

DHI CASE STORY

# DRIVING HYDROPOWER GENERATION IN INDONESIA

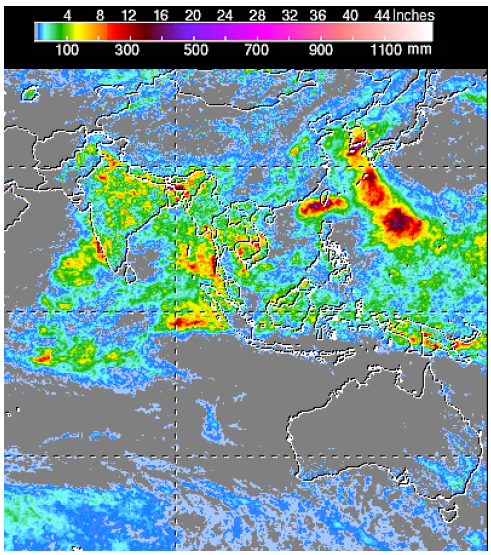
## Predicting river flow for a proposed mini-hydropower site in Sulawesi

Abundant rainfall, mountainous topography and remote communities unconnected to the national grid make Sulawesi an ideal candidate for run-of-river mini-hydropower schemes. However, their development is often hampered by a lack of reliable data with which to assess feasibility and design such schemes. Our client had identified a suitable location but needed a more detailed assessment of the river's flow regime before proceeding with the plant design and permit application. However, the lack of historical stream flow data along the river of interest made this very difficult.

We conducted an in-depth study, to better understand and quantify the river's flow regime at the proposed location. This information empowered the client to proceed with the plant design and permit application in order to obtain final approval and move forward with their project.

### MINI-HYDROPOWER GENERATION – VIABLE BUT CHALLENGING

Indonesia's potential for hydropower generation is immense. With the escalating demand for energy, various companies and government authorities are keen to harness renewable energy from the country's many rivers. This is particularly true of remote communities for which connecting to the national power grid is prohibitively expensive. Thus, local hydropower production from small power plants – known as mini-hydropower plants – is an attractive and viable option. As such, there is a growing need to conduct accurate feasibility assessments for hydropower generation at sites such as these.




*A variety of remotely-sensed data – such as the Tropical Rainfall Measuring Mission's rainfall data – was used in this study ©NASA*

### SUMMARY

**CLIENT**

PT Minaweru Resources

**CHALLENGE**

- Lack of stream flow and other relevant data, with which to assess feasibility
- Inadequate knowledge of the river's flow regime

**SOLUTION**

Hydrological modelling and detailed regression analysis to develop a comprehensive Flow Duration Curve (FDC)

**VALUE**

- Improved understanding of the river's flow regime
- Ability to conduct an informed feasibility assessment of proposed hydropower plant's potential
- Support in plant design, (particularly for low and high flow conditions)
- Facilitation of the approval process for plant setup

**LOCATION / COUNTRY**

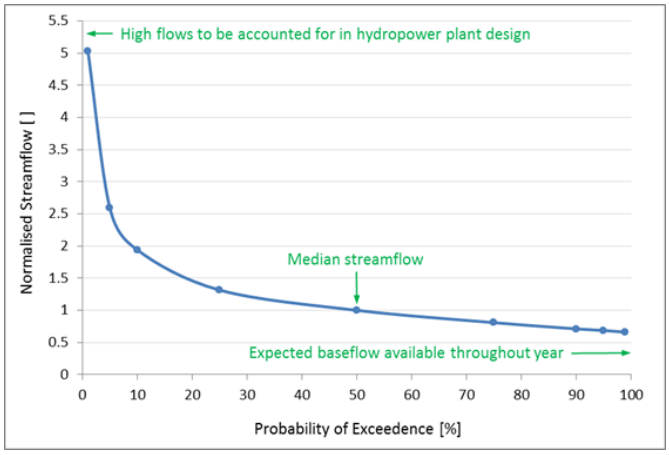
Sulawesi, Indonesia

For this project, our client wanted to set up a mini-hydropower plant at a potentially suitable site along Sulawesi river. However, a reliable feasibility assessment was needed to confirm the site's hydropower potential. It was also required to support plant design and apply for the requisite permits. Evaluating the feasibility of a given site for hydropower generation requires a comprehensive understanding of the river's flow regime at that location. It is imperative to understand both low flows (to determine the possibility of continuous power generation) and high flows (to assess possible damage to turbines). As is often the case for remote sites such as this, the lack of stream flow data was a major impediment to this study. But it was a challenge that we met successfully.

## DEVELOPING AN FDC WITH HYDROLOGICAL MODELLING AND REGIONAL ANALYSIS

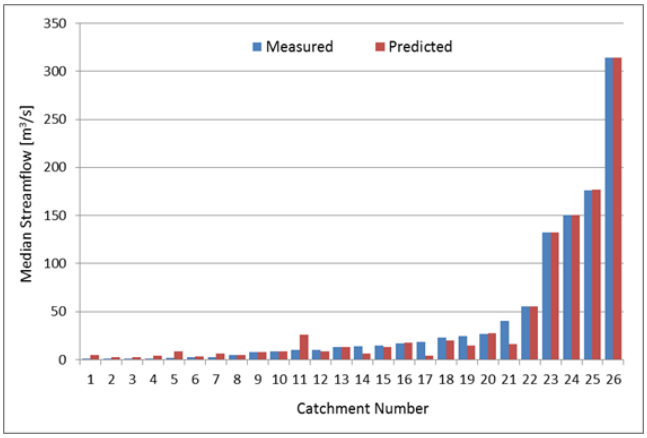
A Flow Duration Curve (FDC) is the most widely-used method to assess the hydropower potential of a stream.

It contains information on the expected base flow as well as maximum flows. FDCs graphically represent the relationship between the magnitude and frequency of stream flow records and help predict the probability of a given discharge. As such, they assist in developing the necessary safety and protection measures required in unexpected events, such as flash floods or long periods of lowflows.




*Composite FDC developed using both hydrological analysis and regional regression analysis (note that streamflow is normalised against the median, for reasons of data confidentiality)*

Currently, there is no standard method to outline the parameters required for generating an FDC. Each project site has its own unique characteristics. Thus the parameters needed to understand the river regime also varies from site to site.




*Comparison of median streamflow values measured in neighbouring river catchments and the corresponding values predicted by the regional regression analysis method*

We based our study on a dual approach – a conventional hydrological simulation of the catchment's rainfall-runoff response, (using our MIKE 11 software package), and a detailed regression analysis of stream flow data available from other nearby catchments, (assuming hydrological similarity with the catchment of interest).

The hydrological model was calibrated as accurately as possible based on the limited available data. It was then used to generate a time series of stream flow data based on historical rainfall data. The regression analysis employed a novel approach to provide another estimation of the river's flow regime, using stream flow data from other rivers in neighbouring catchments to explore the strong dependencies between a river's flow regime, (quantified as discharge percentiles) and the characteristics of its particular catchment, (such as area, soil type, land use, orographic rainfall parameters, remotely-sensed rainfall derivatives, slopes, and so on).

## WE USE OUR EXPERTISE TO EMPOWER OUR CLIENT

Despite significant data scarcity, we were able to generate a reliable and useful FDC for our client, based on a combination of traditional hydrological modelling and a novel approach correlating regional stream flow data against catchment and meteorological parameters. The client is equipped with a more comprehensive understanding of the river's flow regime and has greaeter confidence in the site's potential for sustainable mini-hydropower production. Using our FDC, they can now proceed with the plant design and permit application.

## CLIENT TESTIMONIAL

> *"We turned to DHI as we knew they had the expertise to be able to analyse adjacent catchments and make informed analysis of the dynamics of water flow in our project catchment. DHI characterised the catchment and developed the flow curve. With the results of DHI's analysis we were able to size our proposed plant and proceed with our development applications and feasibility study" Michael de Vink—Director—PT Minaweru Resources*

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