Case Study

Honeywell completed Russia’s first advanced process control (APC) project in an ammonia production facility in PhosAgro Cherepovets

“Implementing APC solutions for ammonia production is no easy task. Thanks to our cooperation with Honeywell, we succeeded in carrying out the project and obtained the results: stabilized the process, increased ammonia yield, and reduced specific power consumption.

Boris V. Levin, Director for Production and Technical Policy, CJSC PhosAgro AG

Benefits

Advanced Process Control (APC) is a state-of-the-art technology deployed in production settings to greatly enhance the efficiency of the existing distributed control systems. The scientific foundations of APC were laid in the 1970s-1980s, and the first APC systems began to appear in production facilities in the 1990s. Today, thousands of APC systems are successfully operated worldwide. They are mainly used in oil refining, petrochemicals, mineral dressing, and production of mineral fertilizers. Russia’s first APC system development projects were completed in the mid-2000s.

An APC system is a software/hardware complex integrated into the distributed control system of a process facility. The hardware of the APC system is just a standard PC – although more powerful than a normal computer. All the specific features of APC are implemented in the software, which runs sophisticated control algorithms based on a predictive model for the facility. The APC system operates in real time, and the models it incorporates enable fast prediction of how the facility will behave in the near future, based on the current data about the facility’s status. If such predictions show impending deviations from the process standard, the software computes the actions needed to correct the mode, and transmits them to the controls via the distributed control system. In this way, the APC system’s built-in model (which can be thought of as its ‘electronic brain’) is able to quickly anticipate the plant’s future behavior based on the current instrument readings.

Many years of experience have shown that the use of APC systems helps stabilize process mode and product quality, reduce losses, and improve production reliability. What’s more, the optimization algorithms built into the APC software make it possible not only to stabilize the facility and handle external disturbances more efficiently, but also to select an economically optimal facility operating mode and automatically support it. These optimization capabilities of APC noticeably enhance the return on investment of such systems, and are often the main driver for their adoption.

These potential benefits of APC technology, combined with its relatively reasonable price, attracted the attention of the management and specialists at PhosAgro Cherepovets.

Background

PhosAgro Cherepovets is Europe’s largest manufacturer of phosphorus-containing fertilizers and of phosphoric and sulphuric acids, as well as a major producer of NPK fertilizers, ammonia, and ammonium nitrate for the Russian agrochemicals industry. PhosAgro Cherepovets was established in 2012 through a merger between Ammofos JSC and Cherepovets Azot JSC, which united the production facilities of both those companies. As a result, PhosAgro Cherepovets JSC is today Russia’s largest...
exporter of phosphorus-containing fertilizers to the countries of Western Europe, Asia, America, and Africa. In this case study, the company shares its experience implementing APC solutions for ammonia production at one of its own plants – a project that was the first of its kind in Russia.

**Challenge**

The company decided to conduct a pilot APC project at its Ammonia Plant No. 1. The main goals of the project were process stabilization, higher ammonia output, and lower specific power consumption. Plant No. 1 was chosen as the one best suited for deploying APC, owing to the optimal condition of its control system (measuring instruments, controls, and servos) – a very important consideration for the success of an APC project.

**Solution**

The project was carried out in multiple stages. During stage 1, Honeywell personnel surveyed the plant, assessed the prospects for implementing an APC system there, developed a tentative control strategy, defined the system’s configuration, and identified the process ‘bottlenecks’ that could yield maximum effect if handled with APC. During stages 2 and 3 the functional and detailed design of the system was mapped out, with the main aim of adapting the advanced control software to the actual process facility.

The functional design stage involved defining the structure of the APC system, setting its input and output variables, updating the control strategy, and outlining solutions for integrating APC applications with the facility’s existing distributed control system. It was decided to implement the APC system as multiple interrelated modules (‘controllers’), covering the primary and secondary reformers, the converter, and the ammonia refrigerating unit of Plant No. 1.

The detailed design stage involved special testing of the facility, building the predictive model, configuring the APC system, and carefully testing it in the vendor’s office. The solutions for integrating the APC system with the distributed control system were also outlined in detail, and the APC system operator interface was designed. This stage also included training of PhosAgro Cherepovets personnel in the basics of proper operation and support of the system, and producing a design documentation package comprising the necessary user manuals.

During the final stage of the project, the solutions developed and tested in the office were deployed on-site. System integration tests confirmed that the APC system met the requisite levels of reliability and safety. After plant operators were duly trained, the system’s startup was authorized. Deploying APC within ammonia plants poses a special challenge, because they are large and complicated facilities, combining slow and fast processes with many interdependencies. The successful implementation of the APC system became possible due to the coordinated and professional actions of Honeywell and PhosAgro Cherepovets personnel.

**For More Information**

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