Afulilo Water Storage and Outlook Module (AWSOM-2)

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In consultation with the Samoa Electric Power Corporation (EPC) and the Samoa Meteorology Division (SMD), the Afulilo Water Storage Outlook Module (AWSOM) that was developed as a manually operated spreadsheet application prior to COSPPac-1, has now been redeveloped as an automated web application (AWSOM-2). The Afulilo Hydropower Scheme is the largest renewable power scheme in Samoa, and is central to Samoa’s goal of becoming 100% renewable in the energy sector by 2030. AWSOM-2 draws on weekly, monthly, and seasonal rainfall forecast products from the ACCESS-S forecasting system, as well as weather and climate forecasts from other global models. Additionally, AWSOM-2 draws on rainfall observations from the dam, dam level measurements conducted by EPC and the Samoa Water Resource Division, and power generation rates being operated by EPC. The model incorporates physical relationships derived from studies of how the reservoir responds to rainfall, water runoff from the upper catchment, and losses from evapotranspiration and seepage.

Samoan Met staff operationally review model outputs, add interpretive commentary from local knowledge and perspectives, and then forward the reservoir storage outlook report to EPC. This enables EPC to consider options for optimising water use for power generation which maintaining a guaranteed electricity supply.
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Alan Porteous, James Sturman, Matt Wilkins, John Powell, Shaun Williams
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Afulilo Hydropower Scheme – background

- Annual rainfall ~ 5000 mm
- Catchment 11.84 km²
- 10,000 ML stored generation potential: 310 to 317.6 m AMSL
- 4 MW/h generation capacity
- Aim to fine tune operational decisions to enhance management of the available water resources of the reservoir
- Reduce reliance on fossil fuels
- Samoa aims to be energy self-sufficient by 2030
Afulilo Water Storage and Outlook Model (AWSOM-2): Upgrading the model

- From SCOPIC to ACCESS-S seasonal forecasts
- Move from monthly to sub-daily model runs
- Incorporate weather forecasts
- Automatic ingest of real-time rainfall and dam level measurements
- Enable run-time options for storage outlook scenarios
- Provide additional seasonal climate information for advance planning.
AWSOM-2: Physical features

- Surface area and storage volume
- Seepage and storage volume
- Rainfall and catchment runoff
- Surface area and evaporation
- Outflow and power generation
- Rainfall and catchment runoff
- Surface area and evaporation
- Seepage and storage volume
- Outflow and power generation

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AWSOM-2: model components

Climate Data
- Rainfall (real time)
- Evaporation

Hydrological Data
- Dam Water Level
- Dam Outflow / MW

Infrastructure Data
- Dead Storage Level
- Generation Capacity
- Model design relationships

Forecast Products
- Afulilo Water Balance Model
- Water Storage Forecast

Forecast Data
- Climate Outlook (ACCESS-S)
- Power Generation Forecast (monthly)
- Weather Forecasts (WRF and GFS)
- Rainfall Forecasts (SMD)

Forecast Products
- Outlook for Rainfall
- Daily Forecast Chart
- Water Storage Forecast Model design relationships
AWSOM-2: Run time options

• Application accessed via CliDEsc's product catalogue and viewed in a web browser.

• The user can edit the Monthly Generation Table to:
  • add actual generation for past months
  • add expected generation for future months
  • test the impact of future energy generation scenarios

• The impact of changes to the Monthly Generation Table on the dam's storage volume can be reviewed in the forecast charts and data tables.
AWSOM-2: Run time options

Monthly Generation Table
Table is editable. Values shown are long term averages unless measured or predicted generation totals are manually entered by the user. Values must be between 0-4 MW.

<table>
<thead>
<tr>
<th></th>
<th>August 2021 MWh</th>
<th>September 2021 MWh</th>
<th>October 2021 MWh</th>
<th>November 2021 MWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historic Average</td>
<td>2.34</td>
<td>2.3</td>
<td>2.17</td>
<td>2.27</td>
</tr>
<tr>
<td>Actual Generation</td>
<td>2.4</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Submit Table

Manually Overwrite Current Dam Water Level

Daily Forecast Chart

Submit Level

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Download Report
AWSOM-2: System output

- Track and display dam water level over past three months and forecast level for the coming month and longer
- Show rainfall forecasts and impacts on dam storage volumes
  - 3 days
  - 7 days
  - 10 days
  - 1 month
- Estimate dam inflows and hence MWh potential of incoming rainfall
Decision support: customised clidesc portal for EPC

- Afulilo storage outlook report
- Model performance tracking
- Regional data/context
- ENSO outlook

Many options for customisation
AWSOM-2: Future development

- Validation and further customisation – focus on key decision making schedules
- Improve catchment scale physical features modelling eg lag time for catchment runoff
- Integrate with EPC data management system as needed (SCADA)
- Add option for rainfall forecast intervention from Samoa Met Division forecasts
- Incorporate spillway losses (rare)
- Improve integration of seasonal scale storage planning
- Incorporate real time dam level monitoring (in progress)
Afulilo Water Storage and Outlook Module – AWSOM-2

Nga mihi kia koutou, tena koutou katoa
Thank you for listening to my presentation.

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