Contact
Sustainable Hydropower Website
C/- Hydro Tasmania
4 Elizabeth St
Hobart TAS 7000
AUSTRALIA

sustainable.hydropower@hydro.com.au

Resource use

Hydropower, due to its potentially non-consumptive use of water, can provide for the sustainable use of a natural resource. Forecasting of inflows, and simulation and optimisation models, can ensure the best generation value from available water resources.

Issue

As a renewable energy source, hydropower generation does not lead to long-term resource depletion or pollution. The efficient design, operation and management of hydropower schemes can result in stable long-term power generation and provide for the non-consumptive use of water, thereby allowing for the highly efficient use of a natural resource. Available water resources can be used sub-optimally in the absence of inflow forecasting, or simulation models to assist generation and maintenance scheduling.

Management

Fundamental to the economically sustainable use of water is the design of a hydropower scheme to provide for the efficient use of the water resource. Modern turbine technology will allow up to 95% of the energy available from water to be converted into electricity. Efficiency of conversion depends on scale and the use of best available technology including control systems.

To optimise the use of water through hydro schemes, it is necessary to understand the variability of the inflows and the value of the water in the scheme. Such value should be based on machine efficiencies, storage characteristics of the system, inflow variability, maintenance requirements and the ability to pass the water through any station(s) downstream. Variability of inflows is system-specific, and can be over timeframes varying anywhere from days to decades. Inflow or rainfall forecast/prediction models should be developed to assist in the minimisation of spill, maintaining production levels and planning maintenance most effectively.

Optimising the value of water from hydro schemes needs to examine both the real time situation and the medium- to long-term horizon. For all schemes, but particularly run-of-river schemes, the focus is generally on real time to weeks ahead; thus an understanding of potential inflows, likelihood of spill and in times of low flow likelihood of running out of water is needed. For larger storage schemes with monthly to annual carry-over storage, long-term simulation/optimisation is also essential.

Simulation and optimisation models ideally allow an understanding of the interaction of inflows, storage and asset maintenance. Such models allow strategic maintenance scheduling, and can also be used to evaluate opportunities to improve efficiency in the system(s). In systems where hydro interacts with other generation sources (e.g. thermal, nuclear, wind), the use of such models can minimise the use of other more costly generation and can be used to better manage and operate the other generation sources in the system. In cases where other generation sources are owned by independent operators, it is still important to reflect this interaction in the models to ensure optimisation of the hydro operations. If the hydro plant operates in an electricity market, then a view of market price in to the future is needed to maximise the value from the hydro system.

With the current climate change outlook it is advantageous to consider future impacts of climate change and also determine mitigation strategies if negative impacts are predicted.