Price prediction module

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The overall objective of the **price prediction module** is to estimate the hourly electricity market price five days ahead for the Spanish, Portuguese and German electricity markets.

The tool uses as inputs historical data for pool price data, electricity generation by technology and electricity demand. Furthermore, the module uses weather forecast data to forecast electricity generation of renewable energy technologies and energy demand.

The module updates daily and generates electricity price forecast hourly values for the next 120 hours. (with UTC timestamps).

Summary

Agriculture sector is accountable for 30% of the total water consumption in Europe, but reaches up to 70% of total water consumption in several European southern countries. In recent years, most of the efforts have been focused on water efficiency, but without taking care of energy aspects, resulting - in some cases - on a significant increase in energy consumption, combined with a scenario of increasing energy costs throughout Europe.

The **WEAM4i** project has addressed these challenges by developing an on-line crop water demand projection ICT tool that combines crop water demand (quantified by satellite observation) with a weather forecast to project future crop water needs to determine the optimal irrigation time balancing crop water needs and energy costs.

WEAM4i project has covered many case studies to demonstrate innovative techniques for resource efficiency at local level, decision support tools and an ICT/cloud platform for sharing weather forecast and remote sensing data services & applications.

Challenges:

➢ Energy is a key cost input for irrigators where the cost varies significantly from day to day in the day-ahead market.

➢ To be used for irrigation, water demand must have a flexible profile to shift demand to hours of low prices.

➢ The client's energy supply contract has to be indexed to the wholesale energy market.

Description of the studied energy markets

The scope of the price prediction module are the Spanish, Portuguese and German electricity markets and thus a univariate data analysis of those markets was carried out:

➢ Analysis of the historical pool prices for Iberian (Spain and Portugal) and the German markets.

➢ Analysis of the linear correlation between price, electricity generation by technology and demand.

➢ Analysis of the meteorological variables that affect each technology selected for the model (i.e. temperature, solar radiation, etc.).

The module has been designed to have a relative error below 10%, as an example, on the December 31st the module was run being 9% the mean relative error.

Predictions on 2016-12-31

Spot Market price - Spanish side
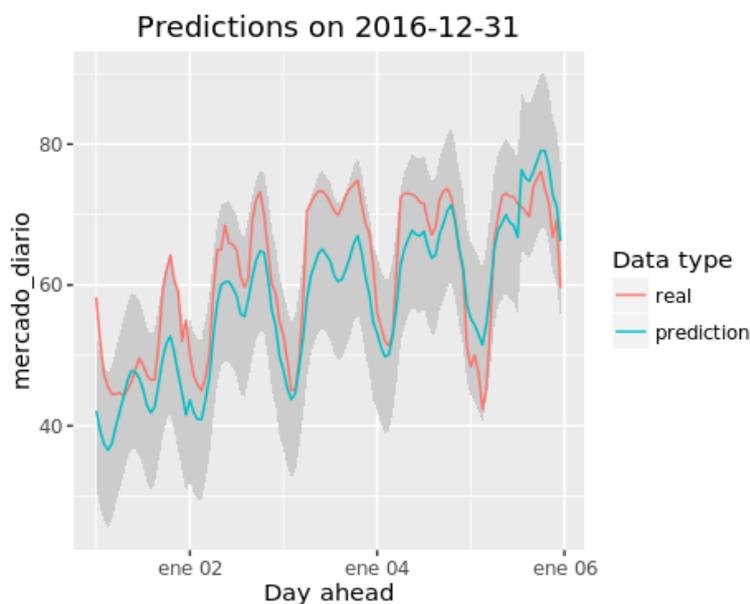
Description of the Solution

The prediction model estimates the hourly electricity market price for the five days ahead. In order to achieve that, the following elements are taken into consideration:

➢ Availability of generation plants of each country, (i.e. whether the plant is operational to generate energy).

➢ Meteorological variables, which affect energy generation (i.e. the lack of radiation or wind decrease energy production from photovoltaic and wind installation respectively) and demand (i.e. extreme weather conditions increase energy consumption)

➢ Price reached on the futures markets; the price of future contracts is closed days before the spot market auction.
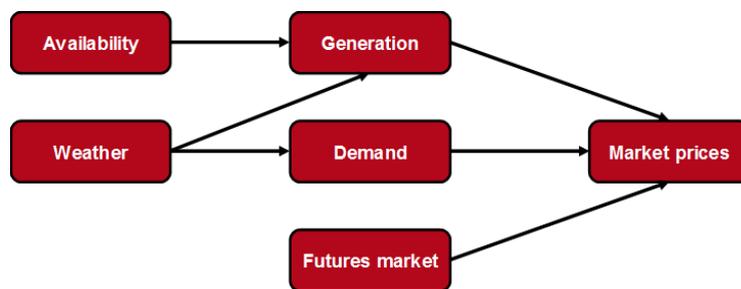
Results

➔ The price prediction module forecasts 120 hour prices (with UTC timestamps), available daily to the Decision Support System.

➔ The relative error in the predictions is in average below 10%
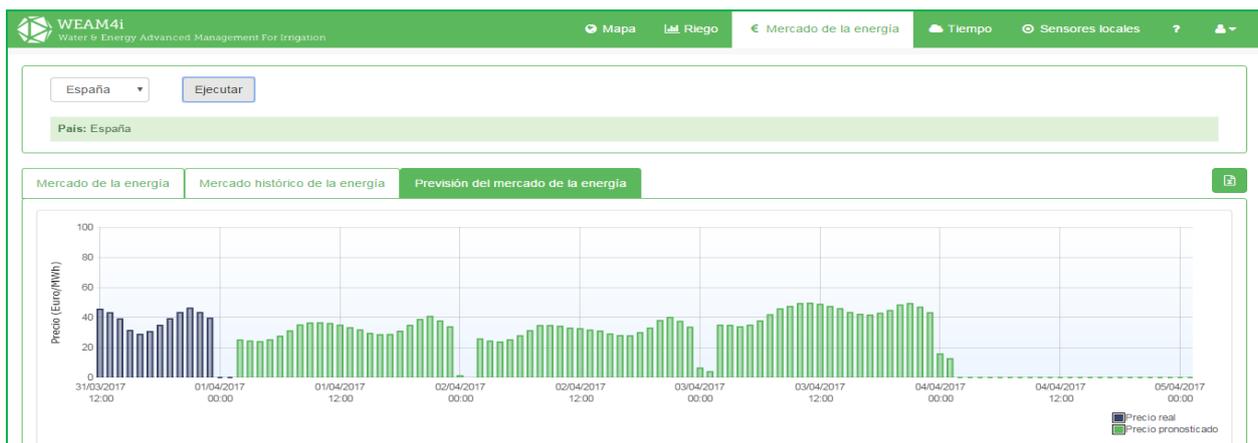

Learned lessons, conclusions and perspectives

1. As a broad rule, when summer irrigation spend is below 40% of the annual spend it is advisable to close an indexed supply contract. This includes mainly the South-East of Spain where the typical crops are berries (strawberries, blueberries, etc.) and horticultural crops (lettuce, tomato, etc.); such as Alicante, Murcia, Almería and Huelva.

2. Irrigators will reduce the average price of the energy the consume if they select for pumping those days in which energy prices are expected to be lower

> Using advance statistics analysis is possible to forecast the energy costs, and thus, irrigators can take advanced of the energy market volatility

> The target clients for the price prediction tool are irrigators, meeting two conditions:

  o Flexible energy demand

  o Summer energy demand is below 40% of annual demand
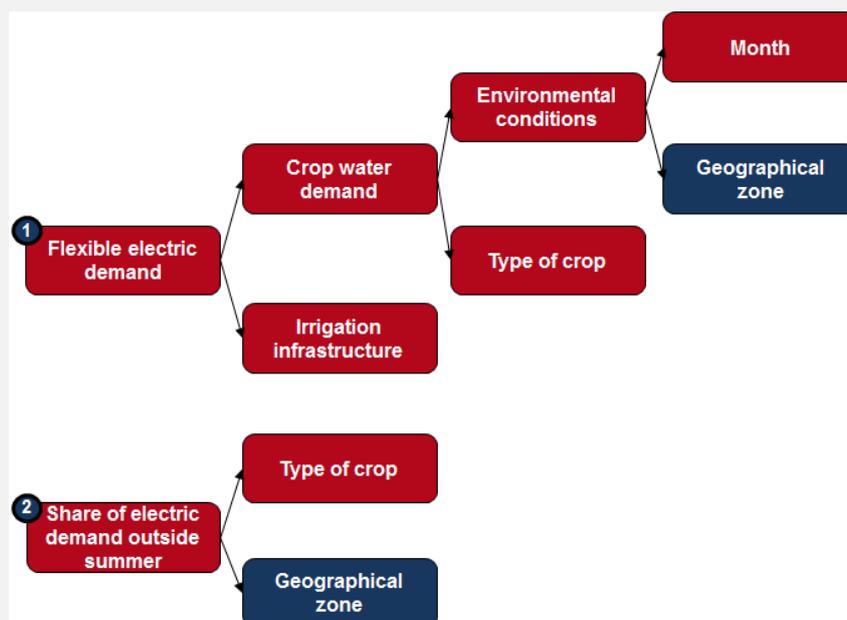
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