Geophysical Research Abstracts
Vol. 21, EGU2019-9567, 2019
EGU General Assembly 2019


# Using machine learning to predict renewable electricity generation, electricity demand, and electricity prices from climate data

Johann Baumgartner, Johannes Schmidt, and Katharina Gruber
Institute for Sustainable Economic Development, University of Natural Resources and Life Sciences, Vienna, Austria

Recent academic literature successfully demonstrated the wide applicability of machine learning algorithms for different modelling purposes in the energy sector such as predictions of electricity generation from wind and solar resources as well as electricity demand and prices. However, current research mainly focuses on short to medium term predictions and on predictions within spatially restricted study areas.

We assess here if machine learning can be successfully applied as a means to derive predictions of nationally aggregated electricity generation from renewable energy sources (i.e. wind, photovoltaic and hydro power) for Austria and Germany and electricity market determinants such as load and electricity prices for the formerly combined electricity market zone of Germany and Austria.

We apply neural network and short long term memory machine learning algorithms in combination with climate reanalysis data and compare the predicted time series with actual values in terms of model quality. The model inputs for predicting generation and load are mainly climate data (e.g. wind speeds, solar radiations, temperatures), while for electricity price predictions specific commodity prices (e.g. emission, gas prices) are also used. Model training and prediction periods depend on the response variables considered, as a consequence of the different availability of observed values used for model training and validation. The ratio between training and prediction period is kept to 2/3 to 1/3.

The assessment of model quality is based on an equally weighted comparison of hourly correlation, normalised RMSE and normalised MAE values. Additionally, the ability of the modelled time series to replicate seasonal characteristics as well as extreme events is assessed. Model runs for photovoltaics (PV), wind and hydro generation based on reanalysis data show acceptable results with good hourly correlation (0.992 for wind power in Germany) and low model error (normalised root mean square error of 0.10). Electricity demand and price models however still need to be refined to generate results of acceptable quality.