# Sustainable Hydropower Generation by utilising Dynamic Water and Dispatch Management (DWDM) system in Sarawak

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Power to Grow

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# About Us

**Vertically integrated energy development company and power utility and Malaysia's largest renewable energy developer**

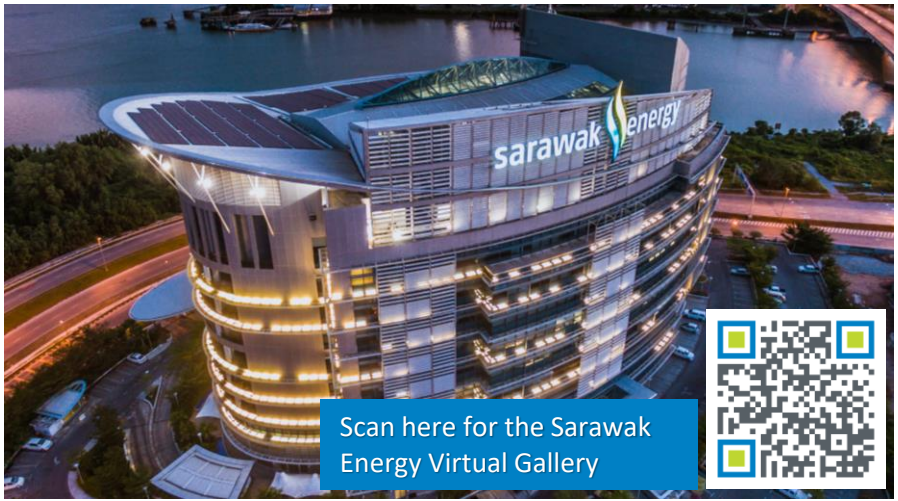
- **Power generation, transmission, distribution, retail and export**

## Our Vision

To achieve sustainable growth and prosperity for Sarawak by meeting the region's need for reliable, renewable energy

100 YEARS
Power to Grow

- Wholly-owned by Sarawak Government
- Established in 1921; a century of operations



# About Us

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Manpower ≙ 6,000

Account Holders 780,000 in 2023

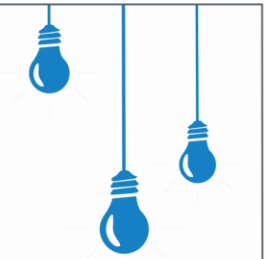
Population of Sarawak ≈ 3 million

## Our Values

- Courage
- Integrity
- Unity
- Accountability
- Respect

## Lighting Up Communities

Towards Achieving Full Electrification by 2025

# Hydropower in Sarawak


| Batang Ai | Bakun | Murum | Baleh |
|---|---|---|---|
| • 94MW Available Capacity<br>• Commissioned in 1985 | • 2,520MW Available Capacity<br>• Commissioned in 2011 | • 944MW Available Capacity<br>• Commissioned in 2014 | 1,285MW Available Capacity<br>Expected Commissioning Date: Q4 2030 |

*Correct as of Q2, 2024*

All hydropower facilities operated by Sarawak Energy are guided by the International Commission on Large Dams (ICOLD) and the Hydropower Sustainability Standard (HSS).

# Dynamic Water and Dispatch Management System (DWDM)

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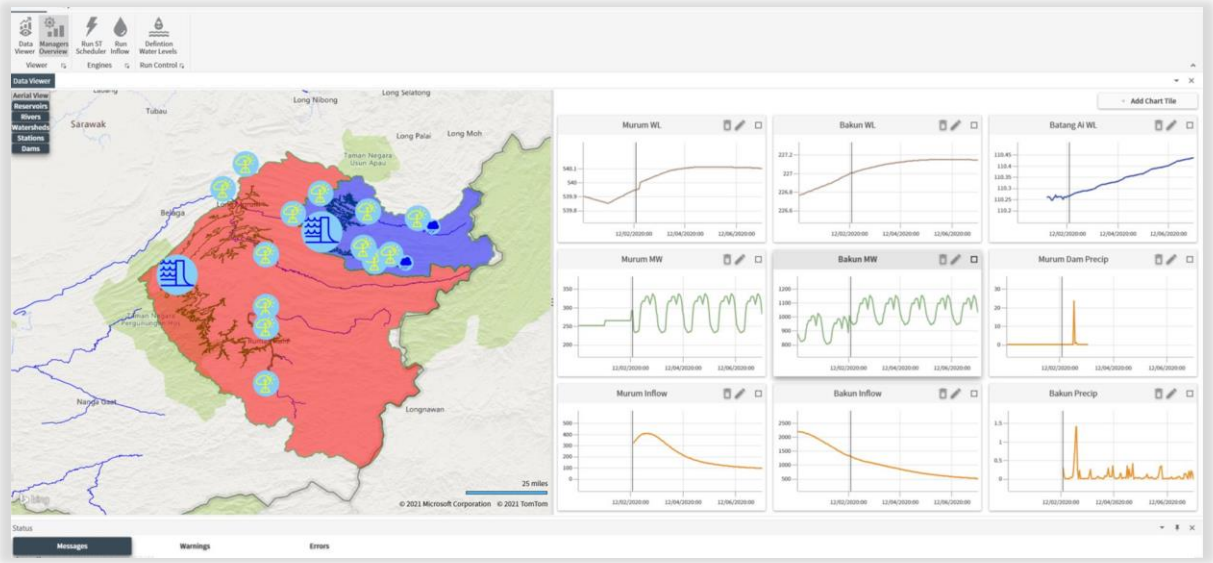
## Objective




- To provide **weather forecast**, **inflow forecast** and **dynamic dispatch management system** to deliver efficient hydro operational tool for all Hydro plants
- To establish efficient hydro operational tool for all Hydro dams ensuring **dam safety**

# DWDM - Linking the Multiple Systems

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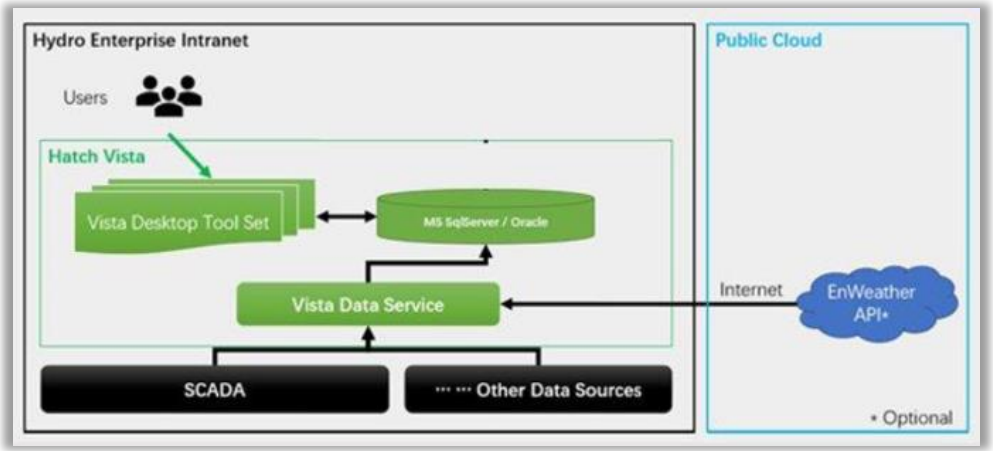
Vista DSS
Inflow
Forecasting and
Reservoir
Scheduling



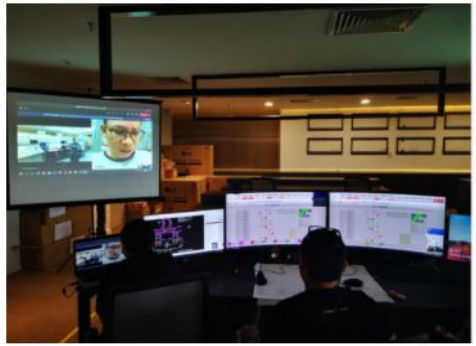

EnWeather
High- Definition
Weather Forecasts

One System for Sarawak Energy

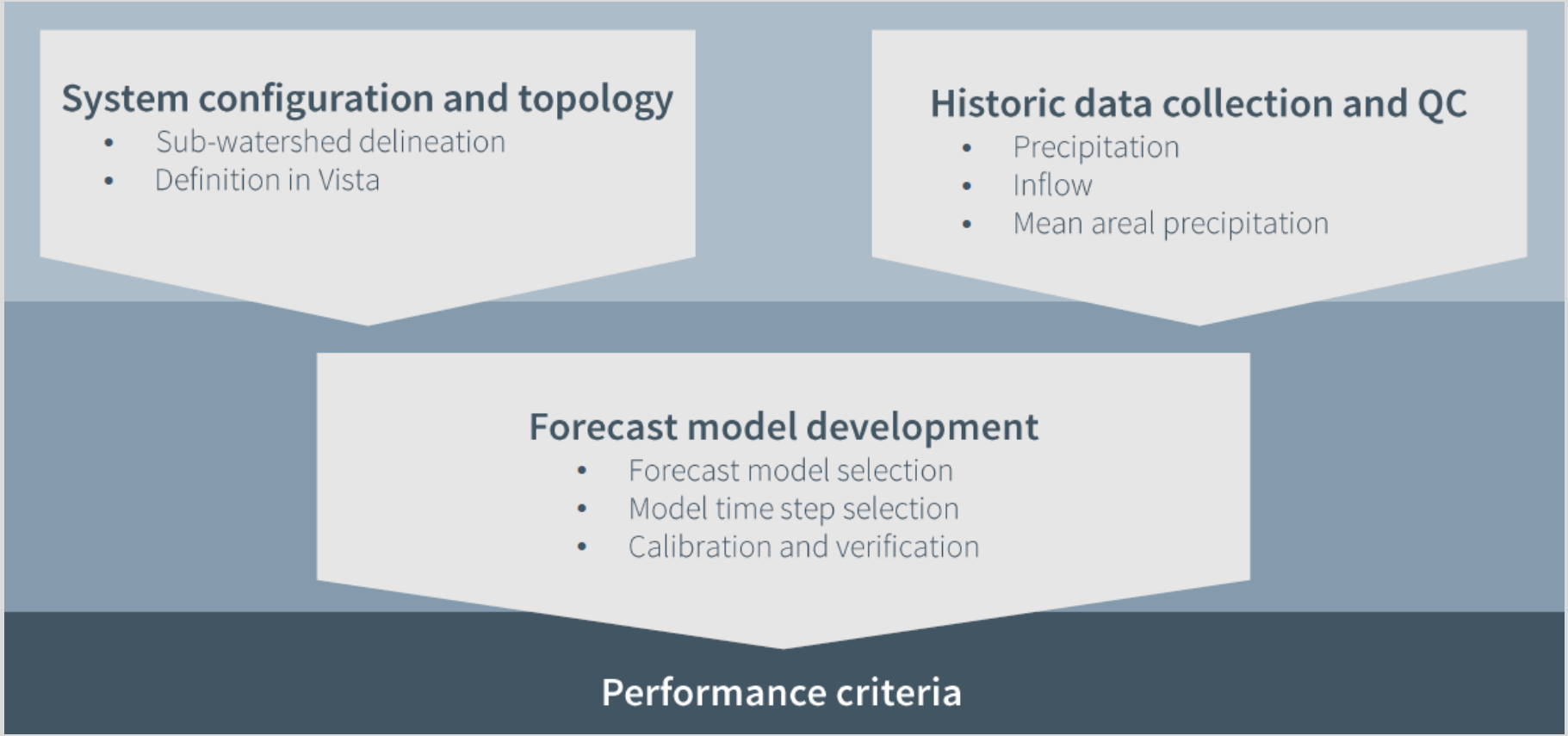
# System Capabilities

- Short & long-term forecast
  - Short term (3-day & 7-day forecast)
  - Long term (7-months)

- Reservoir management
  - Water level forecast
  - Spillway operation recommendation



# Model Steps and Implementation



# Numerical Weather Prediction (NWP) Model

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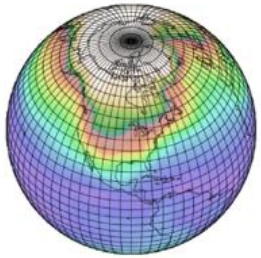
## NWP modelling introduction

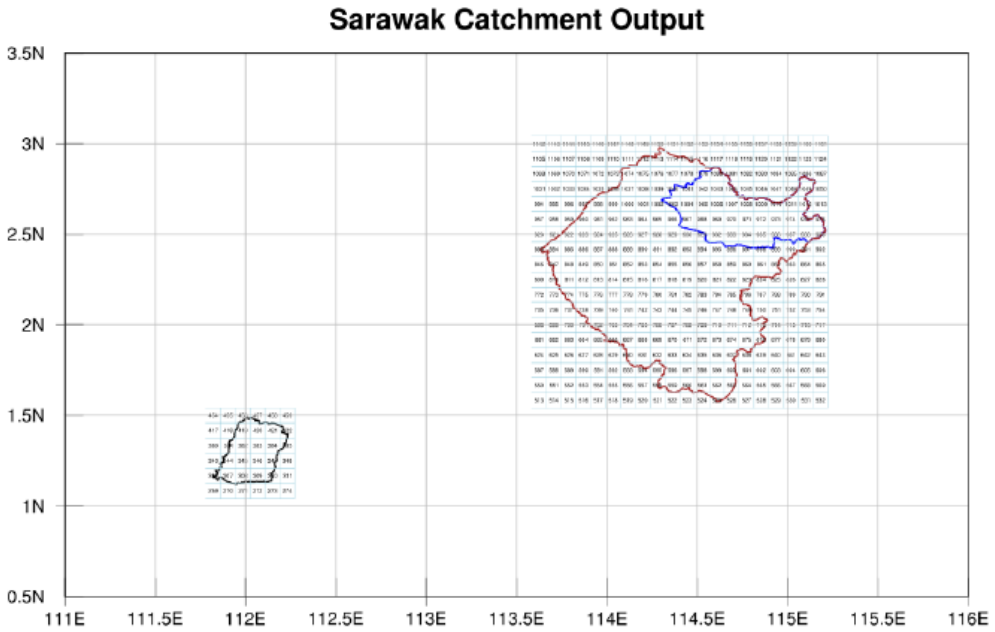


Global Model Options:

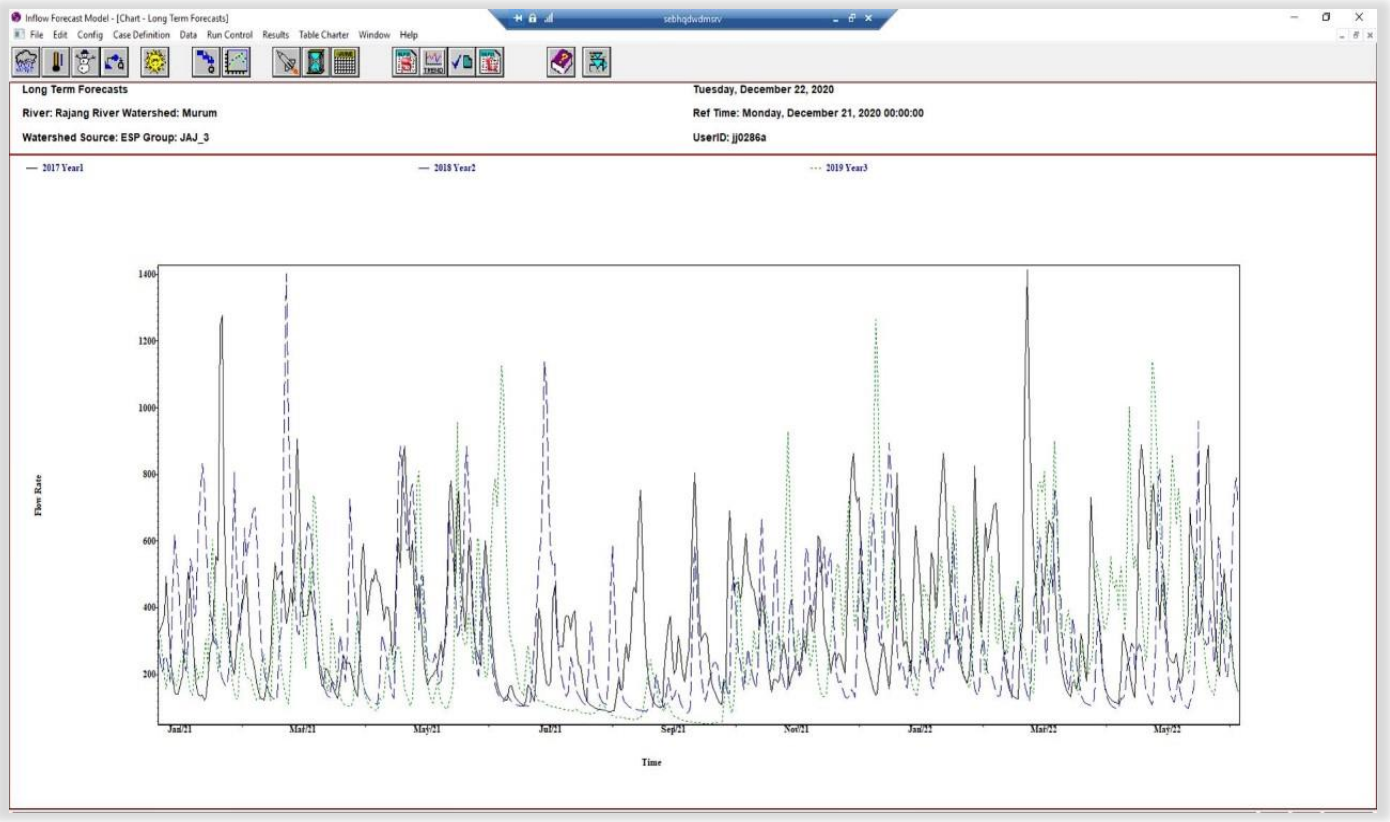
- European Centre for Medium Range Weather Forecasting (ECMWF)

Gridded Weather and Watershed Forecast

- Provided on a 9x9KM grid
- Weighted average of grid points in and around watershed boundaries



# Inflow Forecasting




- Flexible Met Data and support Regional and Gridded weather forecasts
- Short and long-term forecasting capability
- Manual or automatic functions tools

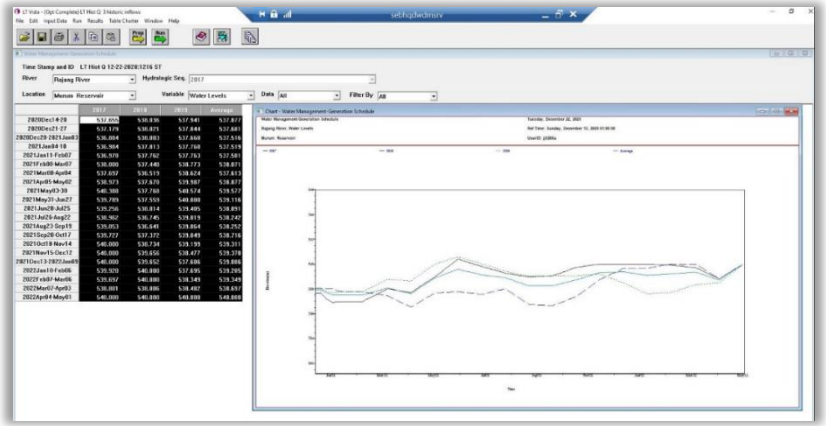
# Planning and Scheduling

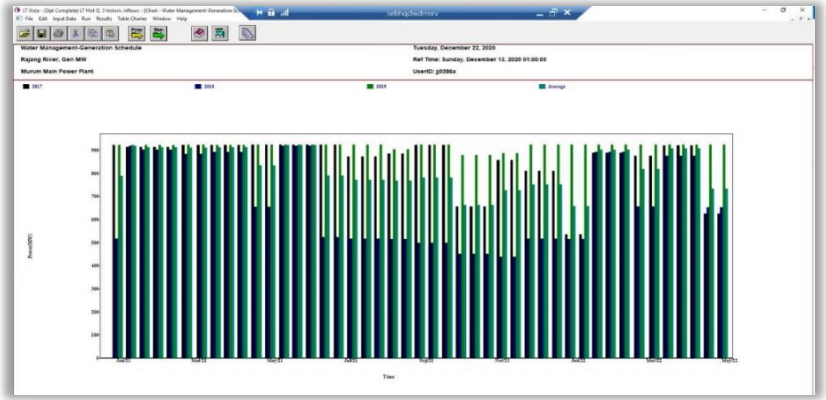
**Short Term Scheduling**

- Optimal water allocation
- Plant and unit dispatch & maintenance
- Hydro-Thermal coordination

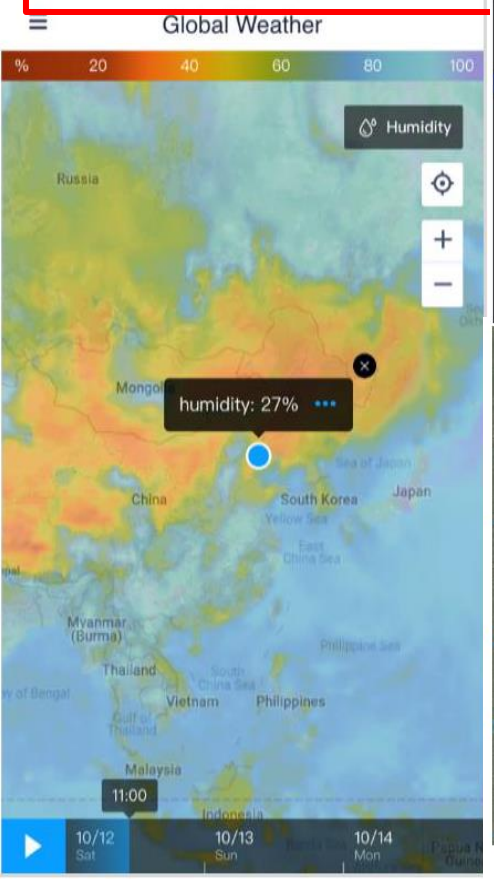
**Long Term Planning**

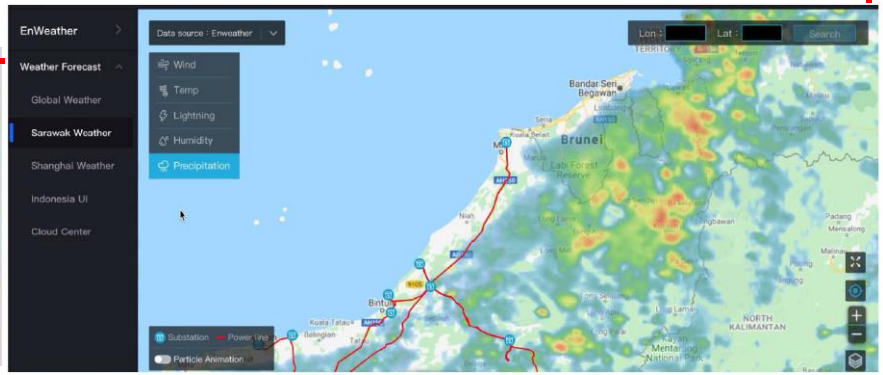
- Seasonal reservoir trajectories
- Value of water in storage
- Long-term generation and transactions

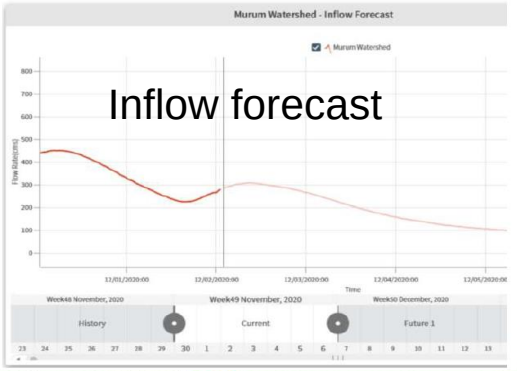


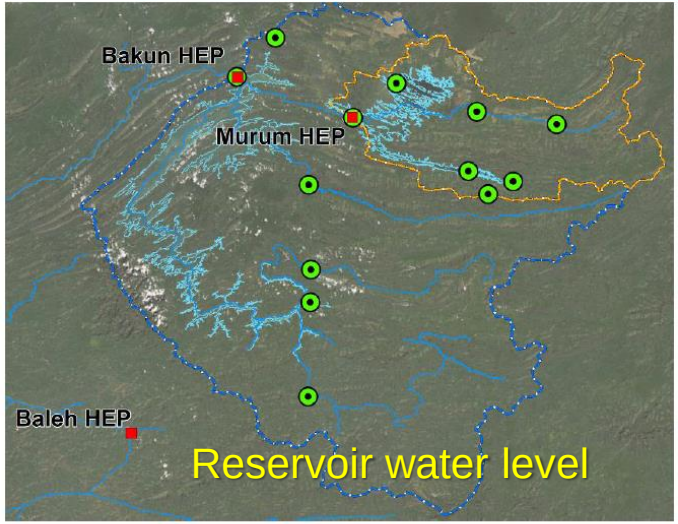


# Weather Forecast and Graphical Interface

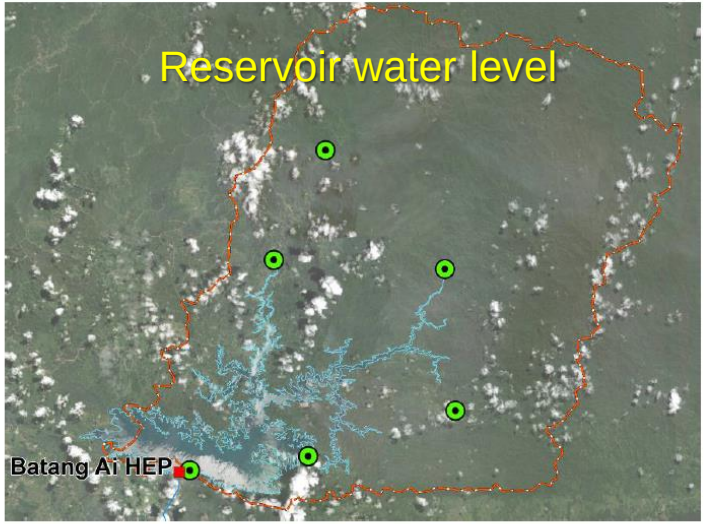


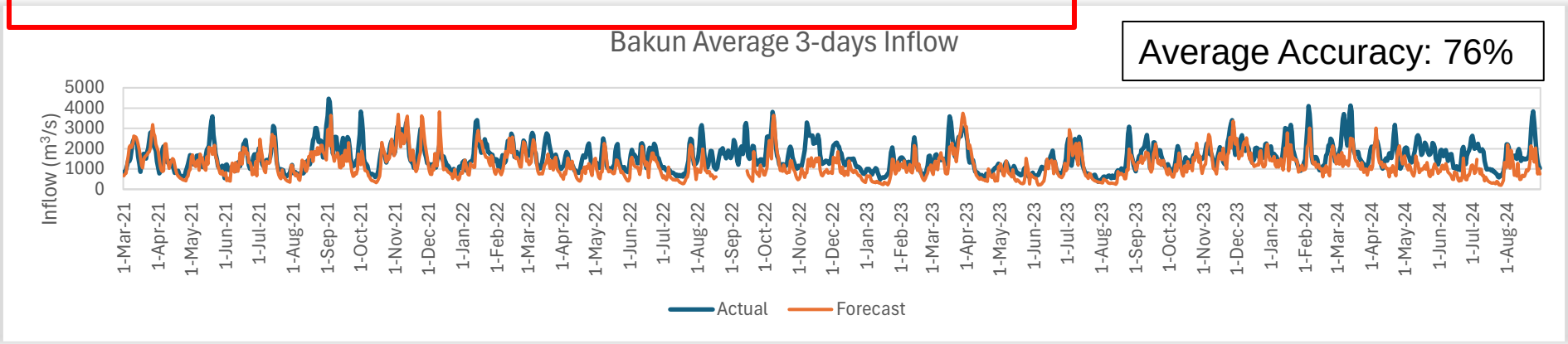



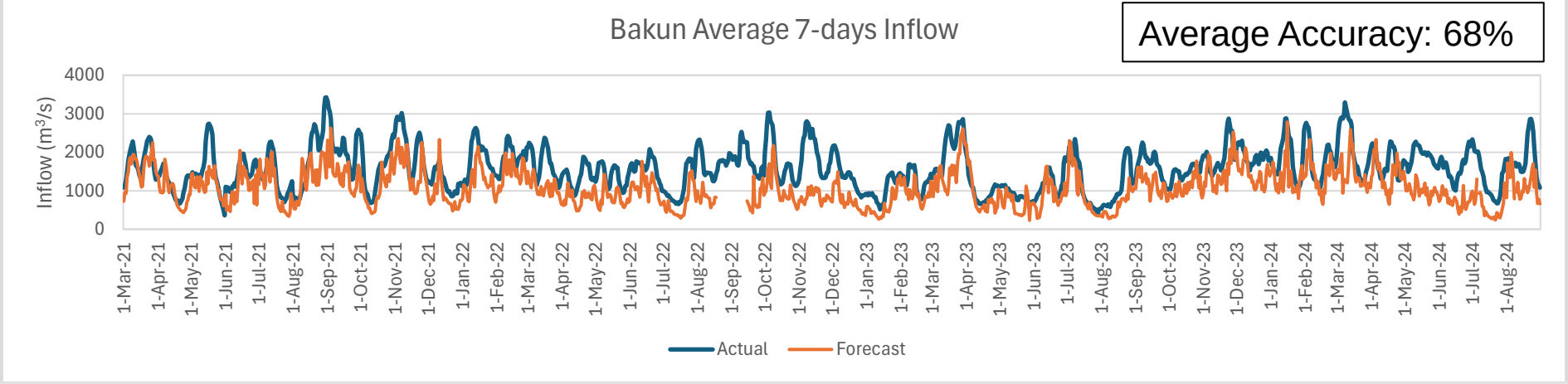

Murum and Bakun watersheds




Batang Ai watershed

# Inflow Forecast Accuracy – Bakun HEP



# Inflow Forecast Accuracy – Murum HEP

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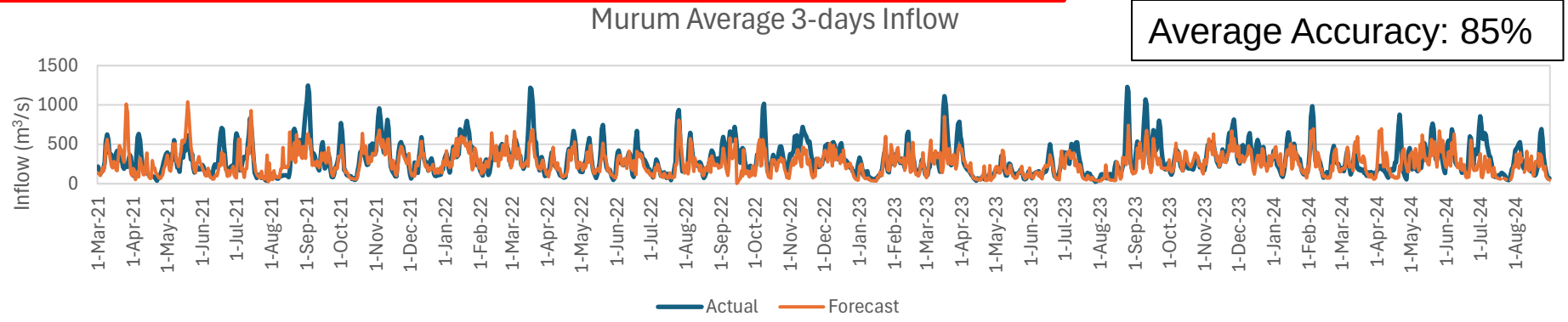
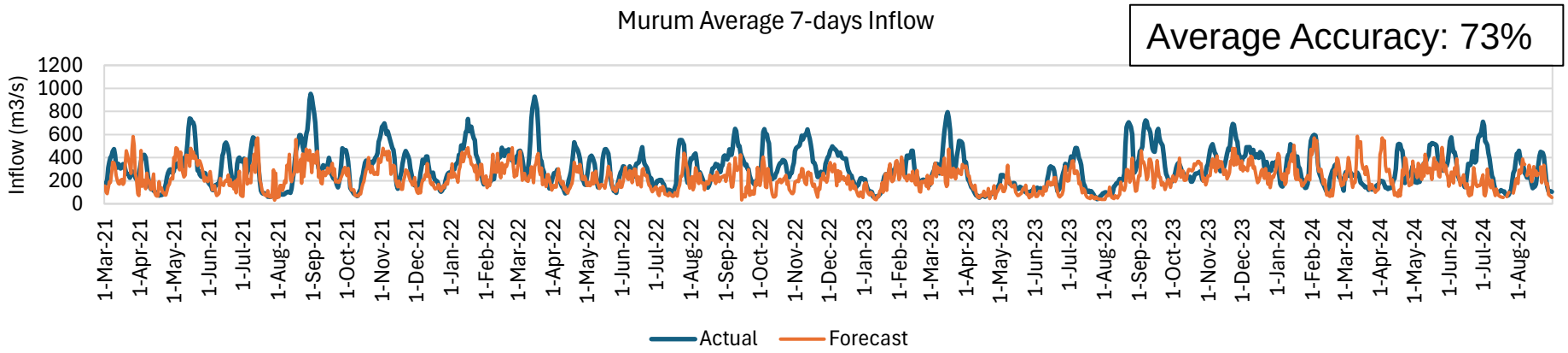
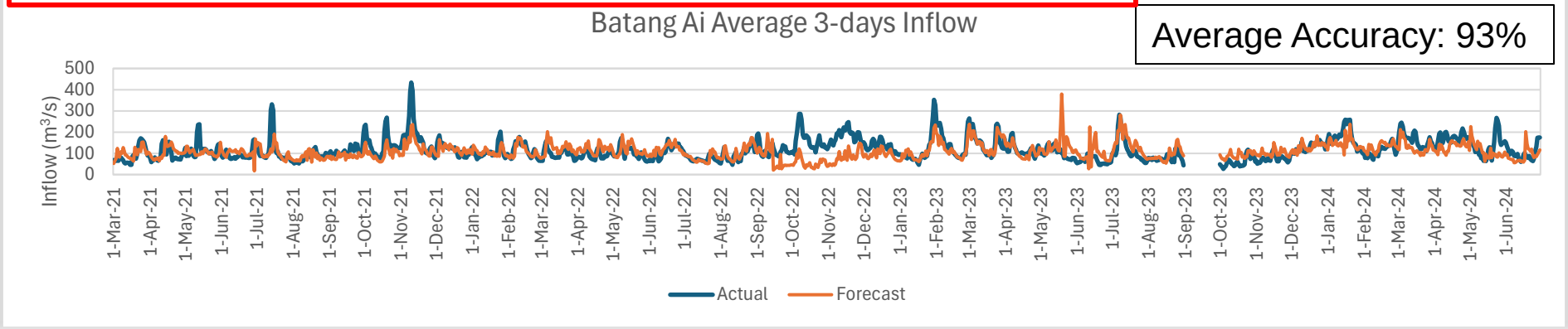
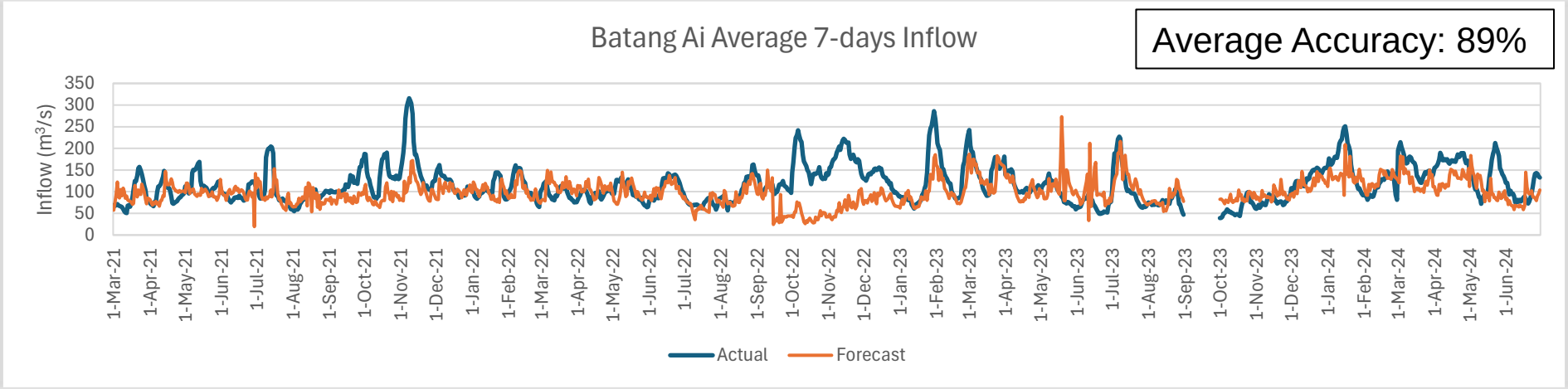


# Inflow Forecast Accuracy – Batang Ai HEP



# The Challenges for DWDM

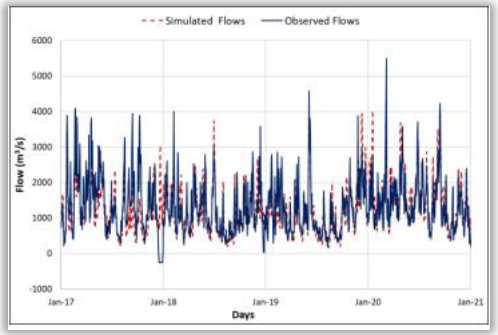
- 100% Remote Deployment
- Network Connectivity
- Capacity & Capability
- Cost Justification

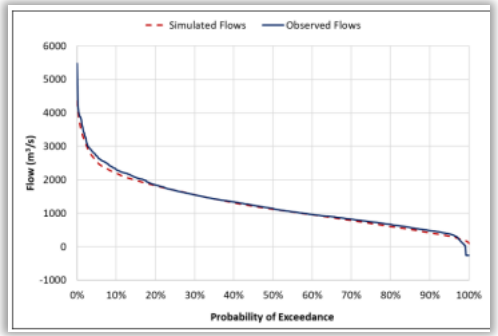
# Moving Forward

- Predictive and accurate projection of future inflows at each dam
- Reservoir operation under future climate and hydropower energy potential
- Maximise hydro generation & dispatch
- Mitigate spill/opportunity loss
- Sustainable and safe operation

# Improvement Works

- A recalibration of the inflow model with updated data is currently ongoing.
- Long-term forecast is extended to a 12-month horizon.
- The frequency of long-term forecast delivery is increased to twice a month (fortnightly) to:
  - Address the rapidly changing weather pattern, especially during extreme events such as drought and floods, and,
  - Improve the projection of hydropower generation for Sarawak's long-term dispatch planning, optimising both hydro and thermal plants within the network.



# Thank You

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