WORLD BANK GROUP

Discussion on Hydropower in West and Central Africa

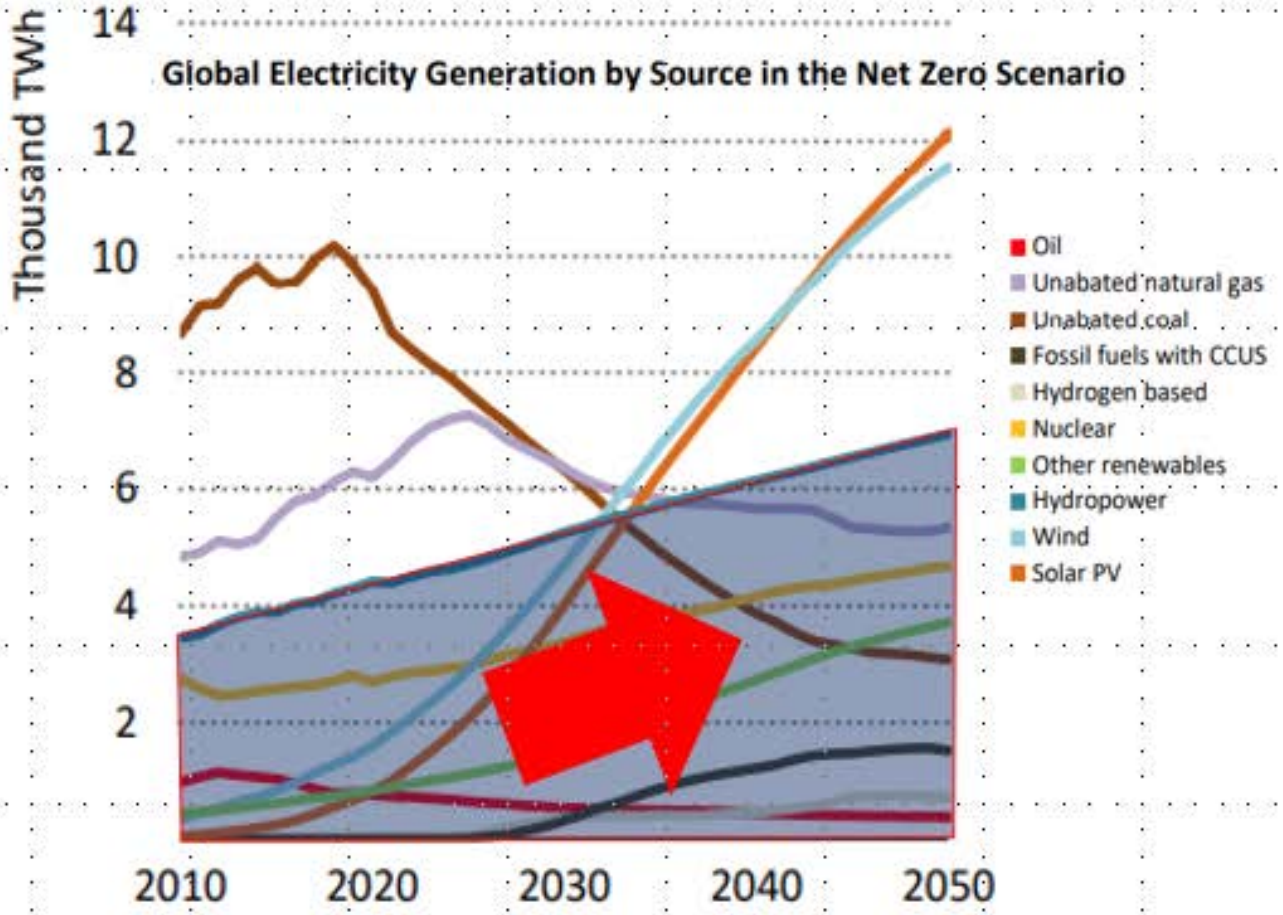
ESMAP Hydropower Development Facility,
Side event at HYDRO AFRICA 2023

July 9th, 2023, 15:00-17:00

ESMAP
Energy Sector Management Assistance Program

HYDROPOWER IS BACK

- Backbone of the energy transition
- Low-carbon
- Dispatchable and flexible to integrate variable renewable energy (wind, solar…)
- IEA Net zero calls for doubling the existing installed capacity by 2050
- Third largest energy source in the electricity mix by 2050



Source: International Energy Agency 2021. *Net Zero by 2050*. Paris: IEA.

Hydropower's Role is Changing …

	TRADITIONAL ENERGY MARKET YESTERDAY	ENERGY TRANSITION TODAY	NET-ZERO EMISSIONS TOMORROW
HYDROPOWER ROLE	• Generate energy - baseload and hourly peaking	• Enable integration of VRE (i.e., wind and solar) and facilitate energy transition/grid decarbonization	• Support VRE generation which will determine operation patterns of the power system
GRID SERVICES	• Balance energy supply	• Ensure grid stability and reliability through ancillary services such as frequency regulation, voltage support, active power-loss compensation, black start	• Store surplus VRE generation and provide increased grid resiliency (e.g., enhanced energy balancing and frequency regulation) through pumped storage hydropower and other storage technologies
MULTIPURPOSE BENEFITS	• Flood protection, irrigation support, water supply and recreation		
SUSTAINABILITY	• No defined/ unique industry standard	• Hydropower Sustainability Guidelines are voluntary	• Sustainable hydropower development is the norm • Renewable energy projects contribute to biodiversity protection and conservation

Key Findings/Observations

Electricity Sector

1. More than half the people in the region do not have access to electricity; Over 60% of countries in West Africa will be facing water scarcity by 2025
2. Half the electricity is generated by thermal sources, including imported gas and HFO
3. New thermal plants are still being committed to on an ad-hoc basis
4. Hydro provides 25% of the generation but solar is rapidly increasing (~10%)
5. Least-cost generation is typically amortised public hydro
6. Private sector is engaged in refurbishment/acquisition of projects in some countries (Nigeria, Côte D'Ivoire), with some appetite for selected greenfield projects

Key Findings/Observations *(continued)*

Regional Cooperation

1. WAPP (and CAPP) continues to strengthen, mainly through bilateral agreements
2. About 1 GW of regional solar parks are being developed under WAPP strategy (WBG-led)
3. Some river-basin collaboration achieved at national (Sanaga basin/Cameroon), transboundary (Togo-Benin Mono river) and regional (Sénégal, Gambia and less so with the Niger) levels
4. Climate studies show moderate to possibly consequential impact on hydrology (more work needed at the basin level)

Key Findings/Observations *(continued)*

New Opportunities

1. Increasing interest in synergies of renewables (regional and project levels); hydro design and equipment will determine level of complementarity
2. Some solar-hydro hybridization projects developed (Ghana), others under planning (Manantali, Mali)
3. Considerable opportunities for floating solar that would help create more
4. Some interest in pumped storage projects (Cape Verde); solar growth will drive more interest
5. Some greenfield projects at advanced stages of preparation (Cameroon) and some dormant (Nigeria). [in less than 30 years, today IPPs contributed 45% of Nepal's electricity whereas 55% was produced by the State]
6. Modernisation and repurposing of existing assets to be more resilient and flexible (Congo, Rep)
7. Potential for acquisitions and refinance (Guinea); addressing control and tariff issues

Regional Approach

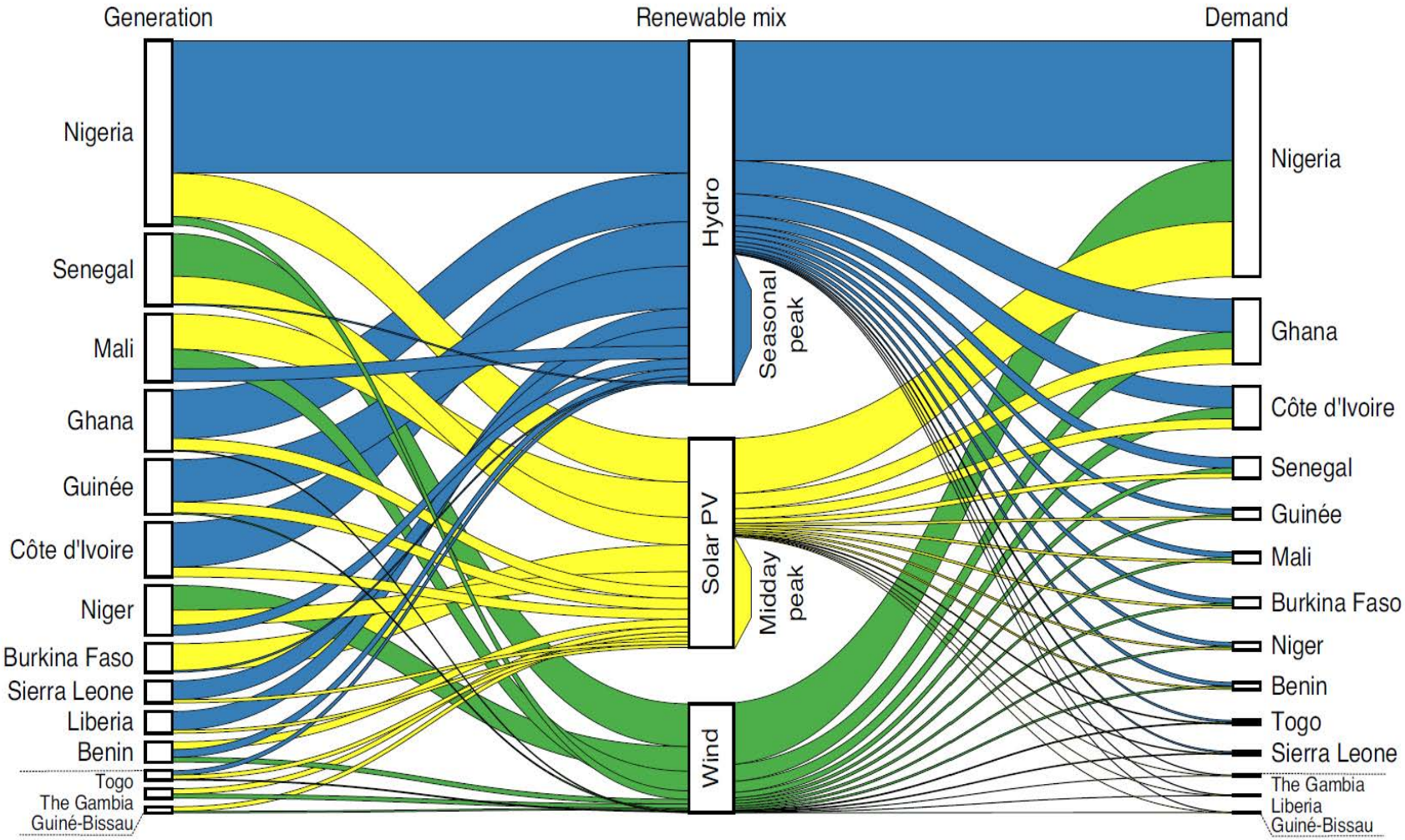
1. Regional approach makes sense from the perspective of closing electricity access gaps, driving the energy transition, and increasing climate-change resilience.
2. This will require, building ownership of renewables-plus-storage power system planning, attracting investment, with a differentiated approach to public and private sources.
3. Need for better coordinated and consistent strategy from lenders and governments – and ensuring that assistance is sensitive to the ongoing (in-country) situation, adequate and competent.

Regional Approach/Actions

1. Develop master plans addressing spatially and temporally differentiated resources (solar, wind, hydro, batteries and thermal back-up)
2. Align with WAPP/CAPP corridors, connecting resources with markets (transmission, interconnections)
3. Address river basin and conservation area constraints (multipurpose infrastructure and transmission corridors)
4. Build support and knowhow on sustainability aspects, including benefit sharing
5. Focus on hydropower storage, flexibility, climate resilience and safety (brown- and greenfield projects)
6. Improve capacity for hydro planning, implementation, operation and maintenance by establishing a regional training hub
7. Align planning at regional level (i.e. ECOWAS, WAPP/CAPP, etc.) and with regional organizations (i.e. OMVS, OMVG, VRA, etc.)
8. Mobilize private sector participation to unlock additional finance for sustainable hydropower development

Theoretical 100% Renewables Mix in West Africa

Spatial Complementarity

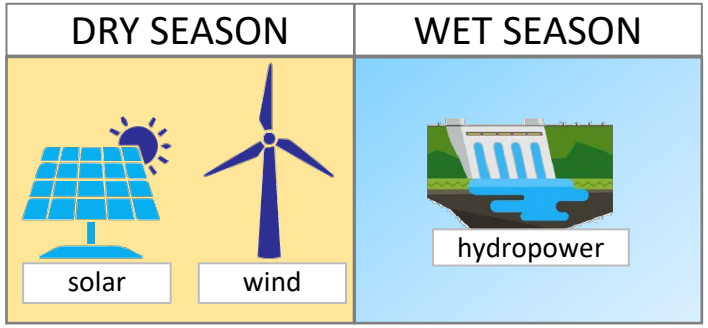


ARTICLES
https://doi.org/10.1038/s41893-020-0539-0
nature sustainability

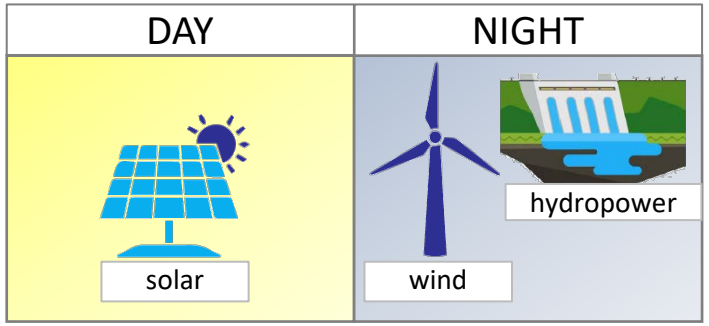
Smart renewable electricity portfolios in West Africa

Sebastian Sterl[1,2,3], Inne Vanderkelen[1], Celray James Chawanda[1], Daniel Russo[4], Robert J. Brecha[5,6,7], Ann van Griensven[1,8], Nicole P. M. van Lipzig[2] and Wim Thiery[1]

Seasonal Complementarity



Diurnal Complementarity



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Thinking New: Pumped-Storage Hydropower (PSH)

Theoretical Pumped Storage Hydropower Potential in Africa

Data set: Global Greenfield 150 GWh 50 h

These sites will store 150 GWh of electricity which will discharge over 50 hours yielding 3.0 GW of power. Each pair of reservoirs would provide sufficient energy for 7.5 million people.

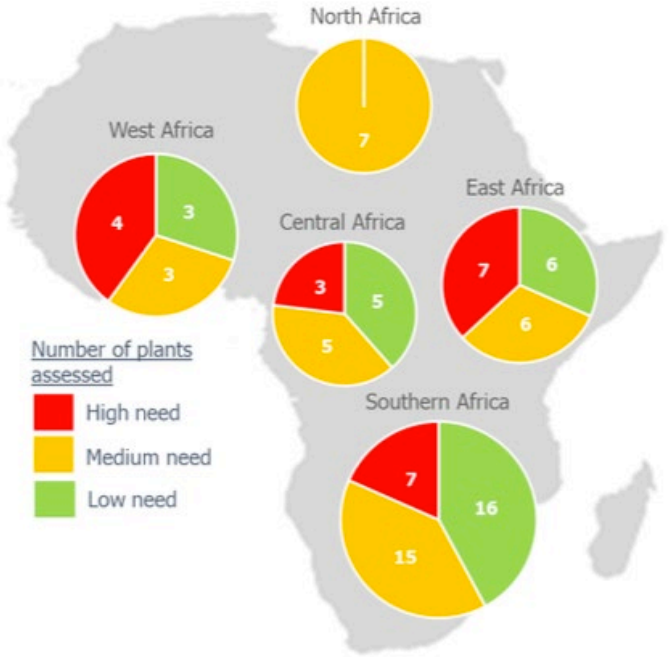
Map color code is based on relative cost-effectiveness of projects in the area. Larger systems (red) are generally more cost-effective than smaller systems (yellow).

Reference: ANU Global Greenfield Pumped Hydro Atlas (http://re100.eng.anu.edu.au)

Opportunities Provided by Modernization

- Secure electricity generation
- Recover derated/idle units
- Upgrade capacity and technology
  - More efficient equipment;
  - More flexible operations;
- Improve climate resilience
- Review & improve E&S impacts

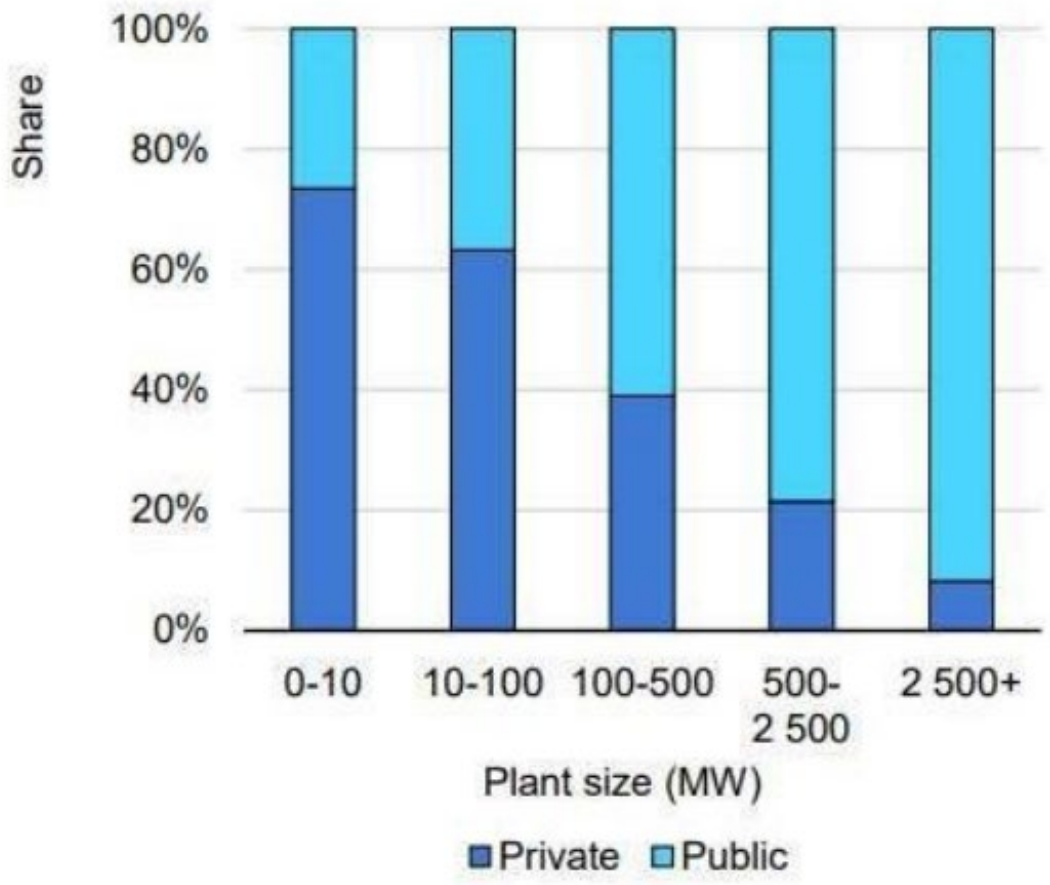
HIGH NEED	• Old technology (30y +) & experiencing major mechanical issues limiting their productivity (units out of service, safety issues). • Severely compromised with several, or all, units out of service, regardless of their age.
MED NEED	• Old technologies but not experiencing any major mechanical problems limiting the production. • Running at partially reduced capacity because of specific electrical, mechanical or civils issue, regardless of their age.
LOW NEED	• Recently built or modernised (0-30 years), running smoothly and not reporting any particular electrical, mechanical or civils issues.



"West (2.1 GW) and Central (1.5 GW) Africa have the highest needs of modernization in terms of capacity at risk."

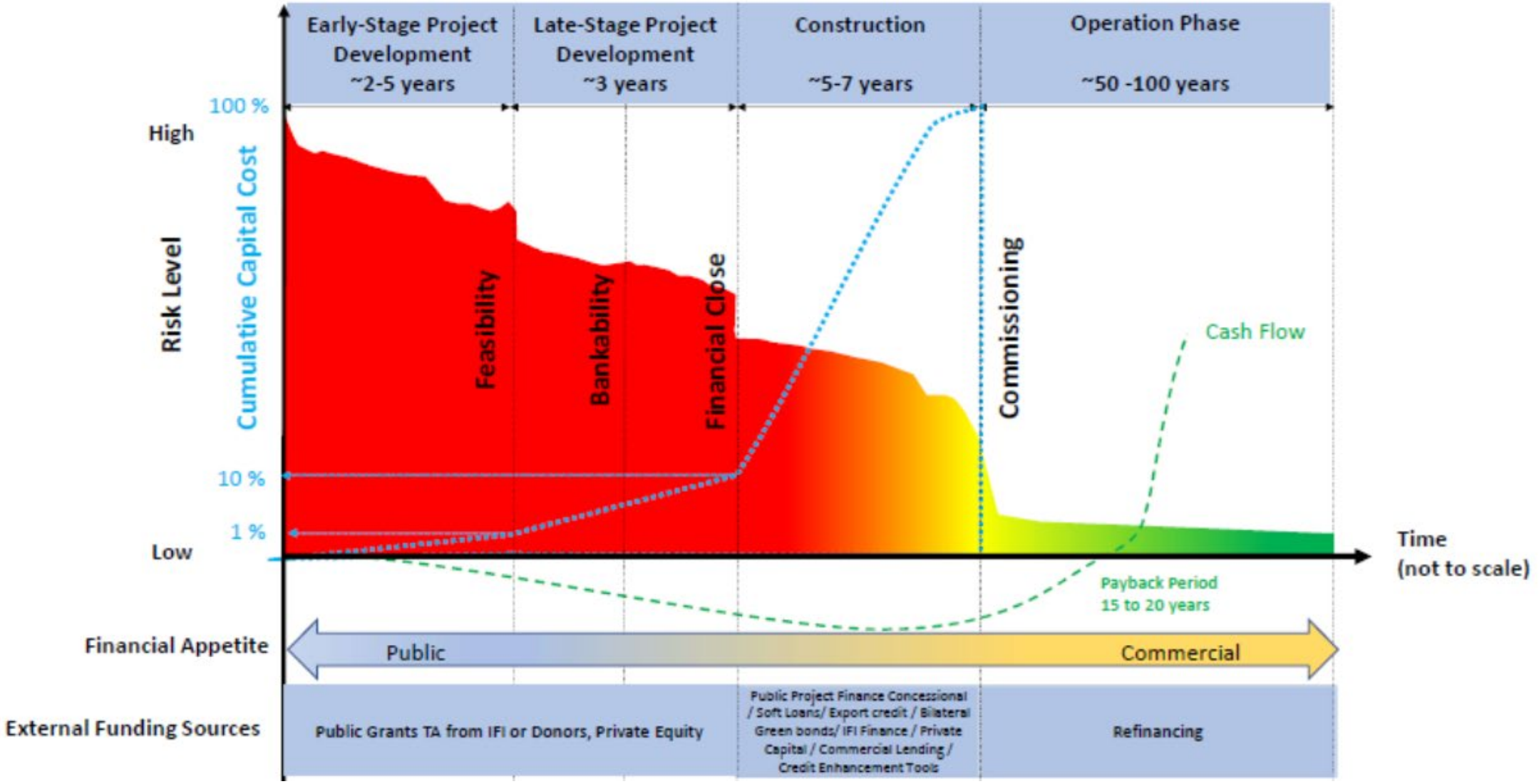
Private Sector Participation remains scarce

- 27% of the added hydropower installed capacity over 2011-20 was private.
- Lack of financially sustainable off-takers.
- Risk profile of Hydropower projects.
- World Bank interventions:
  - Sector reform.
  - Project de-risking (preparation and structuring).



Share of ownership by plant size 2000-2020 (source IEA)

Patient Financing is key to hydropower development



PROGRAM AND SPEAKERS

SESSION FORMAT

20 min. presentation followed by 15 min. Q&A

WELCOME REMARKS

FINANCING NEEDS FOR SUSTAINABLE HYDROPOWER IN WEST AND CENTRAL AFRICA

Pravin Karki - Global Lead for Hydropower & Dams at The World Bank Group

SYNERGETIC RENEWABLE RESOURCES IN WEST AND CENTRAL AFRICA

Prof. Dr. Sebastian Sterl - Senior Research Associate on Clean Energy Transitions at WRI Africa

THE FUTURE OF HYDROPOWER FROM A TECHNOLOGY PROVIDER'S VIEW

Diego Vilanova - Vice President Market Management for Africa at Andritz Hydro GmbH

FUTURE OF HYDROPOWER IN WEST AND CENTRAL AFRICA FROM PRIVATE SECTOR PERSPECTIVE

Engr. Lamu Audu FNSE - Managing Director / CEO of Mainstream Energy Solutions Ltd.

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