ABB launches the first-ever SF₆ recycling center

BRETT ALEXANDER, DUNCAN ROBBIE, MARCUS MARENGHI, MICHELLE KIENER - ABB has developed a patented technology for the comprehensive recycling of contaminated sulfur hexafluoride (SF₆) gas, based on a new energy-efficient cryogenic process. The new technology will be implemented at a dedicated SF₆ gas recycling center, which ABB has recently established in Sydney, Australia. The purity of recycled SF₆ gas using the newly developed technology is about 99.99 percent and is in accordance with technical grade IEC 60376 (the standard for new gas), which enables SF₆ to be reused again and again. Using recycled SF₆ gas will help reduce carbon emissions and could result in a cost savings potential of up to 30 percent.
ABBB has, for many years, been researching ways of recycling used SF$_6$ from electrical switchgear and circuit breakers.
A new research and development project was initiated and the outcome was the first fully automated cryogenic SF$_6$ purification plant in the world. Commissioning of the plant focused on the piping, electrical, software and control systems. As many of the methods being used to control both the process and the pressure vessels for the cryogenic separation were being developed for the first time, a conservative approach to commissioning was used. This involved testing the individual processes, first with nitrogen, and then with carbon dioxide before final extensive testing using SF$_6$ went ahead. These tests allowed the process parameter models to be refined, and also proved that the technology is capable of separating out contaminants from SF$_6$.

The final result was engineered and constructed as a full-scale prototype plant, capable of recycling SF$_6$ at all contamination levels and bringing SF$_6$ up to new technical-grade quality.  

**Successful outcomes**

Launching the SF$_6$ gas management business on the basis of the newly developed SF$_6$ recycling technology has provided successful outcomes in technical, commercial, safety and environmental areas.

The greatest technical advantage of the new process in comparison with existing technology is that it can efficiently recycle SF$_6$ irrespective of the type or level of contamination. Existing technologies suffer from an inability to treat all contaminants and all contamination levels in one process. Furthermore, the level of automation present in the new process allows significantly greater throughput and energy efficiency.

While SF$_6$ is relied upon for its insulating and arc-quenching capabilities, over time the gas can deteriorate, particularly if the equipment has experienced regular switching. Inferior gas quality can diminish the above mentioned capabilities, which compromises the performance and safety of the equipment. Checking the quality of the gas in equipment, as
ABB's fully qualified and accredited technicians are equipped to safely analyze and manage existing gas inventory, and to complete inspections and tests on gas quality and quantity. The gas quality inspections ensure the purity of gas in equipment exceeds the minimum standards required for safe operation. As a leading manufacturer of gas-insulated equipment and with its focus on safety, ABB has gained extensive experience in the safe handling of this gas.

The new recycling center offers a solution to a problem that previously had no commercially or environmentally friendly solution.

It can sometimes be the case that some customers hold unwanted, nonconforming or contaminated SF₆ that is no longer required due to the cost, or lack, of removal options. As part of ABB's commitment to helping customers reduce their environmental impact, the recycling center will accept any quantity or quality of SF₆ for purifying and restoration to a technical grade standard using ABB's new patented recycling process and technology.

The process is designed so that no loss of SF₆ occurs at any stage of operation. Specialist detection instrumentation in combination with an automated process control system is used to detect and prevent leakage that may result through either operator or plant fault.

To ensure safety, all plant processes have been internalized to prevent human exposure and eliminate the chance of accidental exposure to liquid nitrogen. Removal of other nongaseous contaminants is done with solid-state absorbents that are contained within high-pressure demountable housings through which the SF₆ passes. The solid waste products, now safely concentrated and contained, can be disposed of without human contact or environmental exposure. Finally, the recycling plant is operated almost entirely automatically in order to reduce the risk of operator error and to maximize safety.

ABB's complete solution assists companies in reducing their environmental impact and lowers the costs associated with administration and inventory management of SF₆. The new service offering will see contaminated SF₆ gas recycled into technical grade standard (according to IEC 60376) for reuse. This allows the product life cycle of SF₆ to be closed and removes the need for energy-intensive incineration and also provides a viable route for utilities to decrease their stored stockpiles of contaminated SF₆.

The technical, safety, commercial and environmental advantages that this new recycling technology brings are clear. The new recycling center offers a solution to a problem that previously had no commercially or environmentally friendly solution. This new technology and the new plant further advance the benefits of GIS by completing total product life cycle considerations, while not altering the existing benefits of safety and reliability of this essential equipment. GIS customers can now benefit from not just a reduced physical footprint, but from a reduced environmental footprint as well.

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