Press Release

Machine Learning Processes enhance Reliability of Wind Power Projects

Karlsruhe/Stuttgart, 28/11/2013. In order to establish whether a particular site is suitable for a wind power project or not, investors, project engineers and system operators need to obtain an assessment. In so doing they must ensure that they take into account any uncertainties relating to meteorology and technology – something which will, in turn, have a direct effect on the funding of the project by the participating banks. The Karlsruhe weather service provider EWC is exploring new ways to minimise risks of this nature. In collaboration with the Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (Centre for Solar Energy and Hydrogen Research Baden-Württemberg, ZSW), an innovative method for obtaining long term correction of wind measurements (MCP) for wind power locations has been developed which significantly reduces the uncertainties contingent on weather and technology by comparison to the traditional processes.

Based on deep neural networks, this collaborative project on the part of the two partners from Southern Germany enables non-linear corrections to the long time series in order to improve correlation, that is, temporal concurrence with the measurements. The result is based on actual measured values on site and provides an hourly wind time series spanning a period of 34 years for the projected wind turbine generator and/or measurement site.

Conducting a detailed evaluation of the mechanical learning process, a clear superiority by comparison with traditional methods emerges.

Thus the frequency distribution of the wind speed as well as the correlation between measurement and long term data is optimised. In all instances under consideration, the method demonstrates significantly fewer errors in terms of yield estimation than is, for example, the case where classic processes using linear regression or the matrix method are deployed. It emerged from the study that, by the time a measuring period of nine months has elapsed, the process put forward by the south German research scientists and service providers will attain the level of

quality achieved by the classic methods. Where lengthy observation time series are concerned, the full strength of the process is brought to bear: even at complex locations, previous errors can be reduced by up to 50% where the duration of measurement exceeds 12 months.
In addition to the duration of measurement, the availability of the long term data also plays a major role. The time series are based on MERRA re-analysis data, for which EWC calculates individual wind profiles based on 3D data using verified downscaling procedures. A further advantage: the previous month's missing re-analyses are replaced by data from other weather models. This means that it is always possible to refer to active measuring data from "yesterday".

"With the help of the self-optimising neural networks, we are able to minimise the systematic error (BIAS) and the distribution error to such an extent that we achieve an extremely high correlation of the long term time series for the wind data on an hourly basis. This means that we obtain a very high capacity wind time series loading for a new wind farm location with a yield error converted into energy which is only half the magnitude of methods used up to now" explains Jon Meis, CEO of EWC. Anton Kaifel, Team Leader Modelling and Optimisation at the ZSW, regards the fact that the advantages of deep neural networks can now be fully maximised as an endorsement of his long years of experience. "In order to achieve this result", Anton Kaifel continues, "the networks are optimised and trained for several hours on high-performance graphics cards (GPU), which calculate at a rate that is faster than a high-performance PC by a factor of around 100".

"These 34-year time series", Jon Meis goes on to explain, "enable further calculations on the financing of wind power projects to be carried out by our customers. As a result of improvements to the long term correction of measurements, the P90 of the long term wind farm yield will be increased". The P90 level indicates that there is a 90% probability that the long term mean annual energy yield will not fall below this value. "This will then be reflected in the recoverability of the project".

Interested parties can obtain the long term corrected wind time series as of immediately from EWC via info@weather-consult.com.

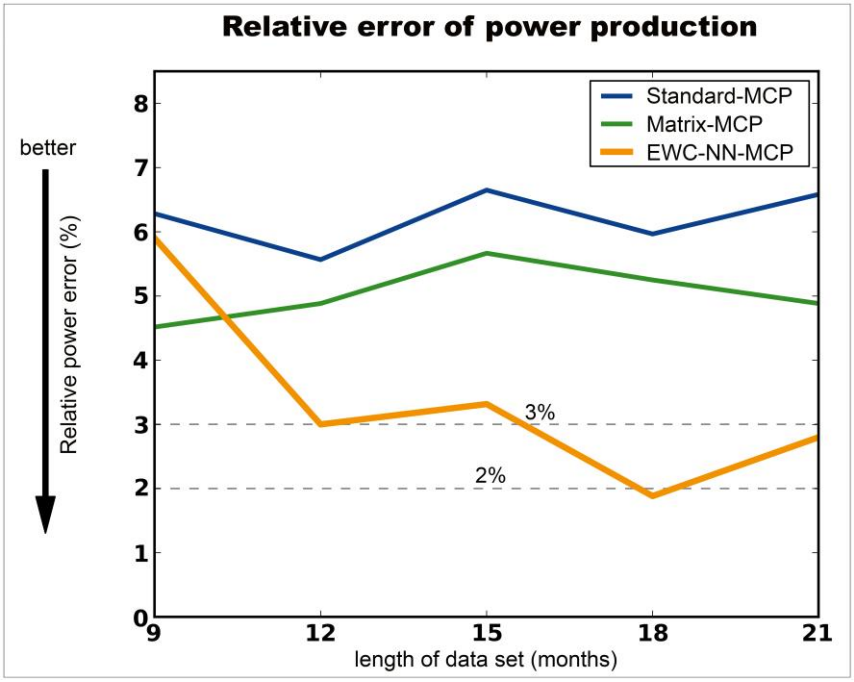

Fig.1: Relative error of power production as a function of the measurement period averaged for a mixed set of six sites. The new EWC-NN MCP reduces the error by nearly 50 % compared to the next-best algorithm.

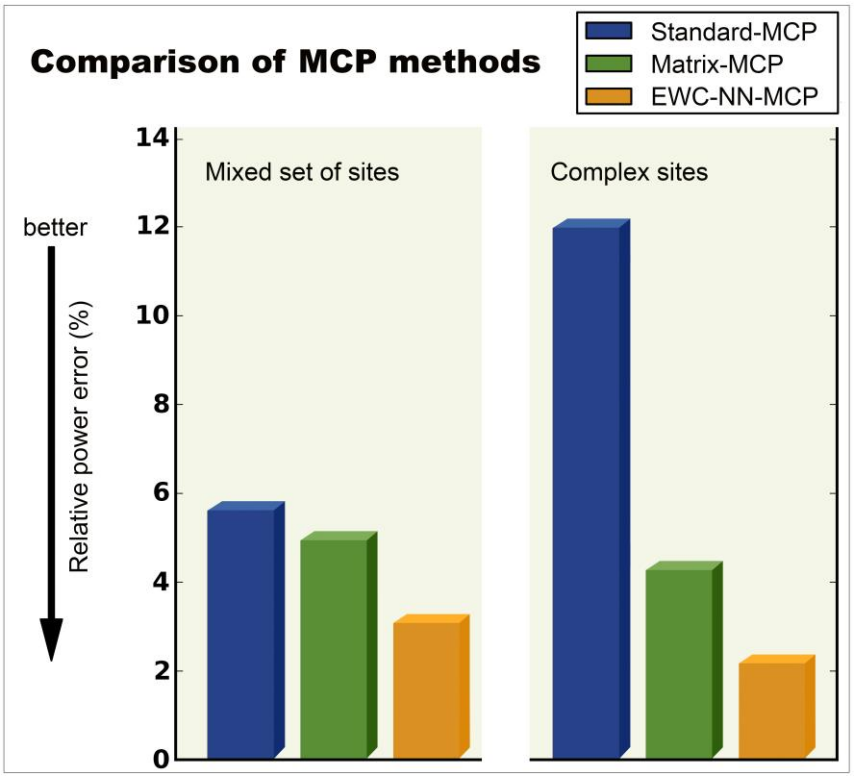

Fig.2: Relative error of power production averaged for a mixed set of six sites (left) and six complex sites (right). The new EWC-NN MCP reduces the error by nearly 50 % compared to the next-best algorithm.

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As an independent, private weather service provider, EWC supplies time- and location-specific weather data, archives, expertises and forecasts as well as lightning and climate statistics for enterprises in the insurance and energy industry, for official authorities as well as for the sports & leisure time sector. By means of the latest internet technology as well as time- and location-specific data, meteorologists prepare short- and medium-term forecasts and make statements to all weather conditions in Germany and abroad. The company was founded in 1999.

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The Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg (Centre for Solar Energy and Hydrogen Research Baden-Württemberg, ZSW) is one of the leading institutes for applied research

in the area of photovoltaics, renewable fuels, battery technology, fuel cells and energy system analysis. There are currently around 230 scientists, engineers and technicians employed at ZSW's three locations in Stuttgart, Ulm and Widderstall. In addition, there are 120 research and student assistants.