e-Report Generator Supporting Communications and Fieldwork: A Practical Case of Electrical Network Expansion Projects

Emerson Castaneda-Sanabria
, Miguel-Ángel Manso-Callejo
Universidad Politécnica de Madrid
Madrid, Spain
emecas@ieee.org, m.manso@upm.es

Francisco-Javier Moreno-Marimbaldo
Department of the Environment
Red Eléctrica de España (REE)
Madrid, Spain
fmoreno@ree.es

Federico-Vladimir Gutiérrez-Corea
Universidad Politécnica de Madrid
Madrid, Spain
fv.gutierrez@upm.es

***Abstract*— In this piece of work we present a simple way to incorporate Geographical Information System tools that have been developed using open source software in order to help the different processes in the expansion of the electrical network. This is accomplished by developing a novel fieldwork tool that provides the user with automatically generated enriched e-reports that include information about every one of the involved private real estates in a specific project. These reports are an eco-friendly alternative to paper format, and can be accessed by clients using any kind of personal device with a minimal set of technical requirements.**

Keywords - Geoprocessing, Assets and Rights Report (ARR), Government and public GIS, Geo-modeling.

I. INTRODUCTION

Electric power supply is essential for the functioning of society since it plays a prominent role in maintaining the standard of living [1]. Electric power is the engine of growth of any developing country, so no major economic activity can be sustained without adequate and reliable power [2]. For this reason the electric power transport and distribution is considered a public utility service.

The Spanish Electrical Network (REE) is the owner of the entire high voltage electric energy transport network in the Spanish territory; it is responsible for its expansion, maintenance and management. The high voltage electric lines located on the territory induce different affections on public and private property land. These affections may be of different types of occupation or easement and should be thoroughly identified on the pertinent documentation to be included into the execution project of these types of infrastructures. Every project is endorsed, approved and processed according to the responsible body corresponding to every particular case; 400 kV installations should be processed according to the requirements of the State Administration; 220 kV installations are handled complying with the requirements of the involved regional governments. This fact implies that the way the projects are presented are not homogeneous since requirements are variable in the Communities and are continuously evolving. This changing situation concerning the requested documentation compels the REE to handle the project data in a structured, standardized way, integrating new processes within consolidated workflow.

The project information is handled as a whole and in the case of possible affections on real estate, lists are generated with the cadastral data of every plot and the result of the calculation of affections due to the new electrical installations. In Spain these lists are affected Assets and Rights Reports (ARR) for landowners. Due to the current high demand, the creation of ARR has been turned into an evolving process with the aim of reaching the goals defined by the strategic plans of the Ministry of Industry, Tourism and Trade. These ARR always go hand in hand with a set of plans containing the pertinent cadastral cartography and the information about the new installation where geographic information about affections is incorporated. The association ARR – set of plans becomes an indivisible unit needed for understanding of the new situation that will take place after building and commissioning of the new installation. From the point of view of the technical drafting of the project, its deliverables, and the competent Administration in the handling of each project, that information is sufficient for the understanding of the project. However, the data of affections should be made known through the public information, so that according to the law the owners of the affected assets have knowledge of the future situation and are able to plead as they see fit.

GIS technologies have an invaluable number of applications in most of the areas related to human development. The electricity market is one of the candidates highly likely to be improved by adopting GIS technologies. Some interesting examples of applications of GIS technologies in the electricity market are: a mobile computing system for repairing and patrolling of electrical power facilities as described in [3], a decision support system based on spatial information of land resources [4], and the development and application of GIS in power marketing and expansion [5].

This paper introduces a simple way to incorporate GIS open source tools in order to assist different processes in electrical infrastructure projects. Some of the processes that are targeted in this work are the group of activities derived from an expansion of electrical networks.

Our contribution can be summarized as a fieldwork tool that supports technical aspects during the development of negotiation process activities. It provides a clear and human understandable preview of future affections that will be produced because of an expansion of the electrical network.

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It also offers a global graphical vision of the susceptible elements included in the project. This vision can be distributed using a tool that allows getting enriched automatically generated reports. Economic, statistical, and geometric information about each individual part of the project can be included with any kind of useful data and descriptors.

On one hand, the automatically generated reports can be taken on as an official communication tool that involves REE, parcels owners, public administration organisms and the citizens. On the other hand, a remarkable purpose is to reduce the impact on natural resources (paper) by focusing on the adoption of e-information policy to expand information society. These kind of e-reporting tools are easily developed with open source resources on an inexpensive hardware infrastructure, which can be accessed by clients using almost any kind of personal device with a minimal set of technical requirements.

The remainder of this paper is structured as follows: section II provides a complete definition of the issue and its solutions. A review of the pertinent literature is presented in Section III.. Section IV presents the proposed methodology followed by the technical aspect of our proposal. The obtained results are discussed in section V. Finally, section VI includes conclusions and future development.

II. DEFINITION OF ISSUE

The issue is the need for a graphical representation of the future affections that will be brought about by the expansion of the electrical network. The purpose is for involved citizens, government, and the electrical network company to be offered as an available digital system supporting official communications (e-reports) able to incorporate economic, statistical, geometric information, or any kind of useful data about the expansion projects. We provide a system to give a solution to the lack of this type of communication so far.

Public utility administrative recognition implies a number of obligations which include the formal legal notification to the owners of the affected assets. The government gets closer to citizens by showing a growing concern for the difficulties of the plots owners affected in understanding the technical information, especially old age citizens for whom cadastral codes and interpretation of maps is a problem. The legal notification to owners of the affected plots is carried out through publication on the Official State Gazette in every case. The projects depending on the State government are published on the Official State Gazette (BOE), Official Province Gazette (BOP) and on two of the most widely read newspapers. The projects whose competence rests with the regional government are published on the Official Autonomous Community Gazette, the Official Province Gazette and two of the most widely read newspapers. Thus the owners of the affected plots will learn about the new situation that will take place in their properties.

Pari passu the Local government has opened a new way of communication with the owners consisting of sending them specific information about the affections of the new installation on their assets. This information should be generated by the REE and this in turn could bring about important delays in the preparation of the project and in the terms established with the different players of the process.

The solution to this new requirement should be integrated into the consolidated workflow, generating a new result using the available data. To that effect, we have designed two types of tools. The first one enabling visualisation of the project's geographic information using maps publishing standards (WMS-OGC) [6]. The second type of tool carries out automatically the necessary tasks to generate the individualized report of the affections of the plots involved in every project. The generation of the reports comprises the creation of a main page made up of a map with the geographic information of the surveyed plot as well as a page for each one of the possible affections.

The manual procedure for generation of these documents comprises different manual processes as follows: (1) *Generation of PDF page* with a quantitative summary and an ancillary graphic of the affections of the new installation on the surveyed plot followed by the generation of another PDF page for each type of affection sustained by the plot. The time consumed by the generation of all the pages making up a single document varies as a function of the number of affections sustained by the studied plot. (2) *Generation of PDF document* by putting together all the pages corresponding to the same plot that have been generated in the previous process. The average time for the generation of a final PDF document is 860 seconds (14 minutes). The average time consumed in the automated procedure is 5 seconds. Therefore a considerable reduction in the terms of execution of this task is achieved.

The new procedure put in place not only influences execution times but it also has a bearing upon the homogeneity of the generated information and its reliability and accessibility. It is of consequence to indicate that it is about a Web application developed with open source software; these facts multiply the possibilities of document generation cutting down the costs derived from software licences.

III. RELATED WORK

The topics covered in this section are: GIS technology applications in the electricity market, main principles of electrical network expansion, tools and methodologies for official communications (e-participation and e-government), and reduction of impact on natural resources.

A. GIS technology applications in the electricity market

Shin et al. [3] present the development of a mobile computing system for repair and patrol of electric power facilities. Shin gives special importance to the integration of a GIS database system with a distribution mobile repair

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work based mobile computing in order to contribute to modernisation of mobile repair work by implementing a system that can track the location of repair vehicles moving all along, so as to dispatch the vehicles to the failed place quickly. There are three main components of Shin's system: the mobile repair server, the terminal for vehicles (Mobile Data Terminal) a PDA device with GPS-based services and the wireless communication network.

A second application is a decision support system based on spatial information of land resources [4]. In this application, Xu et al. highlight the technical support provided by the spatial information technology to the spatial decision support system. They claim the importance of obtaining quickly and accurately the use of land resources and its real-time monitoring by using GIS powerful management and spatial analysis function with the purpose of setting up and honing the whole monitoring system, comprehending land market trends and providing a basis for the government to timely adjust relevant policies.

Finally, the subject of development and GIS application on power marketing and its expansion are described in [5]; the authors state that this application of GIS should not only realise the effect of visual display, quick inquiry, and data management and update of power facilities and circuits, but should also be connected to other existing system and graphic data. They stress improvement of the working efficiency of the system, avoiding repeated investment and saving resources and operating costs.

From the 3 pieces of work above highlighted, we have identified some concepts and elements to be taken into account in our proposal: (1) the mobile computing component with the adoption of a modular architecture based on layers, with clearly identified functionalities, (2) the ability to support fast and accurate decision making based on GIS, spatial systems and new technologies, even in real time scenarios, and (3) the interconnection of GIS applications not only focusing on the display screen, quick reference, management and updating tasks of facilities and circuits, but also for a strategic investment planning focused on saving costs and resources and working efficiency.

B. The main principles of electrical network expansion

An interesting reference about one of the topics related to our work that takes into account the principles of electrical network expansion after a long-term period of planning expansion of the Unified Energy System in Russia is [7]. In that piece of work Voropai starts from the principles of essential updating of electrical network expansion carrying on to a full description of how the requirements for expansion of the Main Electrical Network (MEN) and development of new technologies for power production, transmission and consumption affect the principles of the MEN formation. Furthermore the author includes information about the structure of electrical network expansion planning problems.

In this paper we highlight the principles related to planning and required tools for modelling every single stage of the expansion planning process, namely: Uncertainty Planning: in order to decrease the uncertainty of future conditions of the MEN expansion, it is necessary to develop a technology for planning and monitoring this expansion and the adjustment of its planning. Stages of Expansion Planning Problems: a general structure of the MEN expansion planning problems includes three stages: generation of the MEN expansion options, analysis of their operating conditions, and selection of the best option. The functionality of our system contributes to improve these planning and modelling processes by giving a comprehensive description of the involved areas.

C. Tools and methodologies for official communications

In this section, the concepts of e-participation using GIS and e-Government tools are analysed in order to provide a context about the adoption of methodologies and tools to implement official communications. Our proposal is being presented as an innovative case study regarding the electrical network expansion projects, involving citizen participation in responsibilities of REE, as well as national and regional government authorities.

The term e-participation [8][9][10] is referred to the use of information and communication technologies to broaden and deepen political participation by enabling citizens to connect with one another and with their elected representatives. This definition includes all stakeholders in democratic decision-making processes and not only citizen-related top-down government initiatives. Thus e-participation can be viewed as part of e-democracy, where e-democracy means the use of ICT by governments in general, by elected officials, media, political parties and interest groups, civil society organisations, international governmental organisations, or citizens/voters within any of the political processes of states/regions, nations and local and global communities.

On the other hand, the term e-government [8][11][12] is referred to digital interaction between a government and citizens (G2C), government and businesses (G2B), and between government agencies (G2G). This digital interaction consists of governance, business process re-engineering (BPR), and e-citizens at all levels of government (city, state/province, national, and international). Essentially, the term e-Government,Digital Government, refers to ‘How government utilises IT, ICT and other telecommunication technologies to enhance the efficiency and effectiveness in the public sector’.

A study involving an evaluation of GIS tools and e-participation is [13]. In this piece of work, Loukis et al. performed a systematic evaluation of an e-participation platform based on GIS tools. The evaluation methodology was based on the Technology Acceptance Model (TAM) [14]. It was worked out and adapted to this specific types of information system taking into account the specific

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objectives and capabilities of this platform. The main evaluation dimensions were usage, ease of use, functional usefulness, political usefulness and importance of discussion topic; each of them was analysed into a number of sub-dimensions. Using this methodology five pilot applications of this platform in 'real-life' situations and problems were evaluated with both quantitative and qualitative techniques. Finally, the work concludes that the use of GIS tools can provide significant value in the area of e-participation, which however depends on a number of context factors such as citizens' computer literacy and familiarisation, trust in the political system, interest of the sponsoring public authorities, appropriate promotion, importance of the topic under discussion, and quantity and quality of reference information appended on the digital maps by public authorities.

One additional reference related to the improvement of Web content delivery in e-government application is [15]. This piece of work focuses on creating a Web platform for accessing, processing and delivering statistical data in an effective way. The platform consists of a set of integrated tools specified in the organisation, validation, maintenance and safe delivery of statistical information resources on the Web. The idea is the enhancement of a system providing direct dissemination functionalities to authorized international users. Datasets are tested and validated on the national level, then they will be stored in the Transmission System Database, from which it can be downloaded by Eurostat [16]. The work presents all motivations and technology background for the implementations and it also includes a full case study with the consideration of the implementations. Finally, it concludes that the statistics, production, and dissemination process are improved because the validation verifications take place at an earlier stage as it is performed by the National Statistical Institute itself whereas the transmission is performed by Eurostat.

D. Reduction of impact on natural resources

The topic about the reduction of impact on natural resources is mainly handled from two perspectives. One of them is based on the reduction/replacement of paper use, focusing on the adoption of an e-information policy. An additional benefit and motivation for the adoption of our proposal is that these e-information tools are easily developed with open source software on a low-cost hardware infrastructure that can be accessed by customers with almost any personal device with a minimum set of technical requirements.

A second perspective is related to the adoption of a ubiquitous e-custom service such as the system described in [17]. Razmerita and Bjorn-Andersen address the strategic goals for future custom systems such as simplified paperless trade procedures, the advantages of using novel technologies and the inclusion of an innovative e-custom system architecture. The main technologies for innovative trade procedures considered by the authors are the Web Services (WS), Services Oriented Architectures (SOA) and The Tamper Resistant Embedded Controller (TREC). These technologies are directly involved in our proposal, as described in the following section.

On the other hand, adopting the redesign of administrative procedures for international trade is presented by focusing on the ITAIDE Project (Information Technology for Adoption and Intelligent Design for e-Government, www.itade.org) which has two objectives: reducing the administrative costs implied in the international trade transactions while increasing security and controlling trade procedures. Our work is the first approach to the redesign of administrative procedures to make them more efficient and useful. This affirmation is based on the solicitations for the adoption of our tool received from regional government authorities, in order to notify all people possibly affected by electrical network expansion projects and during field work.

IV. DESCRIPTION OF THE PROPOSAL

This section presents the proposed methodology and the technical aspect of our proposal including details about system architecture, inputs, procedures, outputs, and web user interface.

A. System Architecture

Fig. 1 shows the proposed solution for the implemented architecture; an prototype has been developed by using an incremental methodology.The main parts of this architecture and a brief description of the architecture are as follows: (1) Web Server: it is responsible for publishing the WebApp on the Internet. This server can redirect the requests to the application server or provide the service as a web container. (2) GeoDatabase: it is the repository that stores the entire spatial information related to the expansion project. (3) Data Services: data services are required to provide additional alphanumerical information and to establish additional connections to other database or GeoDatabase. (4) Map Server: it provides the service of maps using the OGC standard Web Map Server (WMS). (5) Web Reporting Application: it is responsible for handling the clients' requests and for generating the e-reports that integrate spatial and alphanumerical information, through interaction between Data Services and Map Server. It is the core of our proposal making geoprocessing tasks to integrate alphanumerical and spatial information and incorporating novel technologies and standards for web development and GIS. (7) Clients: users of the Web Reporting Application such as mobile devices, PCs, or any device with minimum requirements to establish connection with the Web Reporting Application and to handle answers as e-reports.

B. Inputs

The inputs for the process of generation of e-reports are the Data Tables and the 16 Layers (both are contained in the GeoDatabase Fig. 2.). One of the layers represents the real

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estates involved in each electrical installation project (Base Layer); this information is generally obtained from the Cadastre. The rest of the layers represent the 15 affections (Affection Layers), which come from studies for every new electrical installation project to take decisions and to estimate the information by affections.

The number of affections that may influence the real estates is 15: aerial trace (superficial electrical cable generally suspended between pylons); underground trace (part of the electrical cable is buried); flight (safety area represented by the possible maximum movement of the electrical cable due to the influence of wind with a velocity of 120 Km/h perpendicular to the axis of the electrical line); tube (representing the vertical projection of the cables on the ground with wind of 0 Km/h); felling (area that should be felled around the trace for safety purposes); permanent occupation area (area occupied by the pylons); permanent underground occupation (surface the underground power line will occupy permanently); temporary occupation area (needed area for the building of the electricity pylons and other materials); temporary underground occupation (needed occupied surface for underground electric wiring); splicing chamber (area occupied permanently by concrete boxes where cable splicing is carried out); telecommunication boxes (surface permanently occupied by the boxes used for telecommunication equipment associated to underground cable for remote manoeuvring of the line); landmarks (surface occupied by concrete posts in place to indicate on the surface the underground channelling of electrical cables); accesses (easement needed for access from the electrical installations for building and maintenance); auxiliary 1 and auxiliary 2 (two generic affections available in the future if needed).

C. Procedures

In a previous stage, information for a new expansion project has been SDI standard-complying and the data have been converted to the interchange Geography Markup Language (GML) format [18]. Once the data have been submitted, using transactional operations to the server which implements the WFS-T, the *GeoDatabase* is ready to serve as data source from the input layers and data tables. The layers may be queried in a standard way through the Map server by using the WMS and WFS services to get spatial information, and data tables through the Data Services which provide the alphanumerical information.

The core of our geoprocessing consists of the integration of both kinds of data sources in order to get a single and portable document format through a real time procedure. On one hand, the procedure identifies, builds, and executes all needed requests to the map server to obtain the graphical information subset. The identification part defines which layers are involved in map construction, the building part integrates the different elements related with bounding box, styles, colours, labels, scale, and the executing part is related to the control of process to request every single petition and manage these graphic temporal results for its future integration into an e-report. On the other hand, the procedure identifies and recovers through the Data Services all the alphanumerical required information to enrich every single e-report. Finally, the process join both kinds of data to build an e-report by filling templates previously structured and designed. This same geoprocessing used to get a single e-report is executed in an iterative way to get all the e-reports of a specific project.

D. Outputs

Fig. 3 shows the e-report of a project of electrical network expansion that includes the ARR of a particular rural area affected by permanent occupation, power lines passing across and deforestation. In this case the e-report is made up of 6 pages; in our system this kind of e-report could contain up to 16 pages.

The first page shows an outline of the zones of every potential impact on the area susceptible to affection by the expansion project. The next 5 pages detail each one of the areas of real estate that could be affected and the way the affections would be distributed into and around the property. This particular example includes 5 kinds of affection: a. accesses, b. flight, c. felling, d. permanent occupation area, and d. splicing chamber. In addition, other output of the tool is a zip file that contains all e-reports related to a specific expansion project in case that the PDF massive generation option has been used.

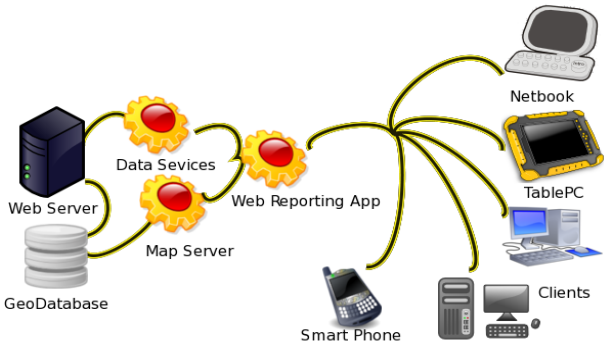

Figure. 1. Proposed Architecture

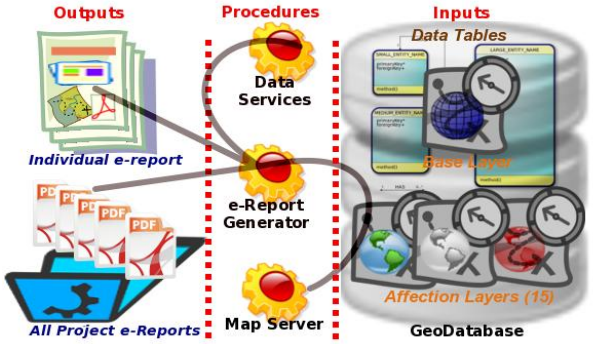

Figure 2. Inputs, Procedures, and Outputs involved in the geoprocessing

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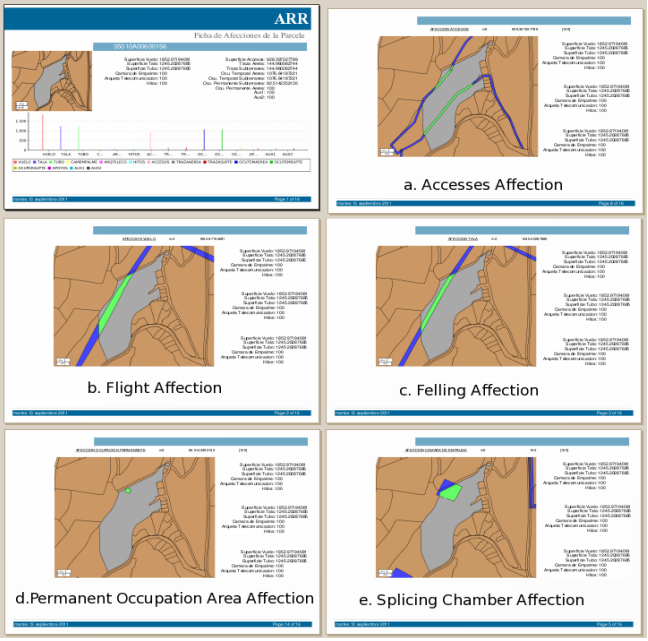

Figure 3. e-Report of affected assets and rights

E. Web User Interface

A Web User Interface is developed using broadly extended Web technologies (HTML and Ajax with the Apache Click API); the system works to assure that almost any mobile device interacts with the Web Applications handling the answers as e-reports (usually PDF).

A Web interface can be appreciated in Fig. 4. It includes part of the main menu and shows auto-complete option that allows the user to search for an individual real estate stored in the spatial database. If the user gets a valid record it will be displayed showing its graphical and alphanumerical information before it generates the e-report. Subsequently the e-report may or may not be requested by the user. Tool includes the option to generate all the e-reports as part of an expansion project and to select the project code and see the list of all the affected plots.

Fig. 5 shows the last confirmation before starting the process of generation of all e-reports in a project. Included is a checking box option to exclude all the real estates that are part of the project but will not be affected. The project shown in Fig. 5 is made up of 1101 realties with the possibility to exclude 858.

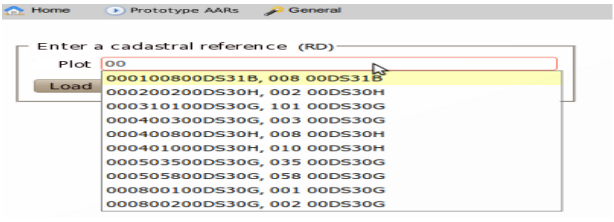

Figure 4. Web user interface searching properties

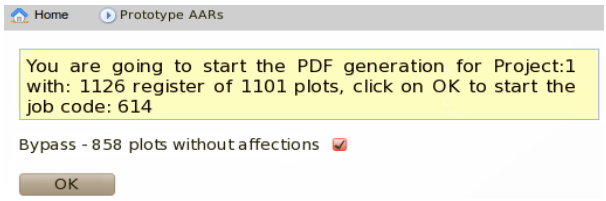

Figure 5. Web user interface before e-report generation for a full project

In this example the generation of 255 e-reports has taken approximately 24 minutes and a total of 1478 images have been generated to produce 255 PDF files (a total size of 80 Mb); that means 1478 successful requests from the Web Reporting Application to the Map server using WMS and 255 requests from the Web Reporting Application to the Data Services to make the geoprocessing tasks to integrate alphanumerical and spatial information.

V. RESULTS

After many iterations of the prototype we have got relevant functionalities about e-reporting that allows us integrating in a single document all the necessary information for every vulnerable real estate to be affected during the electrical network expansion project.

During the first iterations of the project some inconveniences occurred related to the time needed to get the output as an e-report in PDF format. They were cleared up by incorporating a new manner of creating the output that allows handling the process on a low level and at the same time supporting characteristics to produce all the e-reports associated to a specific project on a large scale; the technologies taken on for that solution were JasperReports API, data services implemented with Apache Cayenne API, and an image generator using WMS requests to the Map Server (Geoserver).

The adoption of all these technologies results in a scalable architecture that can be strengthened with new elements whenever the prototype requires to incorporate any new functionality or be improved in order to go on to a new stage.

It should be taken into account as a relevant advantage that every one of these technologies can be manipulated as a plug-in which, depending on its performance, can be kept as a part of the proposed architecture or be replaced with a better element. We want highlight that all the technologies incorporated into the prototype stick to the philosophy of open source development and are under GNU general public licences.

Fig. 6 shows a comparison of the times needed for the manual and automated procedures for e-report generation; the automated method is approximately 175 times faster than the manual method. The manual method is able to generate 1000 e-reports in 14000 minutes (around 10 days) while automated method would need just 80 minutes.

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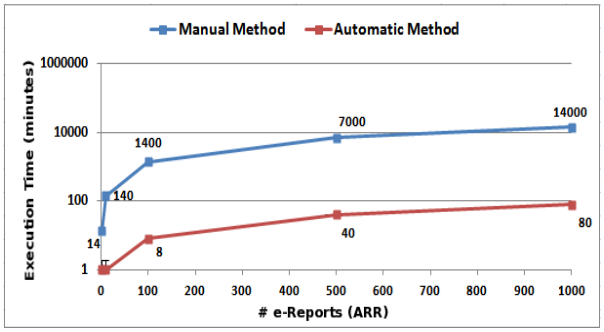

Figure 6. Times needed by traditional and automated methods

As said above, the average time consumed in the automated procedure is 5 seconds per e-report. An important reduction in the terms of execution of this task is achieved. The new procedure influences not only execution times but also has a bearing upon the homogeneity of the generated information and its reliability and accessibility.

VI. CONCLUSION AND FUTURE WORK

The results obtained reflect a favourable situation for all parts involved. On one hand REE incorporates new automated processes into the consolidated procedures providing greater and better information for interested users without warning about delays in the committed terms. On the other hand, the Government satisfies its need to ensure that the rights and obligations of a public utility of an installation are respected, and finally the owners of the affected assets will have a specific, detailed knowledge of the affections the new installations will generate on their real estates.

The new procedure put in place not only influences the execution times but also bears on the homogeneity and reliability of the generated information, and since we are dealing with a Web application, accessible from any point with Internet connection, the possibilities of documentation generation are multiplied and the software licence costs are reduced.

As future work we have planned the incorporation of a security mechanism similar to the one described in [17]. We have taken a step toward the implementation of an e-custom system with characteristics that respond to the new requirements of REE and users. We expect the model to be adopted as an official communication tool that should be recognized by government authorities and any additional social player participating in or being affected by the expansion project.

Along this line the first requests from the different regional government are being formalised to implement the tool during the process of notification to people affected by the network expansion project and by the necessary field work; thereby a second stage is anticipated for continuation of further development of the tool.

REFERENCES

[1] T.Ramachandra, V.George, K.Vamsee, and G.Purnima, Decision support system for regional electricity planning. Energy Education Science and Technology, 17(1): 2006 pp.17-25.

[2] A. Kumar , S.D. Bhatnagar, and P.K. Saxena Integrated multimedia based intelligent group decision support system for electrical power network. AJIS (Australasian Journal of Information Systems). 9(2). May. 2002.

[3] J. Shin, B. Yi, J. Song, J. Kang, J. Lee, and S. Cho, “A Development of the Mobile Computing System for Repair and Patrol of Electric Power Facilities,” in Fourth Annual ACIS International Conference on Computer and Information Science, 2005 pp. 622–627.

[4] S. Xu, P. Yan, and X. Wang, “Application research of land resources decision support system based on spatial information,” in 2010 18th International Conference on Geoinformatics, 2010 pp. 1-5.

[5] X. Du, L. Wang, and A. Sun, “The development and application of GIS on power marketing and expansion,” in Information Science and Engineering (ICISE), 2010 2nd International Conference on, pp. 4143 -4146, 2010.

[6] Open Geospatial Consortium Inc. (OGC), "OpenGIS Web Map Server Implementation Specification" OGC 06-042, Mar. 2006, pp. 1-85

[7] N.Voropai, “Main Principles of Electrical Network Expansion in a Market Environment of Russia,” in 2006 International Conference on Power System Technology, pp. 1-6, 2006.

[8] Wikipedia contributors, Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/ (accessed September 16, 2011).

[9] MOMENTUM. Project to monitor the existing and on coming eParticipation projects co-funded by European Commission, http://www.ep-momentum.eu/

[10] PEP-NET. European network of all stakeholders active in the field of eParticipation. http://pep-net.eu/

[11] eGovernment at W3C: Better Government Through Better Use of the Web. http://www.w3.org/egov

[12] Open Directory Project: Government Computerization Section.http://www.dmoz.org/Society/Issues/Science_and_Technology/Computers/Government_Computerization/

[13] E. Loukis, A. Xenakis, R. Peters, and Y. Charalabidis, “Using GIS tools to support e_participation - a systematic evaluation,” in 2nd IFIP WG 8.5 international conference on Electronic participation, 2010 pp. 197–210.

[14] R. J. Holden and B. Karsh, “The Technology Acceptance Model: Its past and its future in health care,” Journal of Biomedical Informatics, 43(1), Feb. 2010. pp. 159-172.

[15] K.Markellos, M. Katsis, and S. Sirmakessis, “Improving Web Content Delivery in eGoverment Applications,” in Tools and Applications with Artificial Intelligence, 2009, pp. 181-197.

[16] Eurostat: Detailed statistics on the EU and candidate countries. http://epp.eurostat.ec.europa.eu

[17] L. Razmerita and N. Bjorn-Andersen, “Towards Ubiquitous e-Custom Services,” in IEEE/WIC/ACM International Conference on Web Intelligence, pp. 833–837, 2007.

[18] International Organization for Standardization (ISO), "Geographic information - Geography Markup Language (GML)," ISO 19136:2007, Dec.2010.

 ISBN: 978-1-61208-178-6