Project Design Phase-II
Solution Requirements (Functional & Non-functional)

Date	15 February 2026
Team ID	LTVIP2026TMIDS80318
Project Name	Weather-Based Prediction of Wind Turbine Energy Output: A Next-Generation Approach to Renewable Energy Management
Maximum Marks	4 Marks

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Data Collection	Collect wind turbine dataset from reliable source Load dataset into Google Colab for analysis
FR-2	Data Preprocessing	Handle missing values Handle inconsistent data Create required fields for analysis
FR-3	Data Visualization	Generate bar chart for wind speed vs power output Generate line chart for wind speed trends Generate pie chart for power distribution
FR-4	Model Development	Train machine learning model for energy prediction Evaluate model performance Save trained model (.pkl file)
FR-5	Web Application Development	Create Flask web interface Integrate OpenWeather API for real-time weather data Display temperature, humidity, pressure, wind speed
FR-6	Deployment	Upload project to GitHub Deploy application on Render Configure environment variables (API key)

Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Simple and easy-to-use web interface for entering city and viewing results.
NFR-2	**Security**	API key stored securely using environment variables.
NFR-3	**Reliability**	Provides consistent predictions and handles invalid inputs properly.
NFR-4	**Performance**	Fetches weather data and predicts output quickly.
NFR-5	**Availability**	Deployed online and accessible anytime.
NFR-6	**Scalability**	Can be extended with more features and cities in future.