Chapter 10

Conclusion

10.1 – Conclusion:

The proposed weather-based wind turbine energy prediction system demonstrates how data-driven intelligence can significantly improve renewable energy utilization. By analysing meteorological parameters such as wind speed, temperature, direction, and air density, the model can accurately estimate power generation before actual production occurs. This enables operators and utilities to make proactive decisions instead of reactive adjustments.

The approach enhances grid reliability, optimizes turbine performance, and reduces operational costs by preventing unnecessary shutdowns and improving maintenance planning. It also supports efficient power scheduling and smoother integration of renewable energy into modern smart grids. As a result, dependence on fossil-fuel backup sources decreases, contributing to environmental sustainability and reduced carbon emissions.

Although challenges such as prediction uncertainty, data quality issues, and computational requirements exist, they can be minimized through better sensors, continuous model training, and advanced machine learning techniques. With further improvements and real-time data integration, the system can evolve into a fully automated renewable energy management solution.

Overall, weather-based wind energy prediction represents a crucial step toward intelligent, reliable, and sustainable power systems. It not only improves the efficiency of wind farms but also supports the global transition toward clean and green energy infrastructure.