

Climate variability and hydropower production: Improving energy security at Afulilo Dam, Samoa

Jason A. Smith¹, Sunny Seuseu², Wairarapa J. Young³, Elisabeth Thompson¹, Amanda Amjadali¹

1. Climate and Oceans Support Program in the Pacific (COSPPac), Bureau of Meteorology, Australia
2. Samoa Meteorological Division, Ministry of Natural Resources and Environment, Samoa
3. Electric Power Corporation, Samoa

Introduction

Samoa relies on hydropower for around 30-45% of its energy.

By 2030, the Samoan Government wants to increase the proportion of energy produced by renewable sources by 20%. The Electric Power Corporation has identified hydropower as one of the most reliable and cost effective forms of renewable energy.

COSPPac is working in partnership with the Samoan Meteorological Division to develop and deliver improved climate monitoring and prediction tools to assist future planning of hydropower initiatives and improve operational efficiency of hydro electric projects.

Hydropower and climate in Samoa

Hydropower production is highly vulnerable to variability in rainfall and streamflow. As Samoa is strongly influenced by the ENSO phenomena, there are substantial variations in rainfall from year to year.

Inter-seasonal variability and extended drought periods create operational challenges for hydropower dams, such as the Afulilo in Samoa which supplies water to the 4MW Taelafaga hydropower station.

Seasonal rainfall and streamflow forecasts can improve the reliability and management of hydropower to maximise production without the need for costly new infrastructure upgrades.

How this project will help

The long-term aim of this project is for the Samoan Meteorological Division and the Electric Power Corporation to develop a sustainable, operational system for the Afulilo Hydro-Electric Project.

More specifically, the project aims to:

- Build capacity in the Samoan Meteorological Division so they can provide customised climate forecasts to the Electric Power Corporation.
- Strengthen relationships between the Samoan Meteorological Division and energy providers.
- Improve the hydrological model precision and reduce the error and bias associated with the modelled dam volumes.
- Use the data from the sensitivity tests to inform the development of a climate risk management plan.

Progress so far

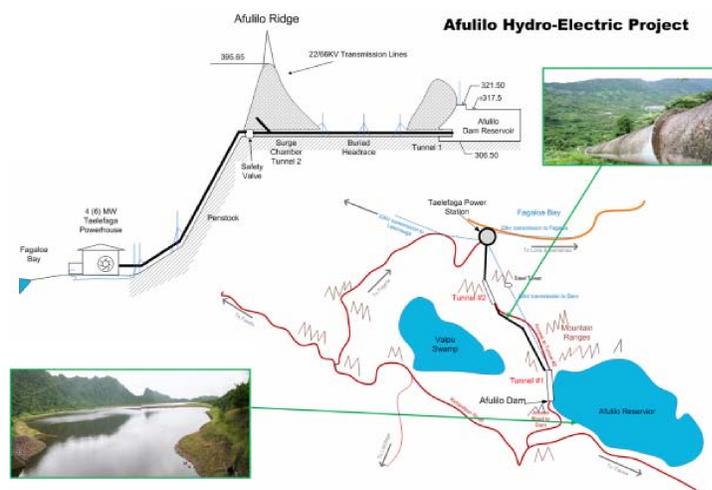
Several outcomes have already been achieved:

- Preliminary analysis showed a significant correlation between seasonal storage volume and ENSO, with El Niño tending to coincide with lower storage volumes and La Niña tending to coincide with higher storage volumes.
- Installation of a new water height gauge at the dam wall.
- Relocation of the local rainfall gauge to an area unobstructed by foliage cover, improving the Electric Power Corporation's data collection capacity.
- A water balance model was derived and validated using climate, streamflow, power production and dam level data.
- The validated water balance model and extended climate data was used to perform long-term sensitivity tests for parameters including power demand, dam storage capacity and seasonal rainfall variability.
- The Samoan Meteorological Division reported on their ability to supply the Electric Power Corporation with customised climate outlooks whilst the Electric Power Corporation had also begun supplying hydrology data to the Samoan Meteorological Division at irregular intervals indicating a growing operational relationship between the two agencies.

How this project is contributing the Global Framework for Climate Services in the Pacific

This pilot project has contributed to the GFCS by:

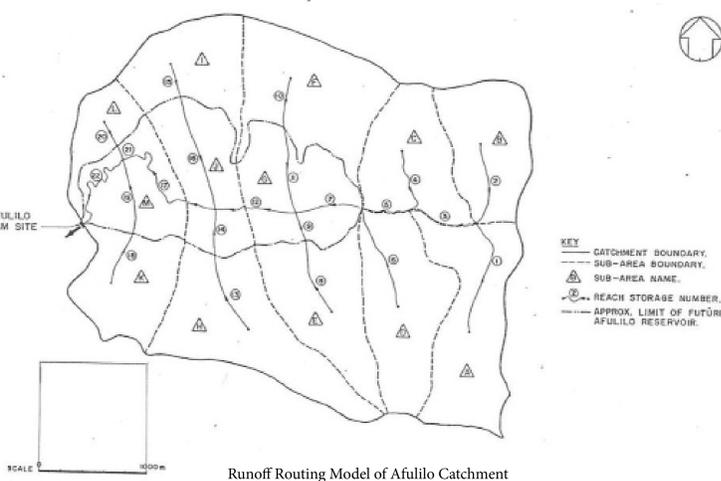
- Enhancing the capacity of the Samoan Meteorological Division to produce customised climate forecasts for the energy sector.
- Facilitating the exchange of data and expertise between the Samoan Meteorological Division and Electric Power Corporation.
- Working towards the implementation of an operational system in a developing country.



Penstock connecting Afulilo Dam to Taelafaga Powerhouse, Yahya Abawi.



Meeting between representatives of the SMD, EPC and PICPP, Amanda Amjadali, May 2012.



References

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Contact

Amanda Amjadali - Team Leader, Climate and Oceans Monitoring and Prediction Project
Climate and Oceans Support Program in the Pacific (COSPPac)
Australian Bureau of Meteorology
Email: a.amjadali@bom.gov.au