GEOGRID solution

Company/Organisation

Software Company Ltd (SC) is a Bulgarian private firm that specializes in software development. Since 1996, the company has offered a wide range of high-quality services in the development, delivery, and maintenance of software in Europe and USA.

SC's key market advantage is the ability to leverage a wealth of experience in this sector, a network of local and international partners, and a very competitive pricing strategy to deliver quality software solutions. The company is also ISO 9001:2015 certified.

SC has experience in gathering requirements, designing, building and testing software related to electricity networks, renewable energy, medical imaging, business intelligence and others. In addition, the company is experienced in developing and customizing business intelligence applications, as well as software for managing databases and data mining.

SC has worked with a number of partners from Europe and USA in the following areas:

- Transmission and Distribution grids applications/software
- Green Energy and Energy Efficiency software
- Medical Software – PACS and RIS
- Custom software development
- Web sites and Internet aware software
- Database management software, Data Warehousing, Business Intelligence

Software Company has successfully participated in several FP7 projects while participates in ongoing Horizon 2020 projects related to transmission and distribution grids such as: FLEXITRANSTORE (http://www.flexitranstore.eu/), INTERRFACE (http://www.interrface.eu/), FARCROSS (https://farcross.eu/), ENERGYSHIELD (https://energy-shield.eu/) and others.

Nikolay Palov (male), General Manager. He started up an entrepreneurial activity when he was a recent graduate and has been managing two companies for the past 30 years. He has delivered a number of software solutions spanning across areas such as renewable energies and medical imaging. He has participated over 35 projects the past 30 years and has accumulated a great deal of expertise in this field. He comes from a technical background, having graduated Engineering from the University of Ruse.

Plamen Tonchev (male), Project Manager. He has over 30 years' experience in computer programming and has worked as a lead developer on a large number of projects. He holds a Master's Degree of Math Operations in Computer Programming from the University of Sofia. In terms of technical knowledge, he works with Microsoft Visual C#, C++, JAVA and others.

Maria Atanasova (female), Computer Engineer. She holds a Master's Degree in Computer Engineering from the University of Ruse. She has over 30 years experience in computer programming, testing, business intelligence, web design. Her programming skills include MS SQL Server, SSAS, Microsoft Visual C# and others.

Viktor Kostadinov (male), Software Engineering. He holds a Master's Degree in Software Engineering from the University of Ruse, Bulgaria and has a very strong technical background. Viktor has considerable experience in software development. His main expertise is in application development while he possess significant modelling skills including UML representation with a special focus on sequence diagrams and class.

Short Description

Challenge & aim

The software packages commonly used by the system operators are mostly focused on those tools that can guarantee the reliable power system analyses. The ways in which the results could be offered to the wider audience, are being heavily neglected. In order to mitigate these events, the tool that would be developed in the scope of this proposal intends to cover both of the mentioned aspects of work. The detailed power system analyses (corresponding to the main advantages of the currently commercially available tools) and the comprehensive way of presenting results, guaranteeing the novel functionalities that would be offered to any potential users.

The aim of GEOGRID is to prototype a multisided platform to complement the F-channel platform for the additional modelling of the grid, power system analysis and illustration of the results on the georeferenced GUI through GIS server application. The proposed use case will particularly focus on residential prosumer and other low voltage installations which are usually not scope of the modelling by TSO or DSO, simulating a portfolio of Prosumers equipped with PV, flexible storage as well as EV smart charging (V1G and potentially V2G) providing a large variety of flexibility options into balancing and TSODSO congestion management processes particularly, as well as usage of DER flexibility potential on a higher levels, especially by TSO operators. To achieve that, SOFTWARE COMPANY EOOD (SC) will develop the necessary simulation models, as well as geographic visualization of simulation results, exposing results and linking to other services being developed under F-channel platform via GIS technologies. The proposed solution will be coupled with the F-channel platform for performing the necessary calculations in the power system, such as the power flow analyses, voltage state estimations and the N-1 reliability assessments. This will give the system operator the level of insight that was not available ever before, with the benefits being almost immeasurable. Finally, the GIS layers and the blueprints of the interlinked layers could be further used on other similar projects, through the developed geo server and associated database/s.

Proposed solution

Power system is obviously evolving and rapidly changing the last few decades. This change will continue, and a vision of the fully decentralized system will soon become the reality. The new vision, based upon the distributed production of the energy in the renewable sources, brings the new challenges with it, where the particular attention should be given to the need for providing the necessary, additional amount of flexibility to the system. Flexibility, in new power system paradigm is no longer strictly connected to the high voltage, controllable resources, but is also distributed in a lower level entities. This brings us to the problem of identifying and exploiting those new distributed FSPs, but also it brings a huge chance of making flexibility services capable for finer “tuning” of the targeted power system parameters. Like the change from old low resolution robust TV screens, into subtle, high resolution screens, which change both quality of usage and perspective for the end users. In order for this to be achieved, the strong cooperation between the TSO and the DSO needs to be established, with each of the operators being aware of the state of the system beyond those voltage levels that were previously of interest to them. In order to avoid misinterpretation of the results/information by the end users, the solutions proposed in the scope of this proposal would use the geographical map for showing any of the requested information, as the universal medium that

literally all of the potential clients would find clear and easily understandable, being scalable and useful for any future application. An additional feature that could further assist the operators in the appropriate fulfillment of the tasks they are assigned would be the modification of the aggregation level, meaning that the operators would not have to deal with the enormous amount of data (even in the visual form, it could be tedious and slow down the process significantly) shown in the entire map of the power system. Instead, the level of granularity that will be used when presenting the data to the end users will solely depend on the zoom-level of the client's window, with the higher level of zoom also providing the higher level of map granularity, i.e., the higher resolution in which the results are shown. To simplify, if the user would not be satisfied with the resolution of the map, they could simply zoom in and, by that, reduce the geographical scope of the map that they are shown, but also increase the resolution all the way to the single entities in the system. Finally, regarding the potential for replication of the described solution, it should be stated that it is rather high, since the necessary input data for the proper implementation of the solution would not differ much from the standard set of data that is available to every system operator – the technical characteristics of the system, the geographical characteristics of the power system (above all, the coordinates of each system element, including the single energy entities) and the weather forecasts for the area of interest. Of course, the latter could prove to be more difficult to obtain than the prior two, but, if this information would be at disposal, the developed tool could be adapted to accommodate nearly every real-life power system and to fit the needs of the various potential users, starting from the system operators, but also including both academic and the industry-oriented projects that could get important insights by using this tool.

The goals that would be covered by the proposed solution would match the ones requested by the Scenario 1 of the OneNet Open Call (i.e., Deep power system analysis through GIS server application). The details on the ways in which these goals would be reached are presenting in the following sections.

It is clear that the vision and the requests of this scenario are founded upon the two main goals that are supposed to be achieved by the proposed solution. The first of those would be the development of the mathematical model that could incorporate the sufficient details on the characteristics of the distribution system down to the lowest level entities (in the Call, the households, the solar units and the wind turbines are listed as those entities that should be taken into consideration). The second main goal would be the development of the connection to the GIS server that would be used as a tool for combining the geographic and the technological characteristics of the system, allowing the results to be shown on the accurate map of the selected region. Since the description of the tool that is submitted via this proposal includes both of the mentioned improvements, it can be said with confidence that it is aligned with the scope of the Call.

This section will be separated into three paragraphs, each of them dealing with one of the KPIs listed in the previous part of the proposal. First of all, the model itself would be developed in such a way that its modification and the adaptation to fit the needs of the user at the easiest possible way, with the exact format to be defined by the potential employers. What is certain, however, is that the proposed under development tool will include the model of the sufficient granularity and level of details to fulfil the requirements stated in the Call. Also, it should be highlighted that all of the codes for performing the necessary analyses would be written in one of the Open Source programming languages, giving the opportunity for the quick and simple modifications in case of need, whether for some of the more prominent corrections or for the adaptations to some cases that are not initially foreseen by the project in question. The second objective of the GEOGRID is the development of the GIS server and map in which the entire power system of the analyzed region would be shown. The main aspect upon which the focus is placed is the possibility of changing the amount of the data and

number of elements shown in the map with the change of the zoom-level of the map itself. Along with this, the map will also include the option of spatial query, i.e., by definition, the option of providing the user with the required set of information upon the simplest actions, such as the clicking at or hovering the mouse cursor above the element of interest to them. Finally, the custom-tailored GUI, that is envisaged so that it could reflect the customer needs verbatim, is founded upon the idea of allowing the client to use with the most efficient way the developed tool. The appearance of this GUI will be defined in cooperation with the employer, but what is already decided is that it would give the users an overview of the map of the system, allow the simple initiation of any actions that user may want to undertake and print out the ondemand automatic report of the results by the specifications provided by the user.

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Development of the solution will be divided into 5 tasks:

1. Development of the georeferenced grid simulation model which contains consumer's (different types and connesction schemes of prosumers) detailed physical models of the connected production units (microgrid simulation models), for different types which can be integrated with the rest of the F-channel modelled grid on Crete.

2. Development of the load profiles of a typical industrial consumer, commercial consumer, residential consumer for characteristic days in summer, winter, system peak.

3. Development of the database tables based on a GIS server, its connection towards the developed microgrid simulation models as well as load behaviour models and its integration into the F-channel GIS server.

4. Development of the GUI to support the simulations and calculations with GIS map results presentation.

5. Overall GUI integration within the F-channel app existing GUI.

Expected results

This solution will allow for full inclusion of residential and industrial prosumers, with its detailed simulation models into the overall power system simulations (TSO network model + DSO network model + prosumer model). It will enable inclusion of the lowest level energy entities into the list of flexibility service providers. The common simulation model of the selected part of the system in the required resolution, together with the GIS server upon which the necessary data will be uploaded and the custom-made GUI will make the overall solution useful and handy for both TSO and DSO short and mid-term planning departments through the f-channel platform. More on this will be given in the separate chapter of this application that will go into the individual KPIs and the deliverables that should be provided during the project realization.

The two main improvements that are aimed in this proposal are the development of the power system simulation model that will include the voltage levels down to the lowest ones, and the creation of the GIS server that will be used for the visualization of the obtained results. In accordance to that, those two improvements can be treated as the first two KPIs that can be used to measure the success of the work that will be done in GEOGRID project. The third KPI that is relevant to this proposal revolves around the user-friendly GUI that is imagined as a mean of making the usage of this tool rather simple and intuitive representing the final step in making the services offered by the tool that is getting developed accessible to any interested stakeholder.

Figures

Company's Logo (high-res transparent)