SOLAR PANEL FORECASTING

Presented by

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INTRODUCTION

- Solar panel forecasting is the practice of predicting the amount of energy that solar panels will generate in the future. It is pivotal for efficient solar power utilization. This forecasting relies on various data sources, including historical solar generation data, weather information, and real-time sensor data.
- Different forecasting types, such as short-term, medium-term, and long-term, are used to cater to specific planning horizons. Various techniques are employed, including machine learning algorithms and numerical weather prediction models, which consider factors like solar radiation, temperature, and panel efficiency.
- Accurate solar panel forecasting finds applications in grid management, energy trading, load balancing, and optimizing energy consumption. It aids grid operators in balancing energy supply and demand, informs energy traders about market opportunities, and helps end-users schedule energy-intensive tasks during peak solar hours.

ABSTRACT

- Solar panel forecasting is the practice of predicting the amount of energy that solar panels will generate in the future. It is pivotal for efficient solar power utilization. This forecasting relies on various data sources, including historical solar generation data, weather information, and real-time sensor data. Different forecasting types, such as short-term, medium-term, and long-term, are used to cater to specific planning horizons.
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LITERATURE SURVEY

PAPER-I

TITLE: Global solar radiation forecast using an ensemble learning approach.

AUTHOR: Mishra, D. P., Jena, S., Senapati, R., Panigrahi, A., & Salkuti, S. R. (2023).

The authors aim to develop an accurate and reliable solar radiation forecasting model that can be used for renewable energy planning and management. The study proposes a novel approach that incorporates multiple machine learning models, including artificial neural networks, support vector machines, and random forests, to achieve better accuracy and reliability than single-model approaches. The proposed approach is tested and validated using real-world data, demonstrating its effectiveness in accurately predicting global solar radiation.

LITERATURE SURVEY

PAPER-II

TITLE: Cloud cover bias correction in numerical weather models for solar energy monitoring and forecasting systems with kernel ridge regression.

AUTHOR: Deo, R. C., Ahmed, A. M., Casillas-Pérez, D., Pourmousavi, S. A., Segal, G., Yu, Y., & Salcedo-Sanz, S. (2023)

which can improve the accuracy of solar energy monitoring and forecasting systems. The proposed approach uses KRR with various meteorological input variables and cloud cover as the output variable, and it is tested on a case study site in Australia. The study aims to demonstrate the effectiveness of KRR in correcting the cloud cover bias and providing accurate solar radiation forecasts, which can support the integration of solar energy into the grid.

LITERATURE SURVEY

PAPER-III

TITLE: How solar radiation forecasting impacts the utilization of solar energy.

AUTHOR: Krishnan, N., Kumar, K. R., & Inda, C. S. (2023).

CSE

The study aims to evaluate the performance of different ensemble methods in improving the accuracy of solar power forecasting. The article discusses various ensemble methods used in solar power forecasting, including simple averaging, weighted averaging, bagging, boosting, and stacking. The review also discusses the advantages and disadvantages of each method and provides insights into the factors that affect the accuracy of ensemble forecasting models. The article concludes by highlighting the importance of ensemble methods in improving the accuracy of solar power forecasting.

LITERATURE SURVEY

PAPER-IV

TITLE : Digital Twin simulation for deep learning framework for predicting solar energy market load in Trade-By-Trade data. Solar Energy.

AUTHOR: You, L., & Zhu, M. (2023).

CSE

The paper proposes a novel approach to construct a digital twin simulation model that mirrors the real-world solar energy market and integrates it with a deep learning framework to generate accurate predictions of the market load. The framework is trained and tested on historical trade-by-trade data, and the performance of the model is evaluated and compared with traditional machine learning methods.

DRAWBACKS IN EXISTING SYSTEM

- Solar panel forecasting relies heavily on accurate weather predictions. Inaccurate weather forecasts can lead to errors in energy production predictions.
- Solar energy production varies due to changes in weather, season, and time of day, making accurate long-term forecasts challenging.
- Forecasts are typically accurate for short-term periods (hours to a day) and become less reliable for long-term predictions.
- Developing and maintaining accurate forecasting models can be complex and resource-intensive, involving advanced machine learning algorithms and continuous data collection

PROPOSED SOLUTION

- Advanced Data Collection: Invest in better data collection systems, such as improved weather monitoring and solar panel performance data, to enhance the accuracy of forecasting models.

- Machine Learning and AI: Utilize advanced machine learning and artificial intelligence techniques to develop more accurate and adaptive forecasting models that can learn from historical data and real-time observations.

- Hybrid Models: Combine different forecasting methods, such as numerical weather models and statistical models, to benefit from the strengths of each approach and improve overall accuracy.

- Real-Time Monitoring: Implement real-time monitoring of solar panel performance and weather conditions to allow for quick adjustments and fine-tuning of forecasts as conditions change.

ADVANTAGES

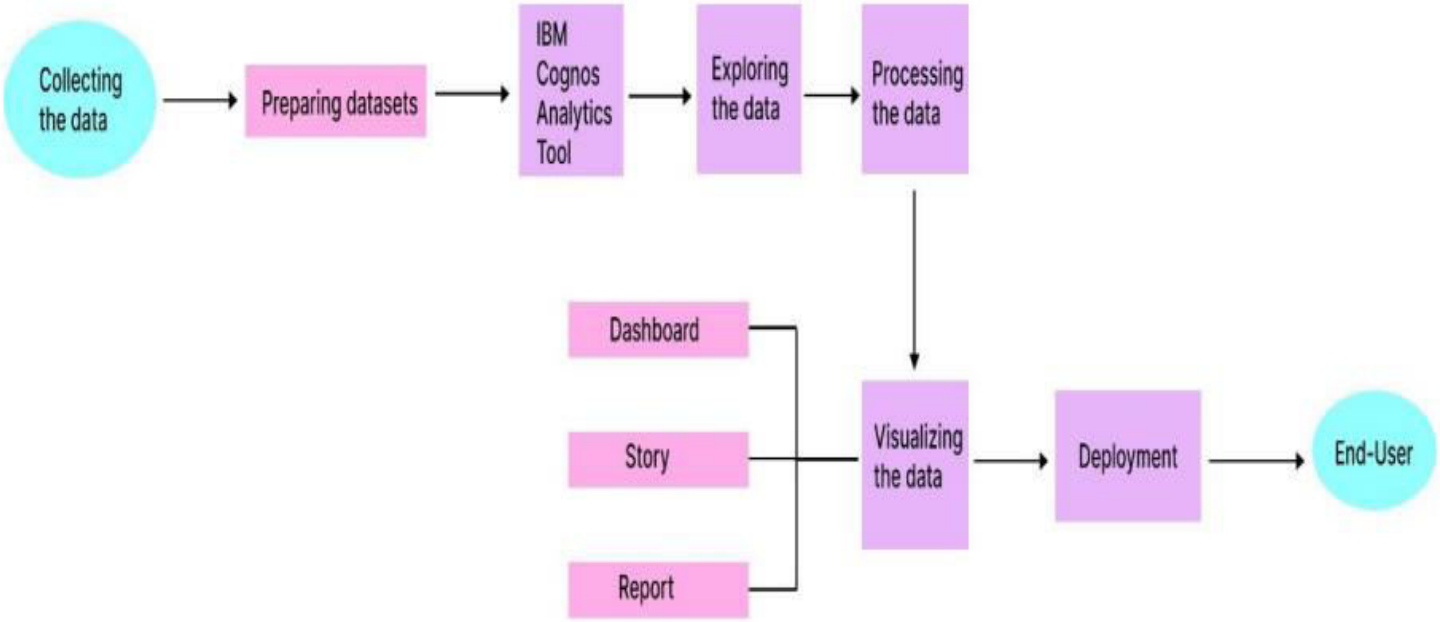
- Grid Stability: Solar panel forecasting helps grid operators anticipate and manage fluctuations in energy production, contributing to grid stability by reducing the risk of imbalances between supply and demand.

- Energy Optimization: Accurate forecasts allow for the optimal utilization of solar energy resources, helping to maximize the use of clean and renewable energy sources.

- Cost Reduction: Solar panel forecasting can lead to cost savings by minimizing the need for expensive backup power sources and by improving the efficiency of grid operations.

- Environmental Benefits: By increasing the integration of solar energy into the grid, forecasting supports a reduction in greenhouse gas emissions and a decrease in reliance on fossil fuels, contributing to environmental sustainability.

DATAFLOW DIAGRAM



SYSTEM SPECIFICATION

HARDWARE USED:

Processor -AMD/INTEL

RAM -4GB

Hard Disk -256 GB

SOFTWARE USED:

Language - HTML, CSS and Javascript

Package Manager & Build Tool - PIP

Database - IBM_DB2

MODULES

1. **Authentication**
   - Login
   - Sign in

2. Home
   - Home page of the Project.

3. About
   - About the Project Web Page.

4. Analysis Page
   - Dash Board Page
   - Report Page
   - Stories Page

MODULE DESCRIPTION

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1. Authentication: Users can create a new account or log in to an existing account. It typically requires users to provide a username or email address and a password for authentication purposes. Once authenticated, users can access their personalized content or services on the website.

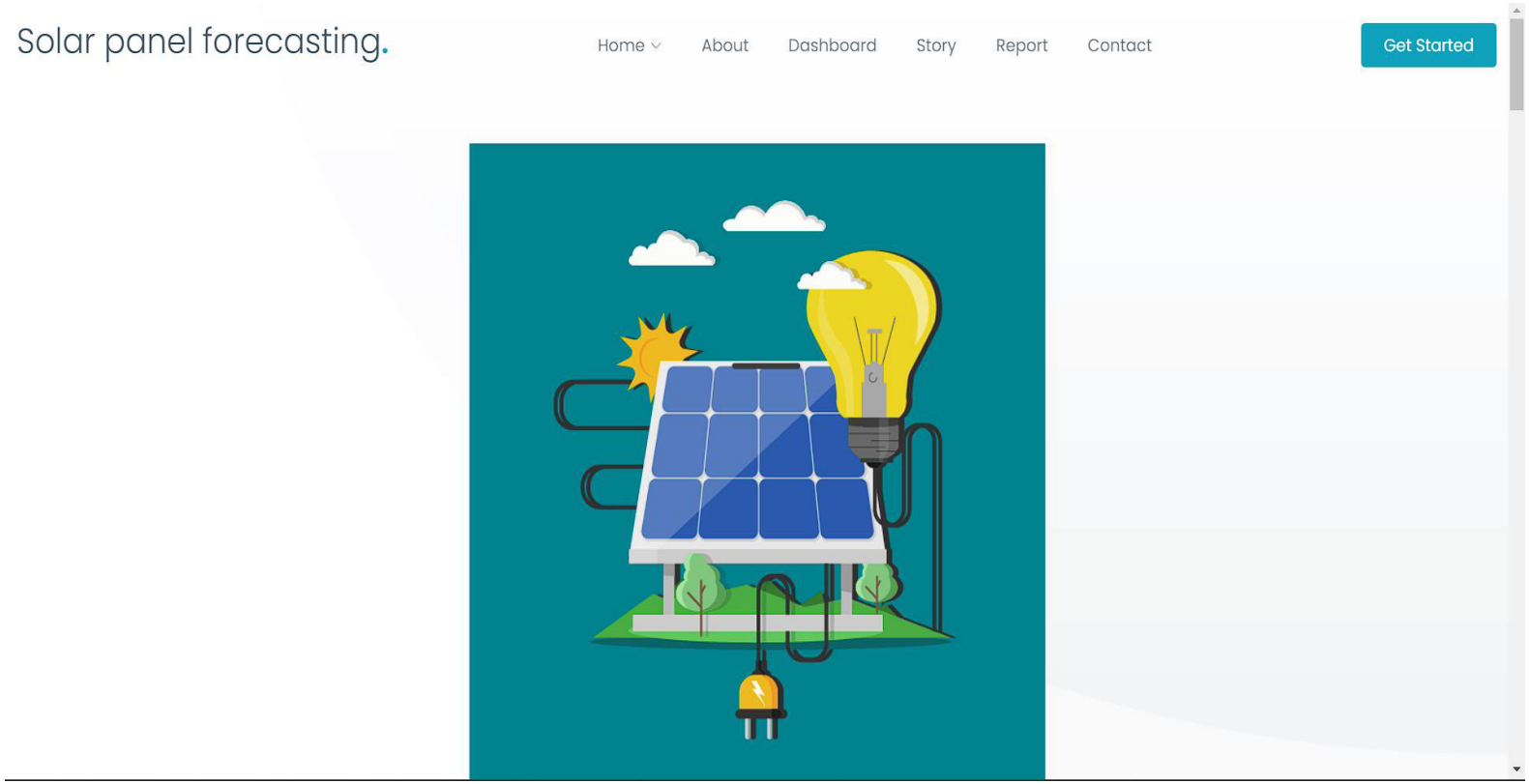
2. Home: User will know about the site using the home page. It contains other navigation page like services page, team page, about page and analysis page. It act like starting page of the website.

MODULE DESCRIPTION

3. About : In this, it contains about the services provided my the web site. It also contains why literacy rate analysis have done, past literacy rate surveys , service details etc...

4. Analysis Page : It contains about dash boards ,report and stories of the literacy rate analysis, their rate percentage , gender based literacy rate , state and area based analysis.

RESULT AND DISCUSSION



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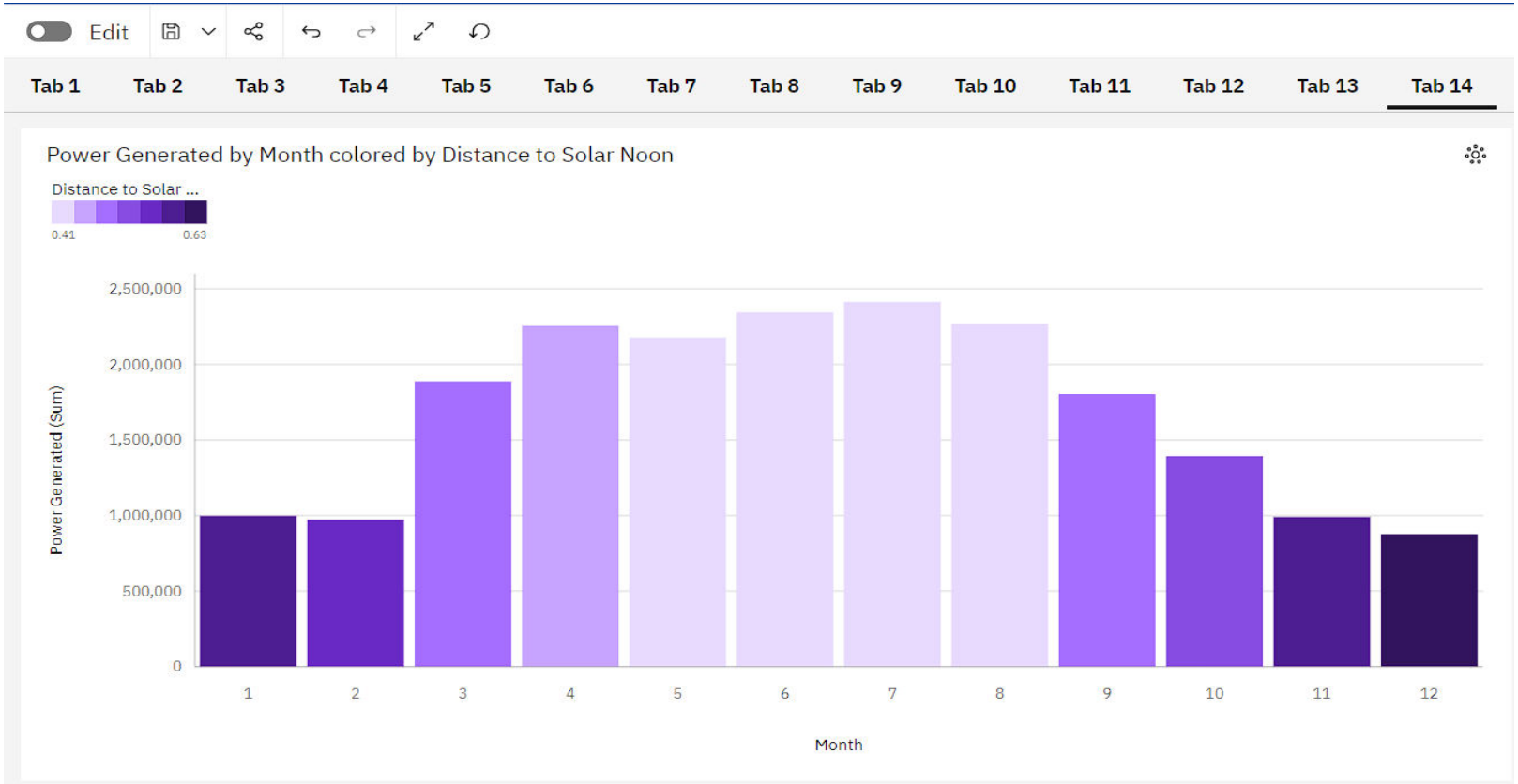

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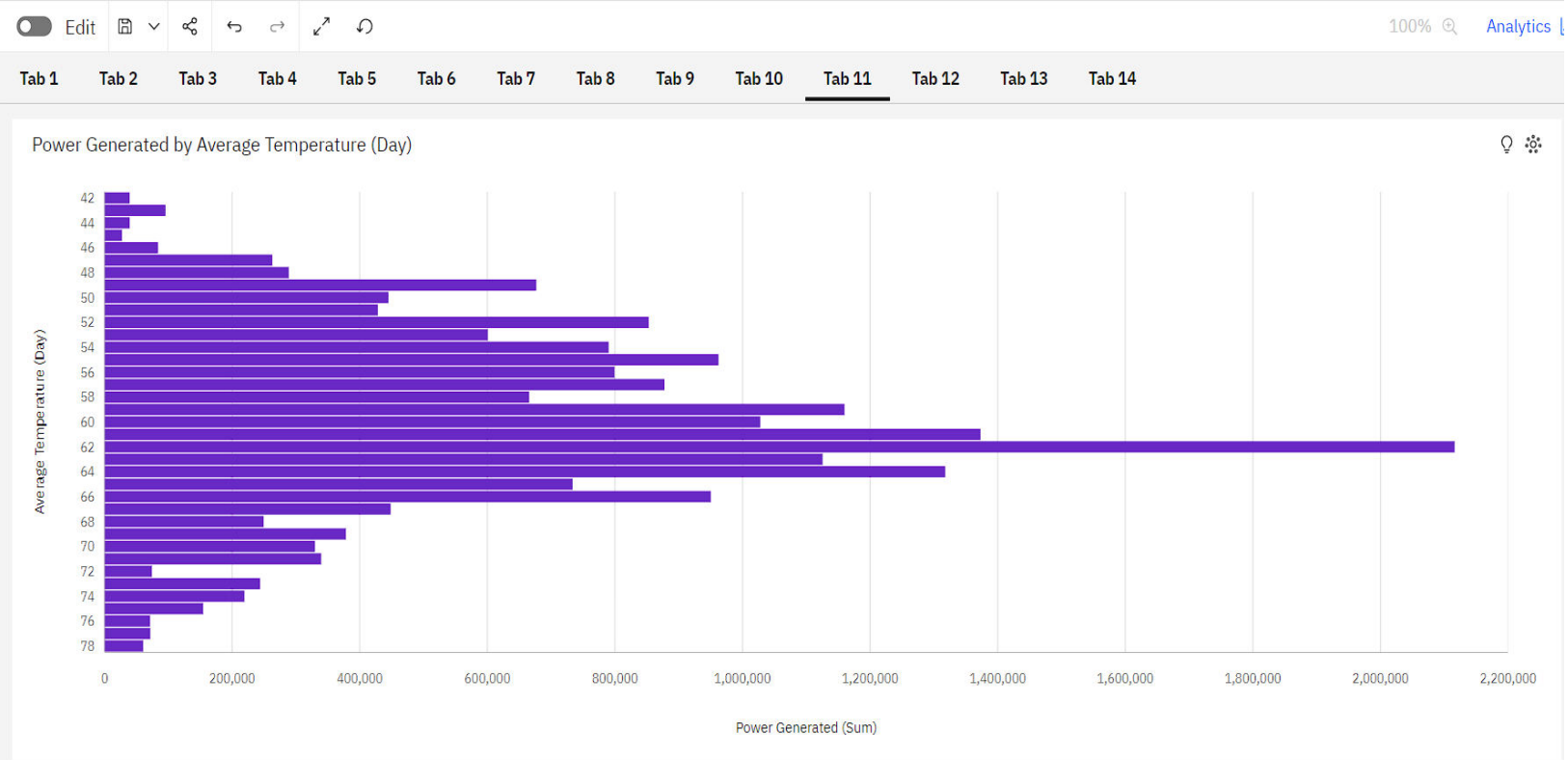

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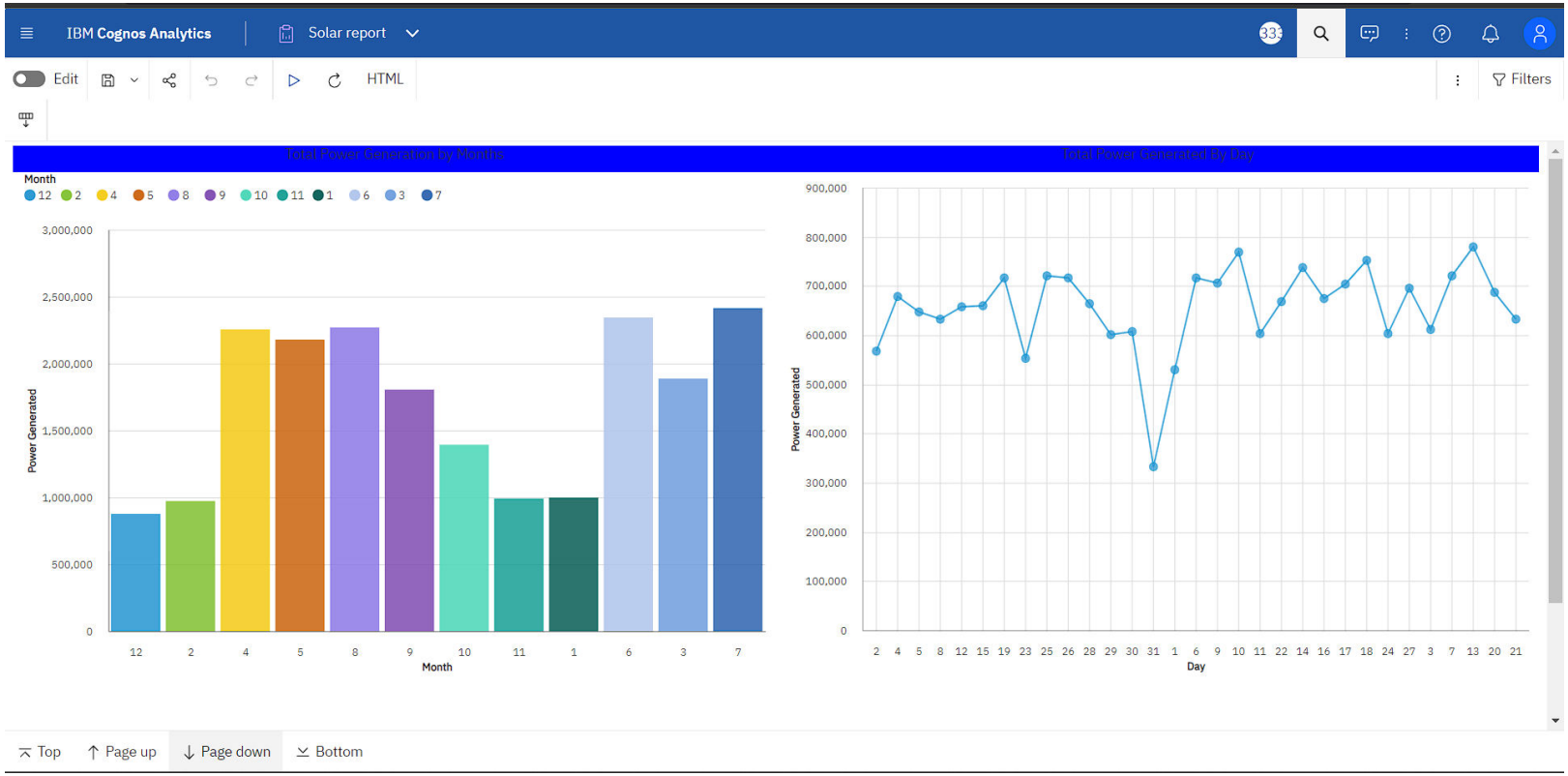

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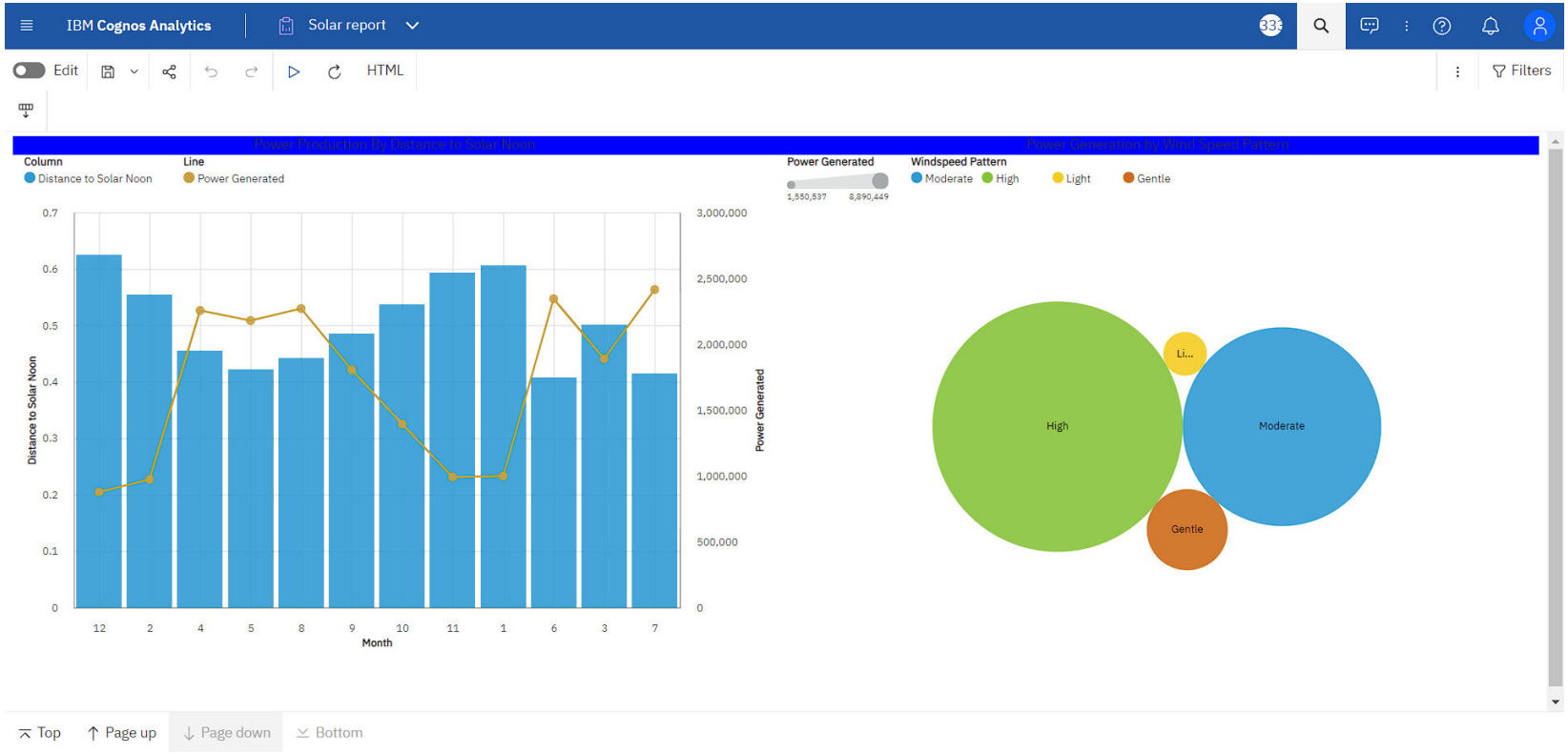

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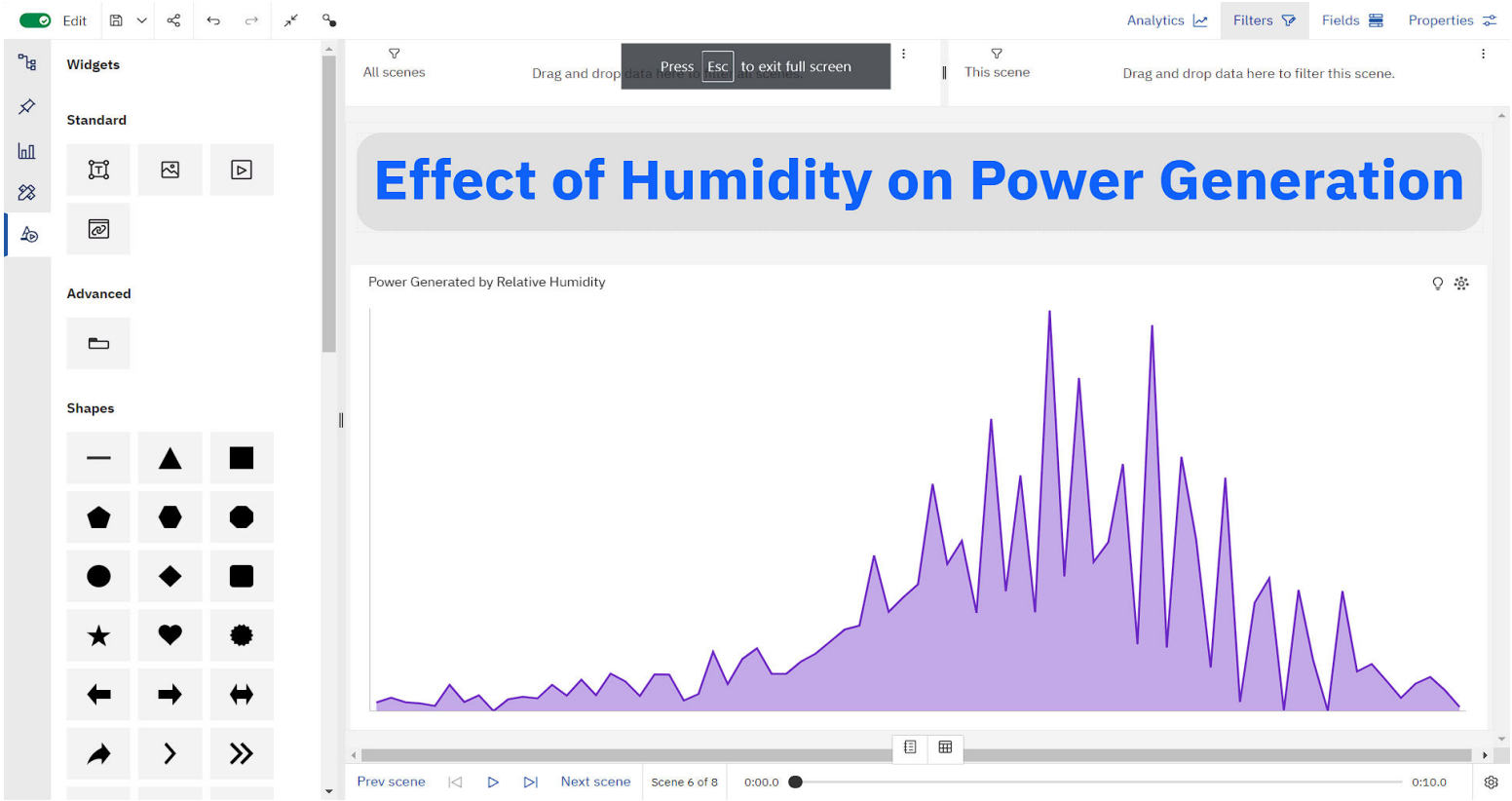

CONCLUSION

- In conclusion, solar panel forecasting represents a crucial tool in the ever-expanding world of renewable energy. As the adoption of solar energy systems grows, the need for accurate forecasting becomes increasingly apparent.
- Solar panel forecasting offers several key advantages, including improved energy management, cost reduction, and enhanced grid stability.
- It facilitates the integration of renewable energy, optimizes energy trading, and supports environmental sustainability by reducing greenhouse gas emissions. Moreover, it enables efficient grid planning and maintenance scheduling, contributing to energy security.

FUTURE SCOPE

- The future scope for solar panel forecasting is promising, with an array of technological advancements and evolving energy landscapes driving its growth. Solar panel forecasting is poised to become more accurate and reliable, thanks to innovations in data analytics, artificial intelligence, and machine learning.
- These developments will enable forecasts to extend beyond the short term, offering long-range predictions that aid in better energy planning and grid management.
- One of the most notable trends is the integration of solar panel forecasting with energy storage systems, such as batteries, which are becoming increasingly prevalent.

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THANK YOU