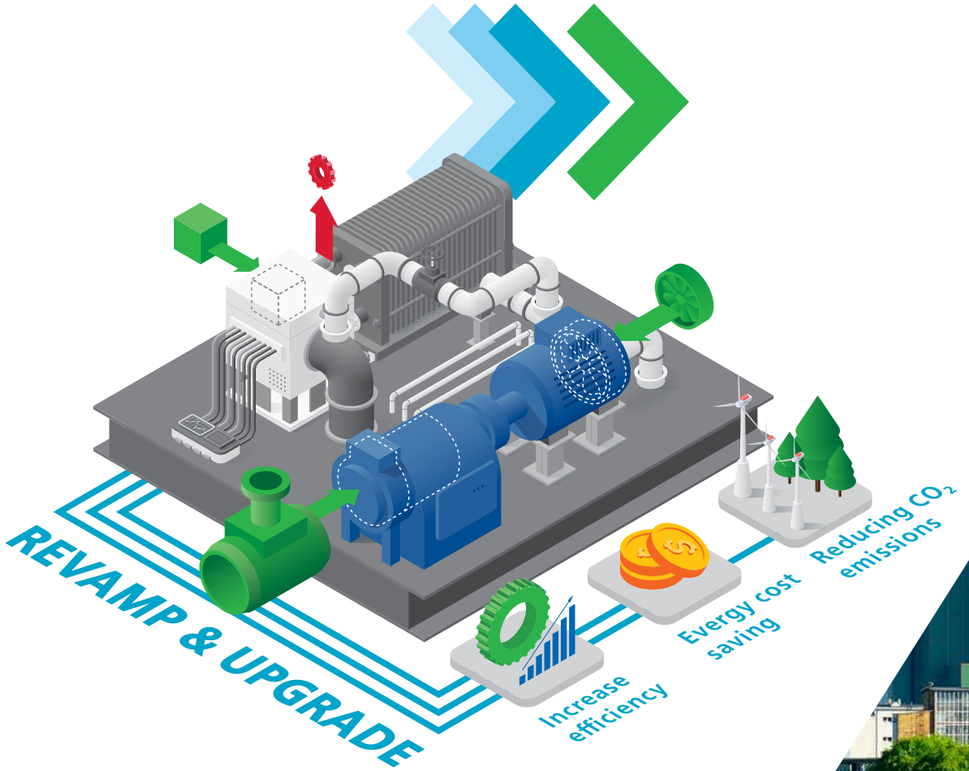
Revamp and upgrade with Atlas Copco Gas and Process

Engineered aftermarket solutions for energy and CO_2 savings for a more sustainable tomorrow

Increase compressor efficiency to save energy and reduce CO_2 emissions

High capacity centrifugal turbocompressors are designed to perform reliably and efficiently for decades. While the machine itself is built to perform as well as it did on day one, changing process circumstances mean that these machines might be operating outside their optimum efficiency levels.

Changes in plant production requirements and shifting gas compositions are two main examples of outside impacts that can affect centrifugal compressor performance. Plant operators must make a decision on how to mitigate these issues. Here is where Atlas Copco Gas and Process' aftermarket engineered solutions come into play.



Today's machinery upgraded to meet tomorrow's challenges

Compressor revamping is a flexible and efficient way to make the most out of your existing machinery. In many instances these revamps can occur in the field during an already scheduled plant shutdown, so minimal production time is lost.

By modifying or revamping a compressor / multiple compressors, particularly in large applications typically employed in air separation (smaller power machines can be employed as well), process inefficiencies can be reduced. This technical modification can be done to a machine in several ways, such as by changing the impeller size, adding an inlet guide vane (IGV), or the removal of a stage.

The fine-tuning of an existing machine not only improves its efficiency. It can also come with the advantage of significant energy, CO_2, and monetary savings. For a comparatively limited investment plant owners get greater efficiencies and lower energy costs, subsequently reducing a company's CO_2 footprint via reduced Scope 2 emissions.

Much more than just scheduled maintenance

Until recently, a compressor service primarily revolved around updating or replacing parts, such as a new filter, demister, or coupling. The idea was to keep the machine in good shape, to maintain its reliability for the foreseeable future. This, however, does not improve the machine's efficiency. The machines' desired operating point becomes a moving target as the machine ages and plant priorities change, so adjusting compressor functions when replacing standard-wear items can bring the machine closer to the current desired efficiency point.

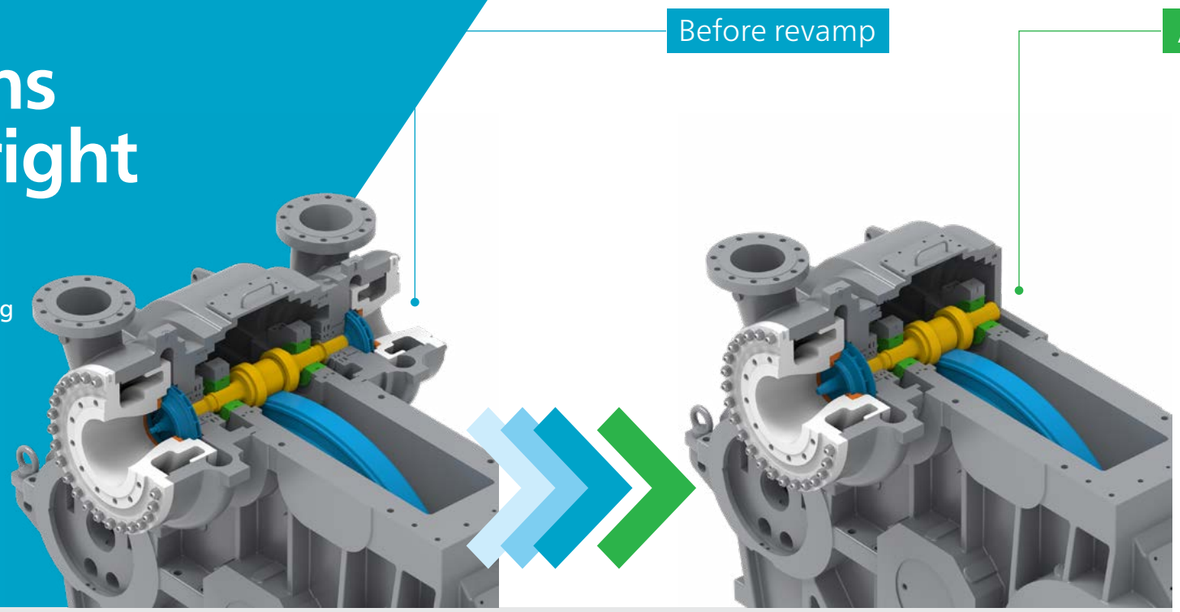
Energy saving means…

Field research shows that by consuming 100 kWh less energy every day, you can decrease annual electricity costs by EUR 160,000 and your carbon footprint by 196 tons. Similarly, consuming 200 kWh less energy every day can decrease annual electricity costs by EUR 320,000 and the carbon footprint by 392 tons. And consuming 500 kWh less energy every day can decrease annual electricity costs by EUR 800,000 and the carbon footprint by 980 tons.

Per day	100 kWh	200 kWh	500 kWh
	*price for the	*price for the	*price for the
Annual decrease	160,000 EUR	320,000 EUR	800,000 EUR
	196 tons	392 tons	980 tons

Aftermarket engineered solutions helps you find the right revamp path

In 2018, we began investigating the possibility of revamping existing compressors for energy savings and CO_2 reduction with customers in Europe and China. From there we developed three general levels of revamping possibilities. As we are a manufacturer of custom-engineered turbomachinery, we fully understand that these three options may not perfectly fit your process, and we are happy to customize and combine features of all levels into a package that best suits your process efficiency goals.



Option 1

Low pressure / flow over time

When a compressor is running at a lower flow capacity and lower pressure ratio over a period of time. In this case, the inlet guide vanes (IGV) and volute would remain unchanged.

What would change, however, is that the wheel sets for the suction nozzle, impeller, and fixed diffuser guide vane (DGV) would be switched from large to small in order to fit the lower flow and pressure ratio. Importantly, this case study is “reversible”, for the simple reason that if the process conditions and demands increase again the original wheel sets can be reinstalled.

Option 2

Permanent low flow / pressure compared to original design

This second scenario foresees a situation in which the compressor is permanently running at a lower flow capacity and a lower pressure ratio than originally designed. Similar to the first case, the IGV and volute require no change, and the suction nozzle, impeller, and fixed DGV are revamped to match the new permanent operating conditions.

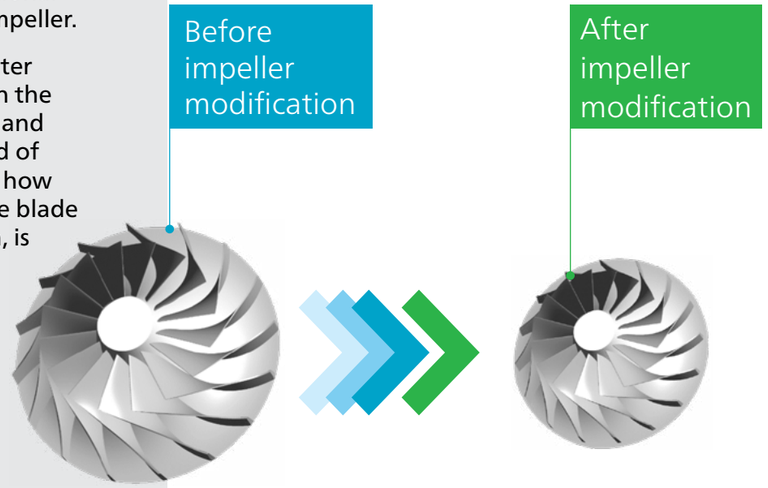
Because this revamp is not reversible, however, once the sets of wheels are modified for the specific process conditions the compressor cannot be returned to its pre-revamp condition. The investment in the revamp is correspondingly lower, though of course the customer would need to be sure that the prevailing process conditions are permanent.

Option 3

Permanent low pressure situation

The third scenario is if the compressor is permanently running at a lower pressure ratio. In this case study, in order to bring the compressor’s best efficient area to match the process’ desired operational point engineers would trim the impeller.

Trimming here means that the outer dimensions of the impeller remain the same and that the suction nozzle and volute are of further use. This kind of “quick fix” is based on calculating how much of the outer diameter of the blade tip needs to be cut off. This, again, is permanent and not reversible.



Scaled to fit your process

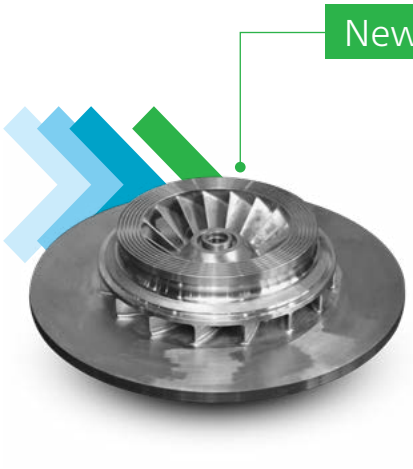
Generally, a revamp is done during scheduled shut-down periods, with no little loss of production time. A revamp becomes even more attractive if it is combined with the repeated purchase of capital spare parts (rotors, gearsets, or pinion), since the above efforts can be combined.

Revamp case studies

In 2021 Atlas Copco Gas and Process worked with a major air separation customer in Asia, revamping air compressors that had been operating for several years. Based on the new operational requirements they produced a feasibility scenario for the customer. Within the first proposed solution, the new operational setup created substantial energy efficiencies as the compressor would not need to be in blow-off mode or have a closed IGV. The revamp would, therefore, keep the wheel set as it is alongside an additional improvement with the last compressor stage (and the IGV and all volutes not modified in order to make the revamp as less as possible invasive).

The revamp solutions are saving around 13,000 MWh in energy and around EUR 2,372,500 every year.

In 2022 Atlas Copco Gas and Process teamed up with a gas power plant in Germany to improve the overall efficiency of their booster compressor. Even though they have a design power consumption of 400kW, the new conditions desire way less flow. For this, the compressor now has to operate an inefficient turn-down case while still consuming 300kW.



With the new layout proposed and with just an impeller change, the power consumption can be further decreased to 150 kW, which creates an annual saving of 930 tons of CO_2

The right way for your process and the planet

Reduce OPEX, energy use and CO_2 emissions with compressor revamping from Atlas Copco Gas and Process. Changes in plant demand, gas composition, and more can affect the efficiency of your machines. By revamping your existing equipment, you can return your machines to peak efficiency, saving energy costs and reducing CO_2 emissions along the way.

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