Analysis the Italian Power Market with considering the impact of renewable energy systems
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Research context and motivation

Introduction
- The deregulation of electricity markets in Italy has changed the shape of the economy in the electricity sector. In addition, particular features of Italian power market gain much attention
- In the Italian Power market, the geographical market includes 7 foreign virtual zones, 6 geographical zones and 5 poles of limited production (national virtual zones). A stylized representation of the geographical market with the most relevant links between zones is reported in Figure 1

Most features of the Italian power market:
- Increment the penetration of Renewable Energy systems (RESs) and its side effects
- Zonal market structure
- Distance between the location of demand and generators causes congestions occurrence in different zonal pairs

Addressed research questions/problems

The main topics of the research are mainly focus on Italian Electricity market
- Preliminary analyses the impact of Renewable Energy systems (RESs) on power market
- Finding correlation between price and demand with/without considering the RESs production
- Analysis of the impact of RESs on different zonal price
- A literature review about the Application of Machine Learning in Solar and Wind Power forecast
- Forecasting electricity price in Italian day-ahead market (MGP) with different methods

Novel contributions

Data science and machine learning techniques to:
- Analyze the impact of RESs on the Italian power market
- Forecast different market results of the Italian power market (Price, Quantity,...)

Adopted methodologies

- Correlation Analysis
  A correlation analysis have conducted on data in MGP and MSD market with the following methods:
  1) Pearson correlation
  2) Linear regression
  3) Polynomial regression

Adapted methodologies

Estimation the impact of off-peak load on correlation between price and demand

A literature review about the Application of Machine Learning in Solar and Wind Power forecast

Forecasting day-ahead electricity prices
1- Using Multilayer perceptron (MLP) algorithm
   Number of hidden layer=2, Number of neurons=20
2- Using K-Fold Cross Validation for test and train the dataset (k=10)
3- Using performance metrics (MAE, RMSE, MPE) to evaluate and compare the accuracy of the forecaster.

Input Selection
consider the following data as an input:

Inputs
- 1-Day-ahead prices from the Italian power market
- 2-Day-ahead grid load
- 1-Last Six hours of MGP load and prices
- 2-Type of the season (Spring, Summer, Autumn or Winter)
- 5-Type of the day (weekend or weekday), peak or off-peak load
- 6-Type of the hour (peak or off-peak load)

Features
- Type of the power market (MGP, MSD)
- Type of the season (Spring, Summer, Autumn or Winter)
- Type of the day (weekend, weekday)
- Type of the hour (peak, off-peak)
- Type of the load (grid, generation)

List of attended classes
- 01ELERV – Power system economics (05/10/2019, 15)
- 01FGRV – Innovative techniques for optimization (08/03/2019, 20)
- 01GSRV – Characterization and planning small-scale multigeneration systems (09/13/2019, 25)
- 01QUGV – Energy in smart buildings (Date, 10)
- 02ITTRV – Generators and photovoltaic systems (Date, 25)
- 015WPRV – Time management (02/02/2019, 2)
- 01RISRV – Public speaking (02/02/2019, 5)
- 02WHRV – Communication (09/03/2019, 5)
- 01SYBRV – Research integrity (08/27/2019, 5)
- 08IKTRV – Project management (03/02/2019, 5)
- 01PJMRV – IT ethics (03/02/2019, 20)