

**S4-01**

## **AI/ML Augmented Hyper-Local Weather Forecast**

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It has been operationally demonstrated that the artificial intelligence (AI) – machine learning (ML) augmented wind energy production forecast has successfully achieved a consistent >30% wind speed and power generation forecast improvement over the NOAA operational High-Resolution Rapid Refresh (HRRR) standalone capability.

Specifically, we focus on improving weather forecast accuracy to support localized and fast-changing weather systems that are currently underperforming and not accurately captured with current state-of-the-art global and regional NWP.

We are to present the use of a suite of AI/ML algorithms, including 1) artificial neural networks, 2) ridge regression, 3) lasso regression, 4) support vector machines, 5) gradient boosting, 6) elastic networks, 7) nearest neighboring clustering, and 8) random forest (RF) models that have been successfully developed, validated, and deployed operationally for wind energy forecasting applications. The renewable industry uses these operational forecasts to better manage the power grid distribution, energy trading strategy, and plant management/operations.

Additionally, an AI/ML model ensemble of different machine learning models is created and demonstrated to significantly improve wind speed accuracy during all seasons, times of day, sites tested, and forecast horizon times. The fully matured framework is thus comprehensive and robust, showing that AI/ML is a natural complement to the existing NWP infrastructure and can be expanded to enhance hyper-local/temporal forecast, especially for the fast-changing small-scale severe weather events that have a greatly impact on routine activities and economy.