Large Scale Output Predictions for Small Emplacement Renewable Energy

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Electrical utilities must be able to accurately predict the power inputs into their grid so that these inputs can be balanced against the electrical demands on the grid. A common objections to distributed, small scale energy production is that the inherent intermittent and unreliable nature of it limits predictability, which in turn limits the utility's ability to factor distributed generation systems into their overall capital expenses, or their short and long term contracts for power purchase or sales. By using mathematical analysis combined with artificial neural networks, performance models of individual renewable energy installations can be generated which both efficiently and accurately predict future energy output of those systems under varying meteorological conditions. The system utilizes algorithmic calculations, historical weather data, and historical renewable energy emplacement energy production data for training, and to demonstrate prediction accuracy. Prediction accuracy from given meteorological conditions matches actual production very closely, with an mse that typically approaches 0.01%, and an r-squared that usually approaches or exceeds 0.99. Further, performance of the system is quite good. The system, running on a commodity laptop, with large meteorological data sets (1432 records) per simulated emplacement, could still generate dozens of predictions for as many as 80000 emplacements in a single day. The system could readily scale to commercial prediction volumes.