Project Design Phase-II

Solution Requirements (Functional & Non-Functional)

Date	12 February 2026
Team ID	LTVIP2026TMIDS83348
Project Name	Weather Based Prediction Of Wind Turbine Energy Output - A Next Generation Approach To Renewable Energy Management
Maximum Marks	4 Marks

Functional Requirements

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Input & Energy Prediction	Enter weather parameters (wind speed, temperature, humidity, pressure) and receive predicted wind turbine energy output (kW/MW).
FR-2	EDA Visualizations	View wind energy trends, weather correlation plots, seasonal generation charts, and performance dashboards.
FR-3	Data Preprocessing	Handle missing values, normalize/scale weather features, encode categorical variables (if any), and ensure consistent preprocessing pipeline.
FR-4	Model Inference	Load trained ML model and generate energy output prediction with performance metrics (MAE/RMSE/R^2).
FR-5	Result Presentation	Display prediction results with clear numeric output, charts, and comparison with historical averages.
FR-6	Dataset & Model Management (Admin)	Upload/update weather datasets, turbine datasets, and retrain or update ML model artifacts.
FR-7	Logging & Error Handling	Log user prediction requests, validate inputs, and handle invalid or

		extreme weather values gracefully.

Non-Functional Requirements

NFR No.	Non-Functional Requirement	Description
NFR-1	Usability	Simple and intuitive UI for wind farm operators and grid managers with minimal manual inputs.
NFR-2	Security	Input validation, secure model loading, and controlled admin access for dataset/model updates.
NFR-3	Reliability	Consistent preprocessing using saved model artifacts (scaler, encoder, feature pipeline).
NFR-4	Performance	Low-latency prediction (< 1 second per request in local deployment).
NFR-5	Availability	Local deployment with optional cloud hosting for high uptime and remote access.
NFR-6	Scalability	Ability to add more turbines, locations, and datasets without major architecture changes.
NFR-7	Maintainability	Modular architecture (separate preprocessing, model, UI layers) with proper documentation.
NFR-8	Portability	System should run on Windows/Linux and be container-ready (Docker compatible).