



Tracing the future: automated performance analysis

Words: Sascha Bauer, CEO at 4cast

In a world of fluctuating conditions and volatile energy markets, long-term performance analysis is becoming increasingly significant. By using advanced analytical methods, we can navigate this uncertain future more effectively. Instead of merely observing the current performance of renewable energy plants, these forecasts allow us to glimpse into the future.

Compliance with legal and regulatory requirements is crucial for the successful implementation of any project. Familiarize yourself with relevant regulations and approval procedures early on. These regulatory obligations often lead to what is termed approval related losses, which, along with technical availability and grid losses, must be considered in long-term performance assessments. In the absence of specific losses and figures, the TR6, the German standard for Windenergy yield assessments 'Technische Richtlinie 6, FGW e.V.', provides generalized values that should be used in such cases as regulations similar to those in Germany are in place.

Creating long-term performance analysis

Long-term performance analysis is an indispensable tool for evaluating the profitability of energy projects. These forecasts provide essential insights for making financing decisions and managing risks effectively. Creating this analysis relies on highly developed analytical methods. In addition to historical operational data, various environmental and site-specific factors are considered.

The forecasts are based on extensive data collection, including production histories and technological parameters of the plants. Models that combine physical and statistical methods deliver particularly accurate predictions. Advanced technologies such as machine learning and artificial intelligence analyze vast amounts of data and identify patterns that might not be apparent through traditional methods. This technology enhances the precision and reliability of performance analysis, making them invaluable tools for project planners and developers.

Role of service providers

Specialized service providers play a central role in the creation and interpretation of these forecasts. They use advanced software and cloud-based systems to deliver quick and precise results. These providers conduct comprehensive site analyses, assess available data, and create detailed renewable energy models. They consider factors such as terrain roughness, the effects of neighboring installations, and other micrometeorological factors.

For example, a service provider might use high-resolution topographical maps and flow models to determine the optimal placement of wind turbines, thereby maximizing energy production.

Understanding the limits of forecasts

Despite advanced algorithms and methods, forecasts are never certain. They provide a probabilistic assessment based on the currently available information. However, it is crucial to understand the underlying uncertainties and how they can affect the forecast. Probabilistic approaches help in

quantifying these uncertainties and providing a range of possible outcomes rather than a single deterministic result. This approach is particularly useful for managing risks and making informed decisions under uncertainty.

Practical steps when planning a plant

- **Analyze legal framework and regulations**
 - Legal Analysis: Study the legal and regulatory frameworks in the region where the project is to be carried out. For instance, in Germany, federal and state laws such as the Renewable Energy Sources Act (EEG) and the Building Code (BauGB) must be considered.
 - Requirements: Ensure you understand and can meet all relevant regulations and requirements, such as the Environmental Impact Assessment (EIA) and nature conservation requirements.
- **Understand approval procedures**
 - Processes: Understand the necessary approval procedures and ensure all required permits are obtained promptly. For example, the approval process for a wind turbine in Germany can take up to 24 months and requires the submission of extensive documentation, including environmental impact reports and noise assessments.
 - Authority Contacts: Build and maintain contacts with relevant authorities to facilitate the approval process. This may include the local building authority, nature conservation authority, and the Ministry of the Environment.
- **Commission long-term performance analysis**
 - Performance analysis: Commission precise and reliable long-term performance analysis to ensure the economic viability of the project, even in its early phases. Automated performance analysis provides a solid basis for decision-making.

For instance, a long-term performance analysis can model the annual yield production of your planned turbine at the acquired location over a usage period of 20 years.
- **Clarify financing**
 - Equity or Debt Financing: Decide whether the financing will be through equity or debt. Clarify the respective financing models and secure project funding. For example, financing a 5 MW wind turbine can

cost between 5 and 7 million euros and may require the involvement of banks or investors.

- **Commission wind reports**
 - Site Analysis: Have a comprehensive wind report prepared to provide financiers with a solid decision-making basis for your project. The report examines the wind conditions at the site in detail which can take several weeks. Plan time and additional costs for this.
- **Future planning and contact with forecasting service providers**
 - Operational Management: If you plan to manage operations yourself, plan this carefully for the future. Seek contact with forecasting service providers to obtain continuous, accurate performance forecasts and optimize the operation of your installations. Continuous performance forecasts can help plan maintenance work better and maximize energy production.

In an increasingly uncertain world, long-term performance analysis is a vital guide for site assessment and long-term performance evaluation of energy projects. Although they carry uncertainties, they allow us to make informed decisions and develop better risk management strategies. The key lies in the continuous updating and improvement of forecasting models to keep pace with changing conditions.

Future of site assessment

Careful site assessment is critical for the success of renewable energy projects. By employing advanced technologies and considering regulatory and environmental requirements, planners and developers can ensure the profitability and sustainability of their projects.

Modern technology such as geographic information systems (GIS) and remote sensing enables precise and efficient site analysis. For example, GIS can be used to analyze various site-specific factors such as land use, topography, and proximity to existing infrastructure, providing a comprehensive overview that supports informed decision-making.

Efficiency and accuracy are paramount in site assessment. Automated performance analytics provide fast and accurate predictions that accelerate decision-making and improve the quality of decisions. This leads to more cost-effective projects and better utilization of natural resources. By integrating various data sources and using sophisticated analytical tools, developers can optimize site assessment to maximize energy production and minimize costs.



Efficient and accurate automated performance analysis

This is where automated performance analysis excels. With advanced, data-driven methods, precise predictions can be quickly made, speeding up decision-making processes.

At 4cast, the focus is not just on technology but on the benefits this technology brings to planners and developers. By minimizing uncertainties and providing accurate, timely data, 4cast supports professionals in making informed decisions and developing more efficient, sustainable projects. Our automated forecasting solutions leverage cutting-edge technologies and comprehensive data analysis to deliver reliable predictions that help optimize energy production and ensure the economic viability of projects.

We understand the hard work involved in planning and implementing wind and solar projects. Balancing various variables, making daily decisions in planning and development, and succeeding despite constantly changing conditions is challenging. 4cast can help with:

- **Efficiency:** By automating individual process steps, you save time and resources.
- **Speed:** Our in-house developed analysis software, which relies on a cloud-based infrastructure, is highly scalable and optimized for fast delivery.


- **Precision:** Extensive data analysis and physical models that consider park layout and shading effects ensure accurate performance analysis.
- **Assessment of uncertainty**
We account for uncertainties in our forecasts and provide clear information on the accuracy of future yields.

Our services include the creation and delivery of gross yield, net energy yield, wind

distribution, and wind energy roses, average wind speed at hub height and average net energy generation from wind turbines. The output of historical time series of energy generation is also made available on request.

Test our long-term performance analysis and our speed and see the benefits for yourself. Book your appointment for a non-binding consultation now, or learn more here.

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About Sascha Bauer

4cast CEO Sascha Bauer plays a pivotal role as a thought leader and innovator in the renewable energy sector.

With his deep technical expertise in data science and his passion for sustainable energy projects, Sascha drives the development of advanced forecasting models and solutions.

He is committed to making renewable energies predictable and economically viable, ensuring that 4cast remains at the forefront of technological advancements in the industry.