Role of hydropower in West African Power Pool (WAPP) interconnected network

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Establishment, Vision and Mission of WAPP
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Establishment:
WAPP was created in 1999 by Decision A/DEC. 5/12/99 and established in 2006 through Decisions A/DEC. 18/01/06 and Decision A/DEC. 20/01/06 by the Authority of ECOWAS Heads of State and Government.

Vision:
To integrate the national power systems into an unified regional electricity market

Mission:
To promote and develop infrastructure for power generation and transmission, as well as, to assure the coordination of electric power exchanges between ECOWAS Member States
Members of WAPP in July 2006 (13#)

Members of WAPP in July 2023 (39#)
West Africa hydropower Plants and their contribution to the WAPP interconnected network
West Africa has 28 transboundary river basins.

- The most important of these are:
  - the Niger (shared by 11 countries),
  - the Senegal (4 countries),
  - the Volta (6 countries),
  - the Lake Chad and
  - the Comoé (4 countries).

14 cross-border basins are listed in Guinea, where a large number of rivers originate. 8 in Côte d’Ivoire, 7 in Liberia, 5 in Nigeria and Sierra Leone.

In total, crossborder basins cover 71% of the total area of the region.
Existing hydropower plants capacity (2018) in West Africa

The ECOWAS Master Plan for the Development of Regional Power Generation and Transmission Infrastructure 2019 – 2033 shows that Hydropower is the second-largest source of power generation behind thermal and the leading source of renewable power in West Africa.

- Nigeria: 1,966 MW
- Ghana: 1,496 MW
- Côte d’Ivoire: 879 MW
- Guinée: 365 MW
- Mali: 184 MW

The map indicates existing hydropower plants in various West African countries, with marks for each plant's location.
Projected hydropower plants capacity up to 2033 in West Africa

By 2033, the ECOWAS Master Plan shows that in terms of installed capacity, to meet the peak demand of 2033 (50.8 GW), hydropower plants will cover 12.8 GW.
Projected hydropower plants capacity (between 2019 and 2033) in West Africa

The current ECOWAS Master Plan has made the development of the region's hydropower potential a priority, in order to optimize the use of profitable hydropower resources.

The projects selected in the current master plan have been chosen not only for their economic interest, but also for their ability to compensate the variability of renewable energies (solar and wind).
ECOWAS Energy Resources

- Large hydropower potential in Guinea, Liberia and Nigeria
- Gas resources in Nigeria, Ghana, Côte d'Ivoire and Senegal
- Favorable solar irradiation conditions for solar PV plants in Mali, Burkina Faso and Niger
WAPP interconnected network to facilitate the pooling of energy resources

The generation deficit of one country can be compensated for by the surpluses of others.

This can only be achieved through the development of a large, robust transmission network interconnecting all the countries in the region.
When WAPP was established in 2006, there were several interconnected and synchronous systems.

To date, with the support of WAPP technical and financial partners, 13 of the 14 continental states of ECOWAS are interconnected.

All 14 will be interconnected by 2023.
The role of the hydropower in WAPP interconnected network

For an interconnected network such as the WAPP, hydropower is an essential component of network stability.

It plays a vital role in ensuring a constant balance between consumer needs and the generation supplied to the network.

Dam reservoirs are batteries, a reserve of electricity that can be mobilized at any time. Hydropower plants with reservoir dams offer great operational flexibility, useful during periods of high demand or when other means of generation are insufficient. They enable electricity to be injected into the grid at very short times. With the expected development of variable renewable energies, the flexibility of hydropower is an essential asset.
World Bank support for the development of hydropower plants in West Africa
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In the past, the World Bank was the preferred partner for dam investments in the West African region, such as the Akosombo HPP in Ghana.

The last HPP commissioned in the region or due to be commissioned before the end of 2023 are financed by other sources, such as the Soubré (275 MW) and Gribo Popoli (112 MW) HPP in Côte d'Ivoire, the Zungeru HPP (700 MW) in Nigeria, the Gouina HPP (140 MW) in Mali, Kaleta (240 MW) and Souapiti (450 MW) HPP in Guinea.
World Bank support for the development of hydropower plants in West Africa

However, the World Bank's involvement in hydropower projects is regaining momentum through the financing of pre-investment studies, such as in Liberia, where the World Bank, after having financed the pre-investment studies through WAPP, is financing the implementation of the extension of the Mt Coffee hydropower plant for an additional 44 MW.

Also, through WAPP, WB is undertaking the pre-investment studies for the future 150 MW SP2 hydropower plant on the St Paul River.
Future of hydropower in West Africa
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With the massive deployment of variable renewable energy capacity in the WAPP interconnected network, the challenges of interconnected network stability are becoming more important.

The current ECOWAS Master Plan that has been developed is a least-cost plan taking into account the primary resources available in the region.

The abundant solar integration observed is due to the decreasing trend in the cost of solar and the availability of hydropower to compensate for the variability of solar.
Future of hydropower in West Africa

Given that hydropower resources are limited, the next revision of the Master Plan will probably not see the development of new hydropower plants, but pumped storage stations to compensate for the intermittency of solar PV power, which is certain to increase.

Dam reservoirs are batteries that can be "recharged" using reversible turbines that can pump water back into the reservoir. Thus, stored as "bulk" energy, the water in the reservoirs can be converted back into electricity when needed.
Reservoirs can also be used to deploy floating solar PV Plant - a study is currently underway on the Manantali dam reservoir in Mali financed by the World Bank.


Thus, through the pumped storage and floating solar PV Plant, the HPP of ECOWAS member countries still have potential to be deployed for greater stability of the WAPP interconnected network.
Thank you