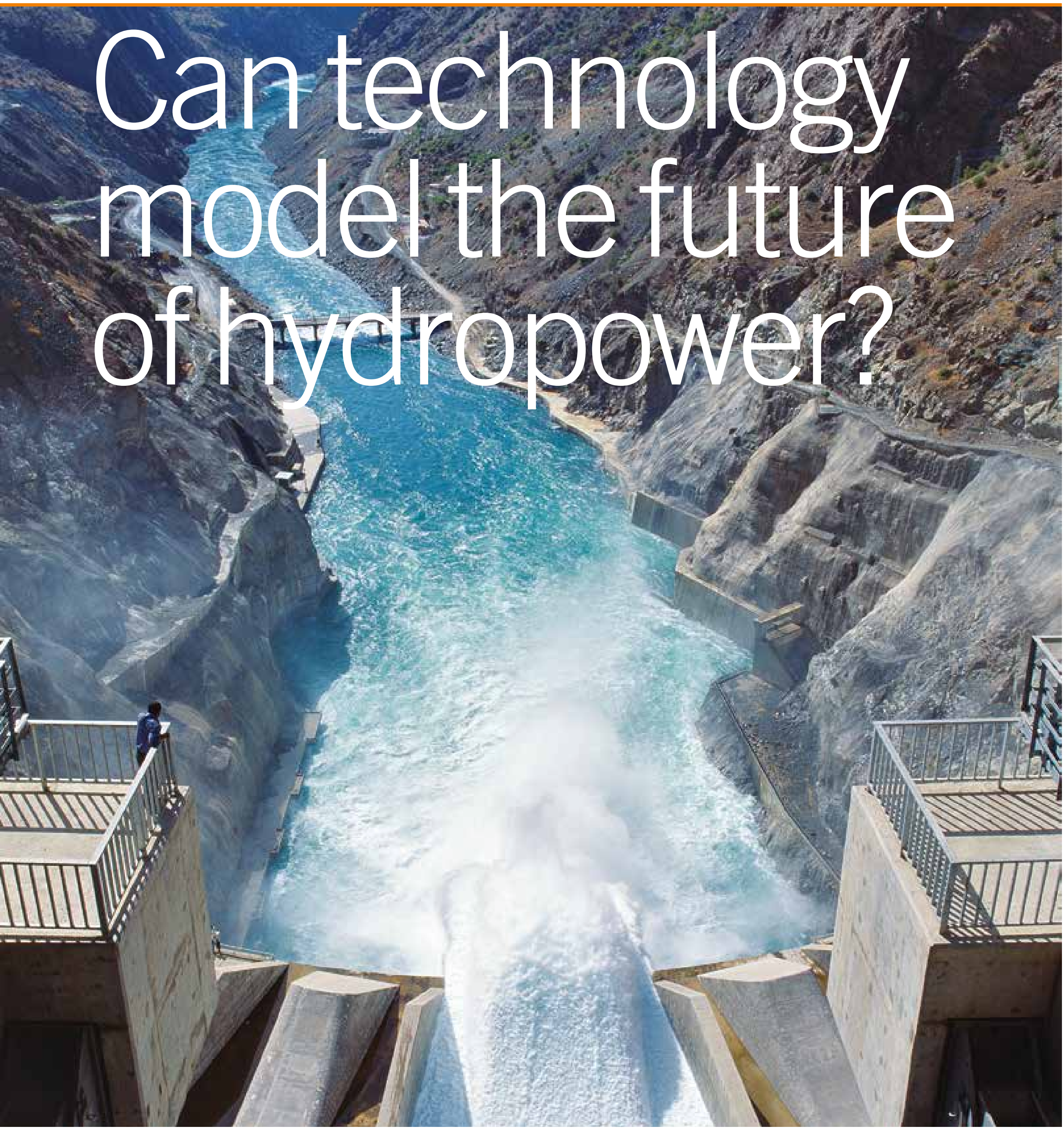
PÖYRY POINT OF VIEW - MARCH 2015



Can technology model the future of hydropower?

Integrated modelling technology – minimising risk and maximising return on hydropower investment

Nature's increasing unpredictability presents unique challenges in generating renewable energy, profitably. Technological innovation in hydropower is breaking new ground in responding to these challenges.

1. HYDROPOWER'S KEY CHALLENGE – NATURE'S UNPREDICTABILITY

The International Energy Agency predicts hydropower capacity doubling to 2000 GW by 2050 and, whilst the opportunities are great, development of hydropower undoubtedly poses complex challenges and risks.

The effects of climate change are already evident in most parts of the world and climate models are predicting even more pronounced changes for the remainder of the 21st century. With climate change affecting all parts of the water cycle, it must be a fundamental consideration in modern water resources planning, and a vital component of hydropower design.

Unlike thermal and nuclear power plants, where the revenues are mainly determined by the cost of fuel, the revenues in hydropower very much depend upon water flow rates, which are subject to significant short and long term fluctuations.

Many hydropower projects struggle to quantify estimates and changes in climatic conditions and as a result suffer from either over or under design due to wrong hydrological estimates. These miscalculations can result in the difference between the ultimate success or failure of a hydropower project. What can initially seem like a sound project can turn to disaster if the predicted water supply is not maintained.

2. ADDRESSING THESE CHALLENGES USING INTEGRATED MODELLING TECHNOLOGY – MINIMISING RISK AND MAXIMISING RETURN ON HYDROPOWER INVESTMENT

Consultancies today are quantifying climate change and its impact on water resources to optimise hydropower plant design, minimise ecological impact and maximise economic benefits.

This work has transformed how government and financing agencies make investment decisions, manage risks and plan and design hydropower projects. Estimation of future trends in water availability has allowed for more sustainable development of hydropower and water resources projects.

2.1 INTEGRATED MODELLING FOR THE DESIGN PHASE

During the early phase of hydropower development, managing risk is key. Early decisions impact on longer term profitability. Companies are realising that by creating an integrated modelling approach that combines climate projections with hydrological and economic models, more accurate estimates of long term energy generation and revenues are possible; which in turn helps to further optimise hydropower plant design.

CASE STUDY 1: THE UPPER DANUBE, EUROPE

The Upper Danube in Central Europe is used extensively for hydropower generation. Pöyry set up a precipitation runoff model for a catchment area of 100,000 km2. Historic discharge assessments focused on the past 200 years, and future runoff conditions were estimated for 30 climate scenarios up to the year 2100. The study found that pronounced changes in runoff conditions are to be expected in the 21st century, with positive and negative effects on hydropower generation in different sub catchments of the basin.

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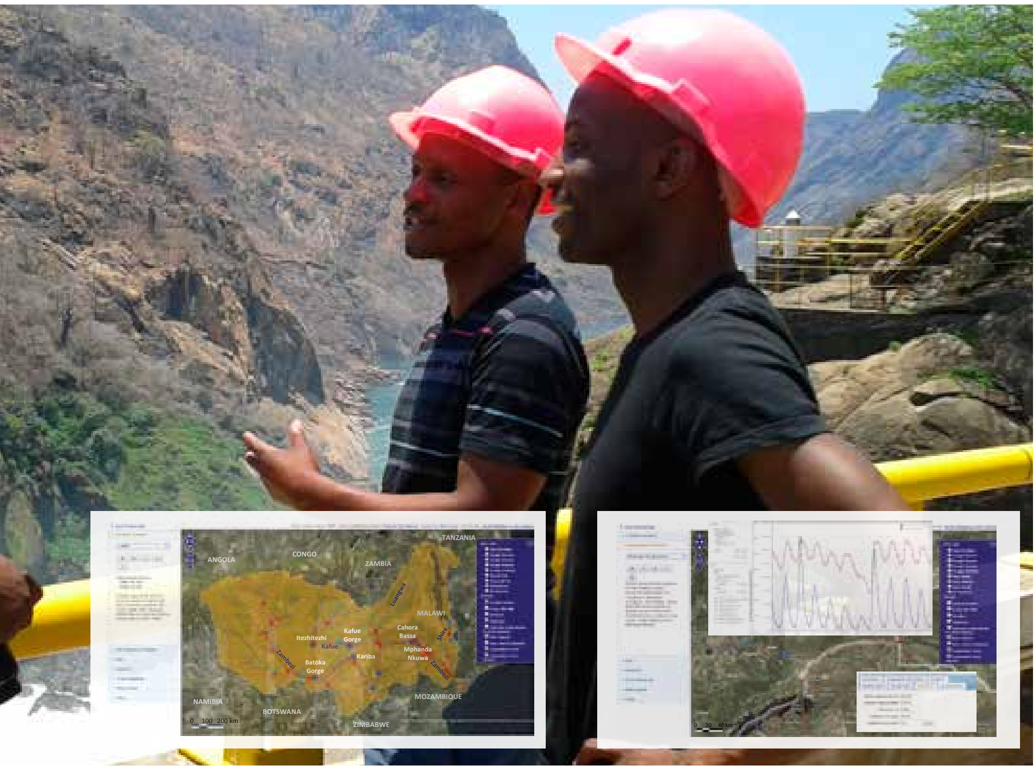

2.2 INTEGRATED MODELLING FOR SEASONAL PLANNING

Currently, the focus is on longer term (> 20 year) hydrological and climate projections, but also seasonal (1-12 month) forecasts are increasing and help better serve the hydropower industry in its decision making, and to help companies maximise their return on investment.

These forecasts - which incorporate an integrated modelling approach - have a range of applications including optimisation of seasonal reservoir operation and reduced risks in energy trading.

2.3 INTEGRATED MODELLING FOR WEEKLY AND DAILY PLANNING

Industry players are also running models for short and medium range (1-10 day) forecasting of inflow, generation and revenues. Such forecasting tools are not only essential for daily and weekly planning and optimisation in hydropower operations, but also for flood warning systems.

CASE STUDY 2: ZAMBEZI RIVER BASIN, AFRICA

For the Zambezi River Basin in South-East Africa, Pöyry developed an online Decision Support System (DSS) to enable the assessment of climate change scenarios and water resources development expected for the 21st century. The DSS simulations showed that climate change and proposed large-scale irrigation projects will have significant effect on the flow regime, especially in the lower part of the basin. Using the DSS regional water resources, planning and development can be optimised with the objective of building a climate resilient system, helping to secure water availability and hydropower generation in the forthcoming decades.

CASE STUDY 3: MEKONG RIVER BASIN, SOUTH EAST ASIA

In the Mekong River Basin in South East Asia, Pöyry is developing a forecasting model which shall be used to provide early flood warnings for some major hydropower sites that are currently under construction. The model will improve flood preparedness during the construction phase and can later be integrated in the systems used for plant operation.

3. SUMMARY

"Through its work with over 100,000 MW of hydropower capacity Pöyry has been able to tailor better solutions which are underpinned by expertise, deep international insight, and a broad reference base. Not only are Pöyry's 300 global hydropower experts able to provide insight and counsel into designing and engineering hydropower projects, but they add client value to projects by combining these classic engineering skills with specific Pöyry know-how." said Didier Mallieu, Head of Hydropower and Renewable Energy at Pöyry

This overview has put forward the case for balanced sustainability – pushing the envelope to propose solutions that offer the best possible path forward, improve resource efficiency and improve return on investment.

With that mission at the forefront of everything it does - and through this innovative integrated modelling approach - Pöyry has been able to help significantly reduce the climate change challenge by minimising risk and maximising return on investment for hydropower projects. Pöyry is engineering better solutions for its customers, providing them with the exact services they need to decide, realise and preserve their investments and commitments in hydropower.

PÖYRY
Engineering balanced sustainability™

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About the Pöyry Point of View

Staying on top of your game means keeping up with the latest thinking, trends and developments. We know that this can sometimes be tough as the pace of change continues...

At Pöyry, we encourage our global network of experts to actively contribute to the debate - generating fresh insight and challenging the status quo. The Pöyry Point of View is our practical, accessible and issues-based approach to sharing our latest thinking.

We invite you to take a look – please let us know your thoughts.

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Pöyry is an international consulting and engineering company. We serve clients globally across the energy and industrial sectors and provide local services in our core markets. We deliver management consulting and engineering services, underpinned by strong project implementation capability and expertise. Our focus sectors are power generation, transmission & distribution, forest industry, chemicals & biorefining, mining & metals, transportation and water. Pöyry has an extensive local office network employing about 6,000 experts.

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