

Success Story – Water Treatment



ControlBuild wins the 2006 Suez Innovation Initiatives Award

“ControlBuild Validation allowed us to reduce development costs by correcting errors as early as possible, and guaranteeing a final product that met our expectations.”

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Summary

In 2005, Lyonnaise des Eaux – Suez, a wastewater treatment and drinking water distribution company, founded in 1880, chose to use ControlBuild Validation to perform dynamic tests, without waiting for facilities to be built, in order to anticipate issues and correct the system right from the design phase. The project consisted in renewing the electric distribution panels of a rainwater pumping station. ControlBuild Validation enabled the project team to win the 2006 Suez Innovation Initiatives award.

Context

In 2005 the team, led by Jean-Marc Lier of Lyonnaise des Eaux, renewed the electric distribution panels of a rainwater pumping station with a capacity of 7.5 m³/s and including six pumps, three generators and two mechanical screen rakes. Since this station had to remain operational while the electric panels were being replaced, a temporary electric distribution panel was built to control the equipment during the switchover. The program of the PLC managing the equipment during this phase was developed by simulation with ControlBuild Validation.

Challenge

The management of production sites by automated systems is now essential to meet the evolutions of regulatory, environmental, safety and economic constraints. Beyond a detailed description of the operation, it is still impossible to predict the dynamic behavior of the installation: nothing is done to ensure the reliability of control systems before the start of construction. The validation of automated systems during design phase is very important because the correction of error after installation & commissioning is expensive, risky and sometimes impossible.

Challenge

Ensure the reliability of command-control systems of machines and equipments before the construction start-up, developing secure applications on the first try, unavailability of machinery and equipments.

Solution

Using ControlBuild during design and study phases to verify and correct the system before its commissioning. The model developed under ControlBuild allows to virtually reproduce the behavior of the installation according to the orders issued by the control system.

Result

Lyonnaise des Eaux used ControlBuild in five projects, including three pumping stations. ControlBuild has reduced the design period by 20% and the commissioning by 75%, correcting earlier gaps and ensuring the customer a product in line with its expectations.

Solution

The model of the system was built using ControlBuild Validation from a library of basic components (pumps, valves, motors, tanks, etc.) which was enriched as the project progressed. The internal behavior of each ControlBuild object was described using a common programming language (Ladder, C, etc.) This customized programming method meant that the details of the description could be matched to the needs and context of the project, while using only the necessary properties. A configuration variable was used to convert an All-or-Nothing valve into a proportional valve, and coupling with mathematical models was used to obtain a behavioral image that is ever closer to reality: for example, the mathematical model of hydraulic network behavior following a control structure, or the modeling of a pump flow curve.

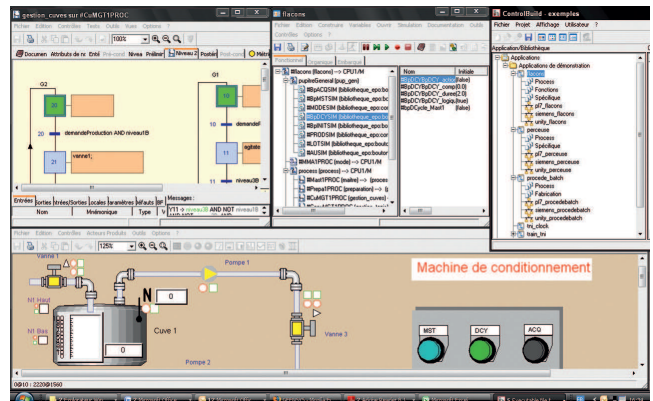


Figure 1 Graphical view of electro-mechanical components and their associated behavioral models

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These components were then brought together in an Assembly and Behavior Model (M.A.C) which was used to describe the links and influences of the objects in themselves. Once the model had been validated by the operators, it was connected to the control system to be tested. It received the commands from the PLC, and simulated the sensors, depending on the programmed behaviors. The acceptance specifications were programmed in scenarios, and the reactions and behavior of the system were recorded for subsequent analysis and validation.

These records meant that the tests were traceable. It is difficult to analyze the malfunctions of a pumping station, since it is not possible to recreate the hydraulic environment. Using the ControlBuild Validation scenario, the hydraulic environment can be reproduced by "injecting" the input flow rate and the incidents recorded during the event into the model. The automatic control systems can then be analyzed and corrected without wasting any time.

Result

It took Jean-Marc Lier's team five days to develop the model of the system. Since significant technical constraints (limited number of startups per hour, etc.) applied to the project, the startup phase

represented two thirds of the duration of the design and programming phase. Since the latter lasted 15 days, commissioning was estimated to last 10 days.

For the second application, a 25% gain was achieved. Since the object library was enriched with each project, the model design time was reduced.

- The automatic control system developers no longer needed to wait for the mechanics and electricians to finish their work in order to validate their automatic control systems, resulting in better schedule management.
- This modeling method cut maintenance costs by reducing the time needed to analyze failures. The analysis was conducted on the model with a scenario that replays the real event and allows all the tests required for diagnostics to be executed without shutting down.
- Poor definition or understanding of requirements results in extra costs during development. It is hard to estimate these surcharges, but they are frequent. They result in additional work representing 2 to 5% of project costs. Using ControlBuild, these extra costs are eliminated.

| | Modelling | Factory acceptance test | Commissioning | On-site debugging | Total duration | Time saving |
|--------------------|-----------|-------------------------|---------------|-------------------|----------------|-------------|
| Simulation | 5d | 2 days | 1d | 0 | 8d | 2d |
| Without Simulation | 0 | 3 days | 4d | 3d | 10d | |

Time savings of:

- 20 % for the first development
- 75 % for commissioning

Environmental benefits:

- Reduction of emissions into the natural environment through the reduction of real-life tests
- Rainwater regulation systems can be tested without the need for effluents
- Optimization of processes without risks of non-compliant production (e.g. exceeding EP or EU standards)
- Reduction of energy costs of tests

Testimonial

"ControlBuild Validation cut our development costs by correcting deviations as early as possible and guaranteeing an end product that met our expectations. This approach can be used in any control-command project in the group. The benefits of the initial investment

can be reaped throughout the systems' lifetime in order to correct, improve or train. This tool has been used in five projects (three straightness and two pumping stations) since the start of 2005 and will be used in seven new projects in 2006."

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