Collaborative Project

SOPCAWIND: Software for the Optimal Place CAlculation for WIND-farms

FP7-ICT-2011-SME-DCL 296164

Publishable Summary

Lead participant:	TECNALIA
Revision:	All partners
Authors:	All partners
Reviewers:	All
Status:	First version
Preparation date:	19/May/2014
Date submitted:	30/June/2104

Dissemination level		
PU	Public	X
PP	Restricted to other programme participants (including Commission Services)	
RE	Restricted by a group specified by the consortium (including Commission Services)	
CO	Confidential, only for members of the consortium (including Commission Services)	

1. Publishable summary

The design of wind farms is a complex task that includes the selection of the best location for each wind turbine, in order to obtain the maximum power from the wind. The availability of a complete database of local wind data and the development of accurate models for estimating the wind nature along the whole local area are the key factors for this purpose.

In addition to the wind resource on site, constraints related to wind farm development within the project area need to be taken into account in the prefeasibility study. These constraints can be divided into two major groups with the first group being the constraints which are independent of the park configuration. These constraints include the presence of heritages sites, important bird areas, residential areas, road infrastructure, *etc*. The second group of constraints are grouped as all constraints which are influenced by the turbine configuration (turbine coordinates and types) for example the potential interference on communication services, such as broadcasting services, data radio links, Weather Radars, Air Traffic Control Radars and DVOR systems as well as the potential disturbance due to shadow flickering and noise production. In order to minimize the impact of the planned wind farm on the environment, these constraints need to be taken into account in an early stage of the project development.

The data related to the above-mentioned issues comes from different sources, such as public administrations and private companies that use different approaches and interests which results in data of different formats and nature. The analysis of these issues is usually a huge difficulty for SMEs which need to consider all these collateral but crucial aspects. The prefeasibility study depends on the availability of data resources or specialised tools which are expensive to obtain and maintain. The combination of all these data, recommendations and assessment methods in a unique software tool would be a very useful tool for the SMEs involved in the multidisciplinary design process of wind farms and will result in a cost- and time-reduced process.

1.1 Project Objectives

The main objective of this project has been to create new products and services for SMEs based on the combination and transformation of large and heterogeneous datasets. These datasets have been converted, manipulated and standardised into a common repository or data pool. The data pool is linked to an optimisation engine whose results are the basis of a novel software tool, used for wind farms siting optimisation. Linked to this, the project has created methodologies to maintain and increase the data pool and to-be-licensed web-access to sell the standardised data to third parties.

The project counts with a twofold general objective:

- On one hand, to **develop a set of procedures to combine large heterogeneous datasets** into a common usable format. These procedures have been implemented in a framework to be used by any SME willing to explore this data. The framework is expandable (able to consider new datasets) and with techniques to keep it updated.
- On the other hand this project also aims at **developing Software for the Optimal Place Calculation for WIND-farms** (SOPCAWIND). SOPCAWIND implements the algorithms that process the previous obtained data pool for selecting the proper location of the wind turbines for an optimal use of the wind power while considering other susceptible parameters such as environmental impact.

1.2 Project results

One of the main results of the SOPCAWIND project has been the creation of a spatial database, called The SOPCAWIND Data Pool, gathering important datasets which are needed within the wind farm design process. These datasets have been gathered, processed, harmonised and normalised from very heterogeneous datasets in order to create a valuable and structured source of information. Multiple public and private sources have been gathered covering a wide variety of information types such as wind data, geographical data, infrastructure data, telecommunication data, use of land, environmental data or strategic plans. The availability of these datasets within one common data pool helps to significantly reduce the time needed for the feasibility studies required for wind farm development. As the value of each dataset on itself is perceived to be high, mainly due to the fact that this data can be used for a wide range of purposes, the first product of the SOPCAWIND project are the processed datasets which are available for download in a specific format and for a specific area. Additionally, an API has been defined and implemented that allows information from the datasets to be integrated in other applications using a Data as a Service (DaaS) approach.

The second achievement of the project is the creation of an Optimisation Module that optimises the micro-siting of the wind farm. It uses a custom designed yield and cost model which calculates the expected energy production and cost for several candidate layouts. Results are returned to a multi-objective optimisation algorithm which iteratively selects the best wind farm layout by optimising one or both parameters. The optimization module takes into account the constraints related to wind farm development, including environmental constraints and telecommunication impact among others.

Finally, IT experts have designed a web tool called ‘The SOPCAWIND Tool’ which works as an interface to the users in order to enable them to use all this information and functionalities to design an optimal wind farm layout. The tool guides the user through a step by step process which has been defined by wind farm experts. The tool offers several functionalities to enable the user to import and export information, visualise this information using GIS technologies, to create reports, run impact studies or execute optimizations.

It can be concluded that, ahead of existing technologies, the SOPCAWIND tool offers a combination of three crucial steps within the wind farm design process being, the visualisation of all constraints which could limit wind farm development within a certain area, the calculation of the optimal layout configuration for the wind park within a certain area as well as the assessment of potential impact of the wind farm on the surrounding e.g. impact due to flickering, noise and telecommunication system disturbance.

The complete tool has been designed using open source technologies in order to design a flexible, scalable and cost-effective solution. The web tool uses a solution based on Spring framework, JQuery, Openlayers, and Geoserver which enhances user experience by providing a very rich and powerful interface. Being a web solution it has been designed to run in any device: server, laptop, tablet, smartphone, etc. PostgreSQL (with PostGIS spatial extension) has been chosen as the solution for hosting the SOPCAWIND Database.

The SOPCAWIND tool is now deployed and ready to be used. All the public information about the project, including the public deliverables, papers and a video based demonstration are available through the project website: www.sopcawind.eu. Furthermore, demonstration licenses are offered to any interested company in order to evaluate the tool.