong need for the project in the country (transformational impact; key to addressing power supply challenges; strong complementarity to the generation mix) and not just a marginal “nice to have”
	•	Assess project attractiveness compared to alternatives in the country (e.g. reliance on higher cost HFO or LNG-to power); compare to system long-run marginal cost (Nepal has feed in tariffs even for large projects – Bankability of the Project?)
	•	If regulation provides pass-through of cost overruns from geological risks in the project tariff, assess project competitiveness also under cost overrun scenarios. Assess risk that all cost overruns may not be passed-through
	•	Will the project make sense for the country if the risks of high cost overruns materialize? What is the required tariff to make the project economics work if the high cost overruns are realized and is that tariff sustainable/competitive?
Sponsor Quality	•	Does the Sponsor have significant hydro experience? Does the sponsor have a long-term, strategic commitment to the hydro sector? Are they are capable to manage cash flow and have staying power (given risks of significant cost overruns)?
	•	Has the sponsor hired an owner’s engineer with relevant and significant experience?
Technical Preparedness	•	Thorough geological investigation, although costly and time-consuming, is key. Limited geological investigations done pre-implementation often contributes to significant unforeseen geological conditions/cost overruns
	•	IFC always retain experienced independent engineers to review the geological investigation and analysis, and the appropriateness of the project design. It is better that the project design is undertaken by an experience design firm
EPC Quality	•	Does the EPC contractor and the key sub-contractors have relevant experience – similar hydro, underground works, geology?
	•	Assess financing strength – especially given long construction period, risk of delays and cost overruns and associated liquidated damage payments
Environmental & Social	•	IFC assesses major E&S concerns (significant resettlement, Critical Habitat and impacts, indigenous people, downstream impact, community opposition, etc.)
	•	Are there satisfactory mitigation measures, which are implementable with broad support?

Project Access

- Does the project require long and challenging access road and transmission lines to be built? Risks of significant delays & **Evacuation** with right-of-way (permitting), community support
- If access road/transmission interconnection is a third-party responsibility, assess implementation risk and impact on project schedule/cost

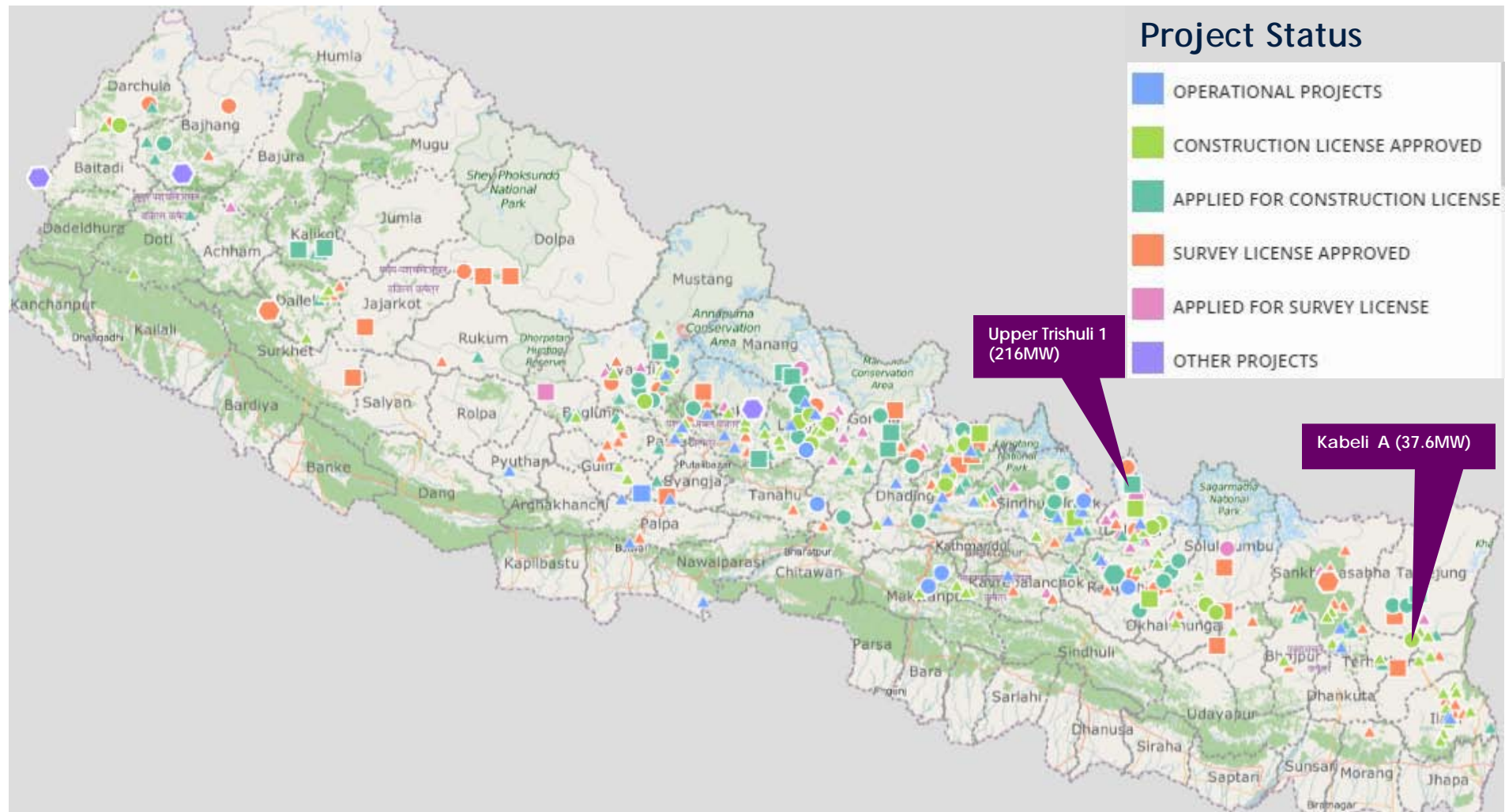
Financial Considerations

Adequacy of Contingency sizing depends on various project specific factors, with the extent of underground works as a key **Contingency** factor. IFC will size conservatively and **Sponsor** Careful analysis of risk allocation between the project company and the EPC Contractor for cost overruns is an **support** integral element in sizing contingency. Who takes the risk from geological variations? Who takes the risk of commodity and labor price inflation?

- Also, IFC will factor in costs arising from delays vis-à-vis PPA/concession (PDA) required commissioning date, and additional costs associated with a delay (financing costs, insurance, etc.)
- If underground works are extensive (long tunnels), IFC will try to procure uncapped sponsor support to cover project cost overruns (or to cover excess tunneling costs)

Financial • How financially robust is the project when stress tested for high cost overrun scenarios: how much more additional **Robustness** debt could it take (if needed)? Assess implied DSCRs and implications on equity returns and incentives for the **under Stress** sponsor to stay committed - need for DSCR above 1.3 -1.4 !!!

IFC and the Nepal Hydro Sector



Key Challenges in Nepal



Key Aspects of PDA

- 1** To complement and supplement local laws
- 2** To specify rights and obligations of the IPP, Lenders and Government
- 3** To address uncertainty regarding guaranteed off-take
- 4** To confirm right to use foreign currency
- 5** To provide certain rights to Lenders

Hydro Cost Overruns – Selected IFC Cases

- 168MW xxx Cost overrun of **62%**. Key issues: **(i) major geological issues (rock bursting) – fatal accidents leading to slowing/stoppage of tunneling works; (ii) underground power house stability issues – had to refill excavated powerhouse in order to reinforce ceiling; (iii) community protest actions interrupted work progress along the project line; (iv) poor project management and on-site delegation leading to inefficiencies and delays; and (v) multiple contractor claims leading to contract renegotiation and major cost overruns**
- 155MW xxx 158MW xxxx: Cost overrun **of 119% and 48%**, respectively. Key issues: **major geological challenges (swelling clays), tunnel collapse and repair, additional insurance costs.**
- 84MW xxxx Significant cost overrun but IFC was prepaid. Key issues: extreme project delays as a result of **slow tunnel boring machine (TBM) progress, including long periods of blockage, due to excess water pressure in tunneling path**

- 192 MW Axxxxxx Cost overrun of **115%**. Key issues: **significant geological problems experienced in the tunneling works (heavily weathered rock with large water inflows), significant increase in price of cement, steel and labor (passed through to the project) and delays due to legal action by community.**
- 250MW xxxx. Cost overrun of 10%. No tunneling works. Key issues - cost increase and delay due to difference in actual underground geological conditions (for dam foundation construction) versus assumed pre-financial close. Cost increase due to difference in ground condition was a pass-through item in the PPA.
- 39MW xxxx Cost overrun of 20%. No tunneling works. Key issues – no single EPC contract, sponsor delay due to handover of site to civil works contractor; civil works contractor did not have previous hydro experience and was slow, with another contractor undertaking some of the civil works (earth fill dam).

Beware of the Young : In geological terms, the Andes and the Himalayas are young mountains – they are still forming and evolving. This makes predicting the underground geology of these mountains difficult but more importantly, there is more risk with tunneling through young mountains due to geological stability issues. Unfortunately, a significant amount of hydro resources are concentrated in the Andes and the Himalayas, as demonstrated by our HPPs in LAC, India, Pakistan and Nepal. Note the relatively lower cost overruns for projects in Georgia, in comparison.

Key Takeaways – the Hard Lessons of IFC Experience

- Each hydro is different and highly site specific. Cost overrun risks are more pronounced for HPPs with significant underground geological works (tunnels, underground powerhouse). Simple hydro structures (no tunnels, small weir) do not carry similar risks
- Where significant underground works are required, critical to perform thorough geological evaluation and project design assessment BUT one cannot take full comfort on underground conditions – be ready to face unexpected challenges
- Project sites are in remote areas – be conservative in time & cost required for road access, transmission interconnection, community engagement, etc.
- Don't be guided by low cost bids. Don't expect a fully-wrapped EPC contract - it is unlikely that an EPC contractor would take on the full geology risks but more of the risks could be transferred to the EPC contractor at a premium EPC price
- As borne by IFC's own-experience, be conservative in sizing ex-ante contingency, especially for HPPs with significant underground works. For higher risk projects, IFC likely to require uncapped sponsor support

- Contingency sizing should account for not only the increase in hard costs (civil works – labor and material) but also insurance costs, E&S costs and other soft costs (financing costs) – significant construction delays compound cost increases
- Build cushion to the required commercial operation date (COD) in the PPA/concession, and try to secure flexibility in the PPA/concession for COD extensions for delays arising from unforeseen geological challenges. Ensure liquidated damages for COD delays are

Thank you
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