**User Acceptance Testing (UAT) Template**

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| Date | 15 February 2026 |
| Team ID | LTVIP2026TMIDS67435 |
| Project Name | Weather-Based Prediction Of Wind Turbine Energy Output**:** *A Next-Generation Approach To Renewable Energy Management* |
| Maximum Marks |  |

**Project Overview**

**📌 Project Name:** Weather-Based Prediction of Wind Turbine Energy Output:

A Next-Generation Approach to Renewable Energy Management **.**

**📌 Project Description:** This project is a predictive analytics web-based application that estimates wind turbine energy output based on real-time and historical weather parameters such as wind speed, wind direction, temperature, air pressure, and humidity. The system leverages machine learning algorithms to forecast energy production and assists renewable energy managers in optimizing power generation and grid management**.**

**📌 Project Version:** v1.0 **📌 Testing Period:** January 21, 2026 – January 27, 2026

**Testing Scope**

**2.1 In-Scope**

The following modules and functionalities are included in UAT:

1. User Authentication (Admin & User Login)
2. Weather Data Input Module
3. Energy Prediction Module
4. Model Accuracy Display
5. Dashboard Visualization
6. Report Generation
7. Error Handling & Validation
8. Logout Functionality

**2.2 Out of Scope**

1. Backend Model Training Optimization
2. Database Performance Tuning
3. Third-party API Performance
4. Security Penetration Testing

**Features and Functionalities to be Tested**

**1. User Registration & Login**

* Secure login with username and password
* Role-based access (Admin/User)
* Password validation

**2. Weather Data Input**

* Manual weather data entry
* Field validation (numeric values only)
* Range validation (e.g., wind speed cannot be negative)

**3. Prediction System**

* Correct calculation of predicted energy output
* Display of prediction results
* Model accuracy visibility

**4. Dashboard**

* Graphical visualization of energy output
* Display of weather parameters
* Historical data view

**5. Admin Panel**

* View all user predictions
* Manage user accounts
* View model performance

**6. Error Handling**

* Invalid input alerts
* Missing field warnings
* Server error handling

**User Stories / Requirements to be Tested**

**📌 Weather Data Collection & Input Management**

**User Stories:**

* As a user, I want to enter weather parameters (wind speed, direction, temperature, humidity, pressure) so that the system can predict energy output.
* As a user, I want validation on input fields so that incorrect values are not submitted.
* As a system, I want to fetch weather data via API (if enabled) so that predictions can use real-time data.
* As a user, I want clear error messages if data is missing or invalid.
* As an admin, I want to monitor data input logs for system accuracy verification.

**📌 Energy Prediction & Model Processing**

**User Stories:**

* As a user, I want the system to calculate predicted wind energy output based on weather inputs.
* As a renewable energy manager, I want accurate prediction results to support decision-making.
* As a user, I want to see model confidence or accuracy percentage along with prediction results.
* As a system, I want to process inputs using the trained ML model without delays.
* As an admin, I want to update or retrain the model when required.

**📌 Dashboard & Visualization**

**User Stories:**

* As a user, I want to view prediction results in graphical format (charts/graphs).
* As a manager, I want to compare historical and predicted energy outputs.
* As a user, I want to filter data by date range.
* As an admin, I want to view system performance metrics.
* As a user, I want clear visual indicators (e.g., high/low production levels).

**📌 Report Generation & Data Export**

**User Stories:**

* As a user, I want to download prediction reports in PDF/Excel format.
* As a manager, I want to generate monthly or weekly production summaries.
* As an admin, I want system usage reports.
* As a user, I want exportable historical weather and energy data.

**📌 API Integration & Error Handling**

**User Stories:**

* As a system, I want to handle weather API failures gracefully.
* As a user, I want proper notification if real-time data cannot be fetched.
* As a system, I want to retry failed API requests automatically.
* As a user, I want fallback to manual data entry if API fails.
* As an admin, I want error logs for debugging purposes.

**📌 Notifications & Alerts**

**User Stories:**

* As a user, I want alerts when predicted energy output is below threshold.
* As a manager, I want notifications for extreme weather conditions.
* As a system, I want to send system maintenance alerts.
* As a user, I want confirmation after successful prediction generation.

**📌 Admin & System Monitoring**

**User Stories:**

* As an admin, I want to manage user accounts.
* As an admin, I want to monitor prediction history.
* As an admin, I want to view model performance statistics.
* As an admin, I want to track system usage and user activity.
* As an admin, I want to control access permissions.

**📌 Security & Performance**

**User Stories:**

* As a user, I want secure login authentication.
* As a system, I want encrypted password storage.
* As a user, I want session timeout after inactivity.
* As a system, I want fast prediction processing (<3 seconds).
* As an admin, I want protection against unauthorized access.
* As a system, I want protection against SQL injection and XSS attacks.

**Testing Environment**

**URL/Location:** http://localhost:5000

**Hardware Requirements**

* Minimum 4GB RAM
* Intel i3 or above processor
* Internet Connectivity

**Software Requirements**

* OS: Windows 10 / Linux / macOS
* Browser: Chrome, Edge, Firefox
* Backend: Python (Flask)
* Database: MySQL / SQLite

**Credentials (if required):**

| **Role** | **Username** | **Password** |
| --- | --- | --- |
| Admin | admin\_test | admin@123 |
| User | user\_test | user@123 |

**UAT Test Cases**

| **Test ID** | **Scenario** | **Steps** | **Expected Result** | **Actual Result** | **Test Status (Pass/Fail)** |
| --- | --- | --- | --- | --- | --- |
| TC\_UAT  \_01 | Verify User Login | 1. Open application  2. Enter valid credentials  3. Click Login | User successfully logged into dashboard | User logged in successfully | Pass |
| TC\_UAT \_02 | Invalid Login Attempt | 1. Enter incorrect password  2. Click Login | Error message displayed | Proper error message shown | Pass |
| TC\_UAT  \_03 | Negative Wind Speed Validation | 1. Enter wind speed = -10  2. Click Predict | Validation message should appear | Validation message displayed | Pass |
| TC\_UAT  \_04 | Valid Weather Prediction | 1. Enter valid weather inputs  2. Click Predict | Predicted energy output displayed correctly | Prediction result displayed correctly | Pass |
| TC\_UAT  \_05 | Dashboard Graph Display | 1. Navigate to dashboard  2. View graph | Energy output graph displayed | Graph displayed properly | Pass |
| TC\_UAT  \_06 | API Failure Handling | 1. Disconnect internet  2. Fetch real-time weather data | System shows API error message without crashing | Application displayed error message | Pass |
| TC\_UAT  \_07 | Logout Functionality | 1. Click Logout button | User redirected to login page | Redirected to login page | Pass |

**Bug Tracking**

| **Bug ID** | **Bug Description** | **Steps to Reproduce** | **Severity** | **Status** | **Additional Feedback** |
| --- | --- | --- | --- | --- | --- |
| BUG\_WIND  \_001 | System accepts negative wind speed values without validation. | 1. Login as User 2. Go to Prediction Page 3. Enter wind speed = -15 4. Click Predict | High | Open | Wind speed cannot be negative. Add validation rule to restrict values below 0. |
| BUG\_WIND  \_002 | Prediction result not displayed after valid input submission. | 1. Login 2. Enter valid weather data 3. Click Predict | Critical | In Progress | Backend model may not be returning response. Check model integration/API response. |
| BUG\_WIND  \_003 | Dashboard graph not loading for historical energy data. | 1. Login as Admin 2. Open Dashboard 3. Select date range 4. Click Generate Graph | Medium | Open | Possible JavaScript/chart library error. Verify frontend integration. |
| BUG\_WIND  \_004 | System crashes when weather API fails to respond. | 1. Disable internet 2. Trigger real-time weather fetch | Critical | Open | System should handle API failure gracefully and show error message instead of crashing. |
| BUG\_WIND  \_005 | Admin role accessing user-only features incorrectly. | 1. Login as Admin 2. Try accessing user-specific page | High | Under Review | Role-Based Access Control (RBAC) configuration needs correction. |
| BUG\_WIND  \_006 | Model accuracy percentage not updated after retraining. | 1. Login as Admin 2. Retrain model 3. Check accuracy display | Medium | Open | Accuracy value may be cached. Ensure dynamic refresh after retraining. |
| BUG\_WIND  \_007 | Session does not expire after inactivity. | 1. Login 2. Stay idle for 30+ minutes 3. Access dashboard | High | Open | Security risk. Implement automatic session timeout mechanism. |

**Sign-off**

**Tester Name:** [Enter Name]  
**Date:** [Enter Date of Completion]  
**Signature:** [Enter Signature]

**Notes**

* Ensure testing covers both positive & negative cases
* Bug tracking should include severity levels & reproduction steps
* Critical bugs must be fixed before project sign-off.
* Final sign-off required before deployment