Supervision Project for Chicapa Hydro Plant, for educational purposes, using Citect SCADA 2016

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BACKGROUND

When analyzing the use of energy in Angola, the electricity sector should be considered as having a real importance in relation to the country's growth, since it has a great importance in the development and expansion of economy and the consequent improvement of basic living conditions of the population, taking into account that its operation has a fundamental impact on other sectors. In this sense, the use of hydroelectric power plants has great importance as a demonstration of use of renewable resources.

Chicapa Hydro Plant

OBJECTIVES

1. To show the main characteristics of technological process of Chicapa hydro plant, as an example of use of renewable energy in Angola.
2. To prepare a non-complex example to explain the work with the interface of Citect SCADA 2016 software and it´s importance.

MATERIALS & METHODS

Citect SCADA 2016 comes in new engineering environment, Citect Studio, which is a brand new user interface. Citect Studio is divided into several "activities" accessible via a vertical Activity Bar to the left, include:

- Projects - Create and manage your projects.
- Topology - Configure system computers, clusters and I/O devices.
- System Model - Configure and view equipment, variable tags, alarms, trend tags and accumulators.
- Visualization - View and configure menus and commands.

Besides, can configure user permissions and others. These activities reflect the steps to build a Citect SCADA project at easier way, if you compare with old versions.

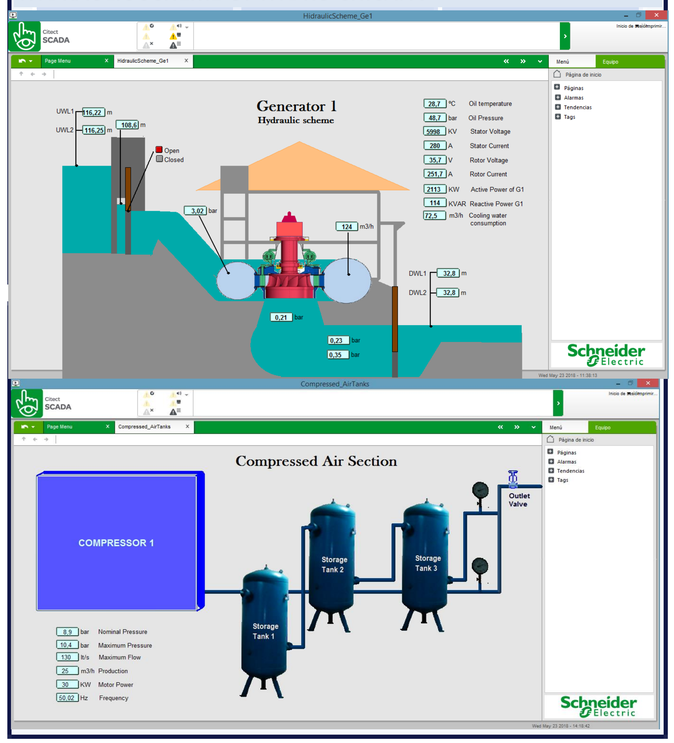
The highlight of Citect Studio is the Grid Editor, which makes editing values easy, with a tabular editing of variable tags, alarms, trend tags, equipment, and so on, across an entire system rather than on a per project basis. Besides, it allows easier edition and multi-column sorting and filtering. In addition, bulk editing of multiple records is possible and Property Grid is shown where you can update each one of component values and the related information of computers, network addresses, clusters and services being used is quickly shown in a single view . Citect SCADA 2016 has another vantagem: it is supported on several platforms of Windows® .

For drawings of this supervision project, some new objects related to hydro process were added by author to Citect SCADA 2016 library, using its Bitmap Editor tool.

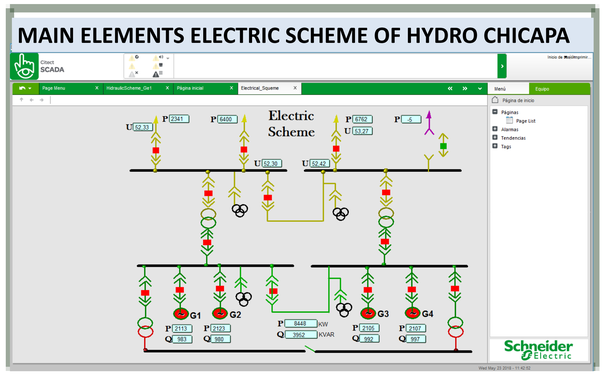
RESULTS

In hydro plants the force of water is used to produce movement in turbines that are coupled to alternators, which transform that movement into electrical energy. An example framed in the social influence of the Polytechnic Higher School of Lunda Sul is the hydro plant built on the Chicapa river, refered in this work.

HYDRAULIC SCHEME OF HYDRO CHICAPA



MAIN ELECTRIC SCHEME OF HYDRO CHICAPA



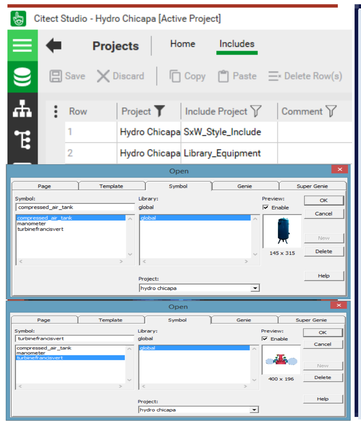
Chicapa Hydro Plant

Hydro plant facilities can be classified into three sizes: micro hydro(<100 kW), small hydro (100 kW - 30 MW) and large hydro(>30 MW). Accorgind to this, Chicapa is a small hydro.

The dam was designed for a reservoir, for which it is a low drop base station. With an installed capacity of 16 megawatts, the right and left margin type dam has a bottom dump, a discharge channel, a water diversion channel, a water outlet and a forced conduit. It has a power station consisting of four "Francis Vertical" turbines with a capacity of four megawatts each and is supported by two 30 and 15 kV open-air substations with 4 output lines for consumers.

Citect Project Topology and System Model

This project includes two building projects of Citect 2016 and, how it is for first experience of students, the runtime is as Stand Alone IOServer, with different types of IODevices, several Tags belongs to the technological and electrical schemes, with simulated values, calculated using Cicode Functions, so they have not the same numerical values that at real process. Some alarms, trends and reports are explained with that project.



Building the graphic pages

For the construction of graphic pages, considering that some technological equipment that we wanted to show (Francis Vertical turbines, compressed air storage tanks, manometers) were not included in Citect SCADA 2016, these objects were drawn, using some diagrams and photographs, edited in the Citect Bitmap Editor, and then incorporated into the library to paste them in the project.

The first graphic page shows the hydraulic scheme of generator G1, since initial water level is measured, covering the entire route through the process until the last water level at the exit of the river. Some examples of measurements and controlled variables are used .

In compressed air section, only measured values in compressor reach the monitoring system, that is, the storage tanks and the compressed air lines have only local measurements. This section was selected due to these characteristics for explaining its limitations for supervision, control and trending data.

In the electrical diagram, 4 generators and their connections to the output substations are shown, with 2 power step-up transformers, which have as output the 4 lines that are used to feed the consumers. These consumers are distant from the generating company, therefore, the objective of these transformers is reduction of transmission losses. Other type of transformers are also part of electrical diagrams, used as an interface between the power produced in generating plant and the equipment used to energize protections and electrical measurements, as well as in the automation system of hydro plant, in that elements dedicated to measurement, supervision and control.

SUMMARY

This work shows a SCADA project for educational purposes, using the SCADA Citect Software in the 2016 version. Several sections of the process of the Chicapa 1 Hydroelectric Power Plant are included, as well as the configuration of graphic screens, variables, measurements and regulation loops, events, alarms, historical records, communication with different Input and Output devices, as well as examples of programing functions for making reports and other calculations that are made using the internal functions of the SCADA Citect software. In addition, it includes some functions for the calculation of working time of technological equipment and monthly elaboration of a file for data exporting, which is a very useful functionality in the industries for the accomplishment of the programmed periodic maintenance. All of this gives a considerable saving of time in learning of both process operation and automation of Hydroelectric Central by students. Besides, it allows the rapid development of projects using the configuration platform of Citect SCADA 2016, new version with functionality enhancements and innovations.

CONCLUSIONS

1. With this work, some of the functionalities of the Citect SCADA 2016 software were used to show the students the development stages of the supervision project and the characteristics of the new user interface, as well as new objects were added to the library that could be used in the future.
2. In addition, main characteristics of technological process of the Chicapa hydroelectric plant are shown, including some important elements such as the main Tags of the technological and electrical section, with their alarms, trends and some reports, to explain the operation of this generating plant as an example of the use of renewable energy in Angola.

REFERENCES

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