Chapter 11

Future Scope

11.1 - Future Scope:

1. **Real-Time Forecasting Systems:**

   o Integrate live weather APIs and on-site sensors for minute-level prediction.

   o Enable instant turbine control adjustments based on incoming wind conditions.

2. **Advanced AI & Deep Learning Models:**

   o Apply LSTM, GRU, and transformer-based models for better time-series forecasting.

   o Improve prediction accuracy during sudden wind fluctuations and seasonal variations.

3. **Integration with Smart Grids:**

   o Automatic coordination between wind farms, substations, and load demand.

   o Dynamic power distribution to prevent overload and blackouts.

4. **Energy Storage Optimization:**

   o Connect predictions with battery storage systems.

   o Store excess power during high wind periods and release during low generation.

5. **Hybrid Renewable Energy Systems:**

   o Combine wind prediction with solar forecasting models.

   o Create reliable multi-source renewable energy plants.

6. **Autonomous Turbine Control:**

   o Self-adjusting blade pitch and yaw angle using predicted wind direction and speed.

   o Reduce mechanical stress and improve turbine lifespan.