



## DHI CASE STORY

# REAL-TIME INFLOW FORECAST SYSTEM FOR HYDROPOWER GENERATION

Improved operation during critical events and better planning of future production

Heavy rainfall and melting snow in the upper Maule Basin in the Andes Mountains can cause flooding in areas downstream of Colbún S.A.'s major reservoir. To help authorities deal with such critical events, we developed and implemented a real-time inflow forecast system. The system enabled Colbún S.A. to plan energy generation effectively and safely operate during forecasted flood events. This helps them to optimise the reservoir's operation in addition to preventing property damage and loss of life.

## PREVENTING DOWNSTREAM FLOODING AND FORECASTING SNOW WATER AVAILABILITY

Colbún S.A. is a utility company in Chile involved in power generation. Countrywide, it manages a total energy generating capacity of 3,279 MW. One of the larger Colbún-operated plants is a 474 MW hydropower station in the Upper Maule Basin in central Chile. This hydropower station shares water resources with upstream power stations as well as with extensive downstream irrigation schemes.

Occasionally, heavy rainfall and melting snow from the Andes Mountains generates floods in the upstream basins and high inflows into Colbún S.A.'s reservoir. When the reservoir is full, such high inflows may require the release of large quantities of water, which can cause flooding in downstream areas if precautions are not taken.



Upstream view of the Maule River from Maule en Los Baños hydrometric stations in July 2010 (winter in the Southern Hemisphere)

## SUMMARY

### CLIENT

Colbún S.A.

### CHALLENGE

- Safely and economically operating the reservoir during flood events and avoiding liability for downstream damage
- Difficulty planning power production
- Insufficient up-to-date knowledge of heavy rainfall and melting snow in the upstream mountain catchments, both of which affect reservoir inflow
- Insufficient mid-term knowledge of water availability for optimal planning of hydropower generation

### SOLUTION

Real-time inflow forecast system for the main and upstream reservoirs in the Maule Basin

### VALUE

- Effective planning of reservoir operations to accommodate forecasted flood events
- Ability to inform local authorities to help them take action and warn downstream populations of flood threats
- Enables Colbún S.A. to avoid liability for downstream damage
- Provides important mid-term information on snow water availability to enable sound economic decisions for power generation planning
- Saves money, water and time as well as prevents property damage and loss of lives

### LOCATION / COUNTRY

Upper Maule Basin, Chile

Limited real-time data on the Maule Basin discharge presented a major obstacle to taking such precautions.

Colbún S.A. relies on snowmelt from October to March to generate power. As such, snow water availability forecasts are extremely important for deciding the most economical mix of energy from its various production plants. The Colbún hydropower plant in the Maule Basin makes an important contribution to the interconnected electricity network of Chile (SIC). The optimisation of the water resources in this basin directly impacts the cost of electricity in the network as a whole.

### REAL-TIME SHORT- AND LONG-TERM INFLOW FORECAST SYSTEM

Colbún S.A. needed to better prepare for critical flood events as well as get timely information on snow accumulation and melting. To help them, we developed a real-time inflow forecast system for the upper Maule Basin.

Utilising our expertise in the hydrology of the Andes Mountains, we used our MIKE BASIN and MIKE 11 NAM software to simulate the hydrology and hydraulics and flow regulations in the basin. We integrated these models into an automatic real-time forecasting system based on our MIKE Powered by DHI platform.



*Flow gauging station on the Upper Maule River (Chile)*

The flexible system produces automatic updated forecasts every hour. It combines available online quantitative weather forecasts and historical data with real time information on precipitation, flows, reservoir levels and snow water contents from the basin to produce:

- near future forecasted inflows to Colbún's reservoir (hourly resolution) for the upcoming five days
- probable inflows to Colbún's reservoir for the coming three to

12 months (daily resolution)

- upstream reservoir contents and releases
- precipitation in flow contributions from various sub-basins
- water volumes stored as snow in various parts of the basin
- simulation of future snow accumulation
- quantity and temporal variation of the flows generated when the snow melts

The output will be available to all relevant people in Colbún S.A. via their Intranet – both at the plant and at their headquarters.

Based on the short-term forecasts, Colbún S.A. can adequately plan reservoir operations. For example, they can choose to increase releases before a predicted flood event, enabling them to accommodate a larger portion of the forecasted flood in the reservoir. This permits them to keep releases at rates that will not damage infrastructure or harm people located downstream. The system also allows Colbún S.A. to inform the responsible authorities in time for them to issue appropriate flood warnings or initiate mitigation actions.

Inflow and incoming volume from snowmelt during the coming months are essential parameters for strategic seasonal production planning. By supplying the expected variation in inflows and reservoir volume for the coming year, the system helps optimise the electrical power system – minimising the costs of supplied energy.

The system has been installed successfully and is being tested on Colbún's servers. Colbún has allocated and trained staff in the operation, maintenance and expansion of the system. They are currently working on further improving the results.

### BRINGING OUR EXPERTISE TO THE TABLE

The development of the system – which has been transferred and installed in Colbún S.A.'s computer server in Santiago, Chile – was possible because we:

- possess the technology and knowledge to offer a unique, real-time inflow forecast solution to the hydropower sector
- have experience in mountain hydrology and snow modelling in general, particularly in the Andes (where data scarcity is a big challenge)
- can transfer the technology and know-how to our client and make them self-reliant in operating the system

Contact: [info@dhigroup.com](mailto:info@dhigroup.com)

For more information visit: [www.dhigroup.com](http://www.dhigroup.com)