



DHI CASE STORY

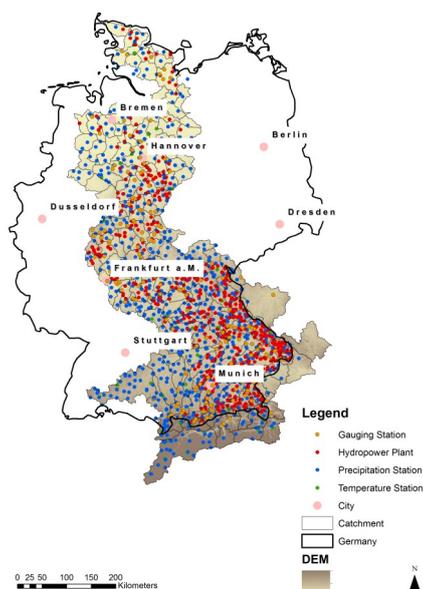
HYDROPOWER FORECASTS GOING PUBLIC

Predicting and trading renewable energies

PREDICTABLE HYDROPOWER PRODUCTION FOR A WELL-UTILISED GRID

Renewable energies are a cornerstone of sustainable development. Yet, their utilisation in the electrical power grid can be challenging. Most renewables depend a lot on environmental conditions, such as wind or river runoff. As a result, their power production is fluctuating and their feed-in into the power grid is difficult to calculate.

This problem needs to be addressed, as the contribution of renewables to the grid is constantly on the rise. According to the German law, for example, energy produced from renewable sources has to be prioritised over fossil fuels in the power grid. An energy forecast - providing information on how much energy will be produced in a certain facility within the next days - can supply the relevant data to optimise the marketing of renewable energies and improve their system integration, while ensuring that the power grid is fully utilised.



Catchment area for the control area of TenneT TSO GmbH (concordant with the project area), with all hydro power stations with a nominal power of less than 5 MW (red dots), meteorological stations (yellow and blue dots) and the used gauging stations (blue dots).

FROM RAIN TO DISCHARGE: THE COUPLED HYDROLOGICAL-HYDRODYNAMIC MODULE

DHI developed a power forecast model for hydropower production for the German transmission network operator TenneT TSO GmbH. The forecast comprises hydropower production from numerous German rivers covering an area of almost 200,000 km². It is separated in 170 subcatchments with an average size of 500 to 1,000 km².

The model is based on a coupled hydrodynamic and rainfall-runoff model (a lumped 4 storage cascade model including snowmelt), which is driven by weather forecast data of over 800 rainfall stations and 400 temperature stations as well as grid based forecasts. These weather forecasts are supplied by one of the leading weather services in Europe, Meteomedia, which operates

SUMMARY

CLIENT

TenneT TSO GmbH

CHALLENGE

Knowledge on hydro power energy production during the next days

SOLUTION

A forecast model with an energy module to calculate the amount of electrical power produced by hydro power plants

VALUE

Balanced electrical power grid

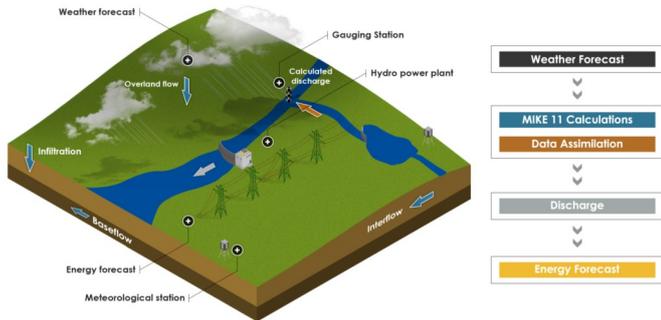
Better energy trading on the electricity stock exchange

Optimised marketing of renewable energies

LOCATION / COUNTRY

Germany

its own private weather measurement network. The model was calibrated and validated on data from two full years and 80 gauging stations.

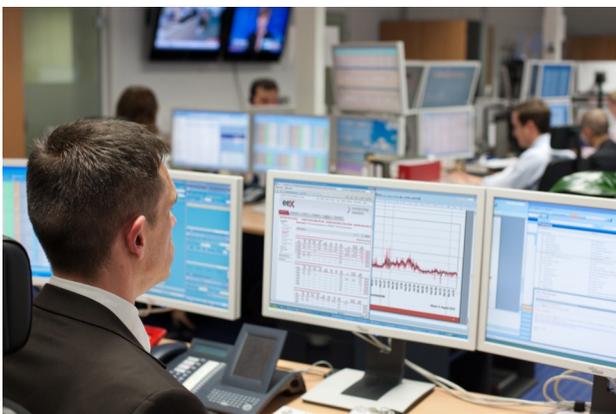


Schematic drawing of the model setup: Data from the weather forecast are processed by the coupled hydrological—hydrodynamic model (MIKE 11). Subsequently, the results from this calculation form the base of the energy model, delivering the hydropower forecast.

FROM DISCHARGE TO POWER: THE ENERGY MODULE

The results from the coupled hydrological-hydrodynamic module form the base of the energy forecast. These are calculated based on a statistical relation between discharge and energy production. The calibration and validation of the energy module is concordant with that of the hydrological-hydrodynamic module.

Prior to the forecasts, the model was tested in hindcast to achieve a daily prognosis. With this single day prognosis it was possible to analyse the model’s validity under forecast conditions.



Energy trading—such as here at the EEX in Leipzig, Germany - requires detailed and reliable information on the expected production from renewable energies. (© Christoph Busse)

CLIENT TESTIMONIAL

“ The unique run-of-river hydro power forecast allows us to optimally market fluctuating energy production from run-of-river power plants. Thereby we are able to significantly reduce expenses for balance energy resulting from deviations from the forecast.
 Christian Schulz—TenneT TSO GmbH

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 For more information visit: www.dhigroup.com

RELIABLE FORECASTS FOR RELIABLE POWER PRODUCTION

TenneT TSO GmbH now receives daily hydropower forecasts for the next 72 hours for the whole project area. The resolution of the forecasts is 15 minutes.

The system was implemented in 2011 and has since proven its reliability. Moreover, it is constantly updated with current measurements of precipitation, temperature, discharge and – above all - electricity production, to ensure a proper calibration.

MARKETING ENERGY – KNOW YOUR OFFERS AND DEMANDS

Our energy forecast supplies TenneT with reliable and timely information on the expected hydropower production. Thereby, they serve to optimise the marketing of renewable energies.

Moreover, the hydropower forecast is used for energy trading at the EPEX Spotmarket. Backup power needs can be greatly reduced due to the increased knowledge on tradable renewable power. The improved marketing allows TenneT saving on costs for balance energy, which are carried by the general public through the German Renewable Energy Law (EEG). TenneT has thereby gained a significant competitive advantage for energy trading on the energy stock exchange.

ENERGY TRADING AT EPEX SPOTMARKET

EPEX Spot is a joint venture owned by German EEX AG, the leading energy exchange in Central Europe, and the French Powernext SA, based in Paris. The products traded on EPEX Spot are standard contracts for the physical delivery of electricity. It operates short-term trading in power within the German, Austrian, French and Swiss transmission system. EPEX Spotmarket can be used to satisfy short-term electricity needs as well as to sell short-term over-capacities.