# Renewable Power Generation Time Series Forecast

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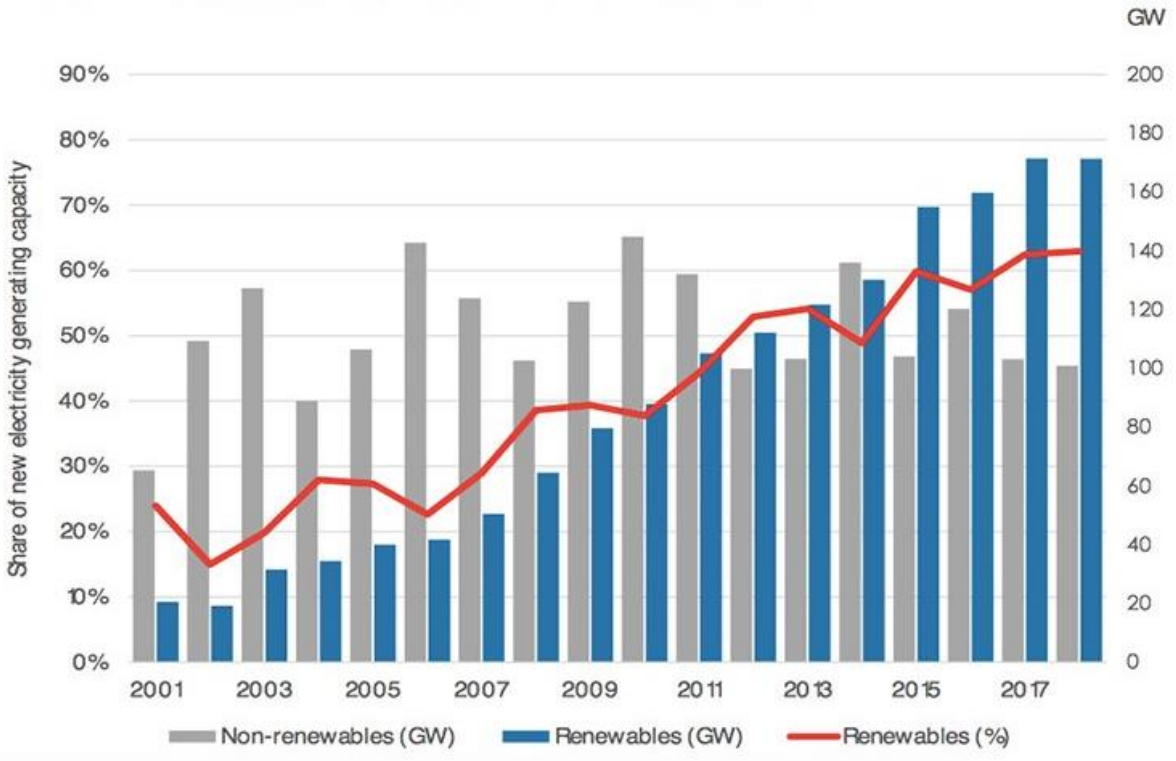



Figure. World renewable generation capacity and energy transition trend


Figure. Examples of solar photovoltaic panels

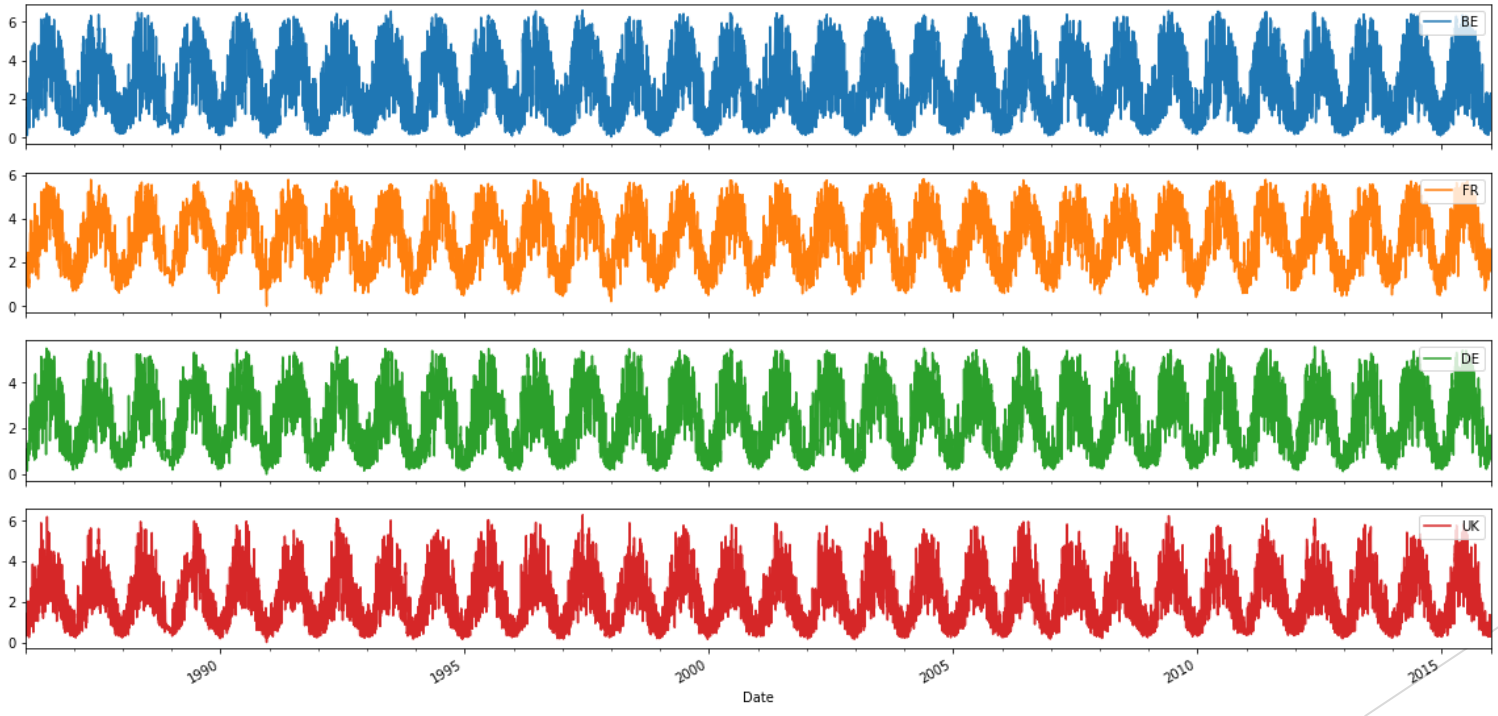
Renewable power production depends on the environment conditions (e.g., snow, high temperature, cloud) and is intermittent and uncertain in nature.



- To better anticipate the performance of renewable systems;
- To better calculate the Return on Investment (ROI) of renewable assets and electricity bills;
- To better integrate renewable power with existing power grids;
- To better dispatch other power systems (fossil-fuel based) when no sunshine or wind;
- **Forecast renewable power production at different spatial and temporal scales!**

# EMHIRES dataset Part II: Solar power generation

- Published by European Commission, Joint Research Center
- 262,968 rows, 40 columns
- Hourly from 1986-01-01 to 2015-12-31
- 35 countries in European Union
- Link: https://setis.ec.europa.eu/publications/relevant-reports/emhires-dataset-part-ii-solar-power-generation




Belgium

France

Germany

United Kingdom

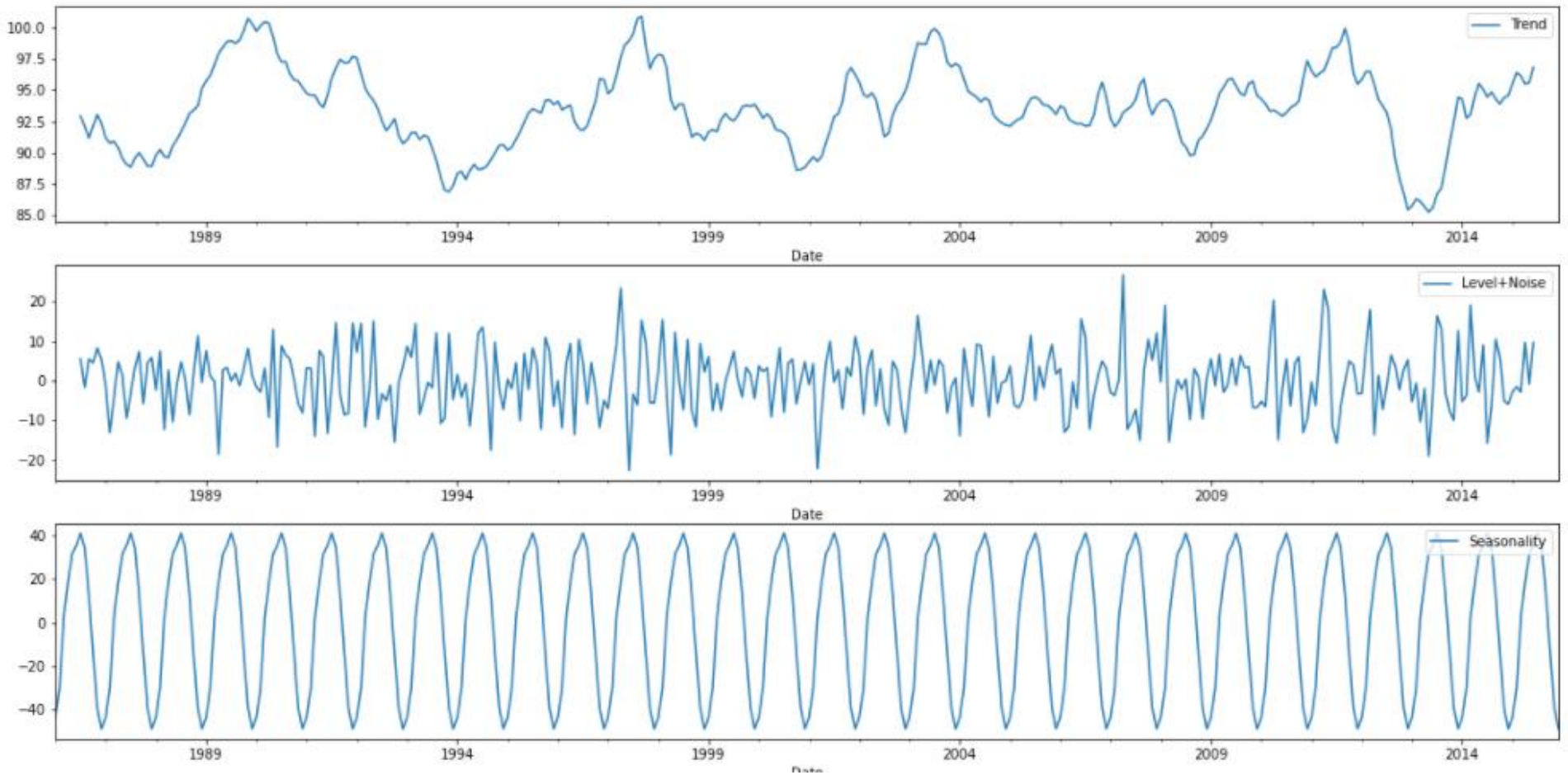



Figure. Decomposition of time series for French power generation time series

French solar PV power generation time series can be decomposed to: Seasonality, Trend, Level + noise.

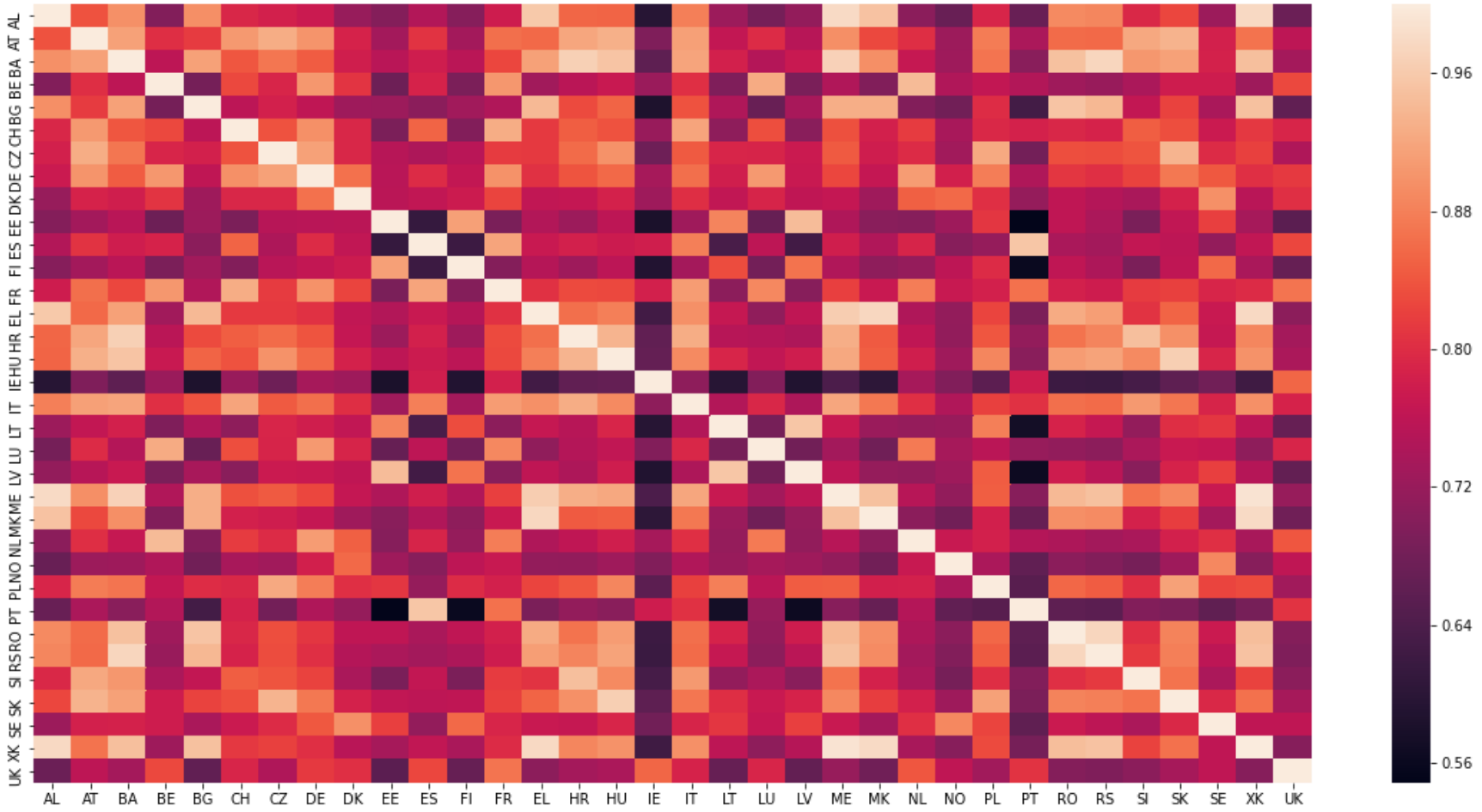
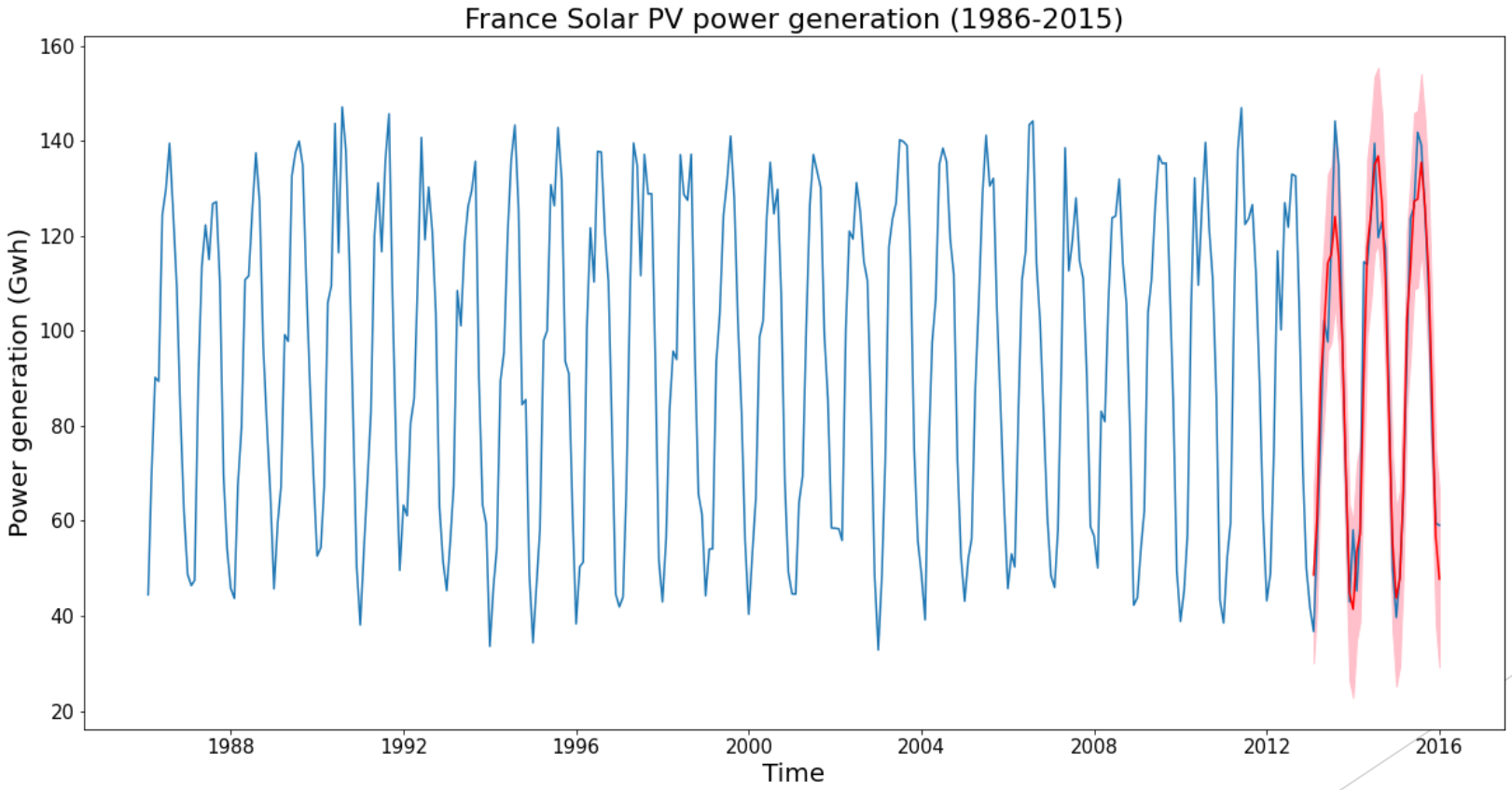



Figure. Correlation among power generation time series of different countries

There are potentials to integrate spatial-temporal characterization into feature engineering and algorithm development for forecasting

Preliminary analysis:

- Augmented Dicky-Fuller test for stationarity;
- Use ACF and PACF to select model orders (BIC);
- Use SARIMA model to make one-step-ahead forecast (36 months);
- Visualize predicted mean values and confidence intervals;



Next steps:

1) develop models to integrate machine learning with time series to forecast the solar power generation for short term and long term;
2) feature engineering to integrate accurate representation of the spatial and temporal characterization of solar sources;
3) evaluate the impacts of meteorological and climate variability on the solar power generation;
4) quantify the relationships among different countries in terms of power generation time series;
5) develop on-line learning capability to continuously learn from past data;

# Thank You!