The Hydrogen Advantage: Partnering for the Energy Transition

Embark on a journey with Atlas Copco Gas and Process, your dedicated ally in the hydrogen revolution. With decades of expertise and reliable solutions, we are capable of navigating the complexities of the hydrogen landscape. Let's team up and do our bit for a sustainable future.

At Atlas Copco Gas and Process, we see hydrogen as a key driver for enabling the energy transition and achieving the goal of net zero emissions by 2050. We have technology today to help you reduce environmental emissions and make a circular, sustainable economy a reality.

From production, transportation and use, we have the machinery solutions now to support the low-carbon hydrogen ecosystem of the future.

Hydrocarbons and Hydrogen

Closer than you think, process-wise.

When you think of hydrogen, applications like gas processing, LNG or petrochemical processes most likely do not come to mind. While gas properties vary, the machines needed to process them are remarkably similar. Our decades of experience in LNG, natural gas processing, chemical / petrochemical, fuel gas boosters and air separation make Atlas Copco Gas and Process well positioned to apply these technologies to hydrogen processes. Creating a boil-off-gas (BOG) compressor that can handle hydrogen is similar to the hundreds of BOG compressors we have produced for LNG carriers. Similarly, the hundreds of cryogenic turboexpanders used in hydrogen-rich petrochemical applications serve as a strong foundation for hydrogen liquefiers. With a few key modifications to material choices and manufacturing techniques, we can apply our many years of expertise to these emerging hydrogen applications.

Addressing **Key Challenges**

Challenge 1: Low volumetric density makes hydrogen difficult to transport

Atlas Copco Gas and Process machinery enables large-scale liquefaction for increased energy density and effective transportation.

Challenge 2: Liquid hydrogen requires low temperatures

Atlas Copco Gas and Process machinery thrives in cryogenic processes. We have the experience and patents to ensure highest efficiency in extreme conditions.

Challenge 3: Lightweight gas properties

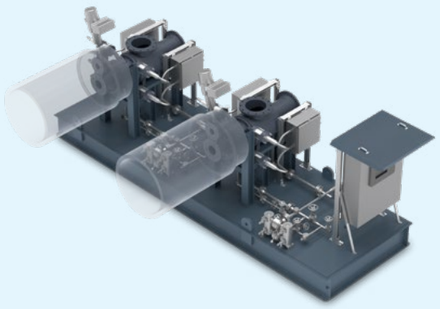
Atlas Copco Gas and Process machinery offers some of the highest impeller tip speeds in the market which ensures effective compression or expansion of hydrogen in your process.

Challenge 4: Hydrogen safety and leakage

Safety is of utmost importance, and Atlas Copco Gas and Process has a proven track record of supplying safe equipment in hazardous environments. Our hermetic solutions can provide additional safety and leakage protection for the most sensitive applications.

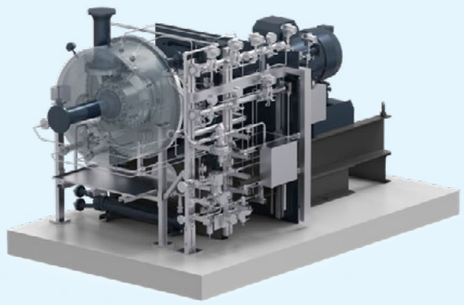
Unique Technologies

Cryogenic Hydrogen Solutions



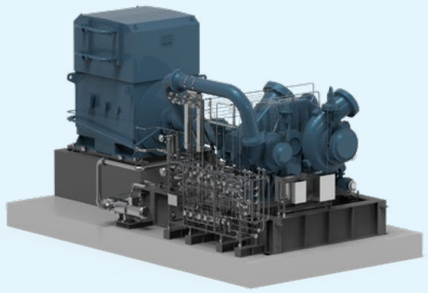
Hydrogen liquefaction expanders

Our turboexpanders for hydrogen liquefaction use state-of-the-art technologies to provide maximum refrigeration for your process. By utilizing oil-free magnetic bearings, our hermetically-sealed turboexpanders offer efficient power recovery with no loss of seal gas.



Hydrogen Boil-Off Gas (BOG) compressors

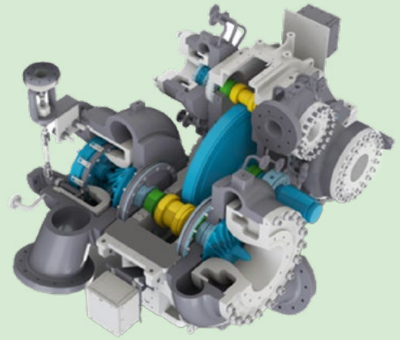
Using our extensive experience in cryogenic LNG processing, we are able to meet the extreme requirements for this high-duty LH2 vapor recovery application. Thanks to meticulous design and material selection, these compressors can reliably operate in environments as cold as -253°C.



Refrigeration compressors and companders

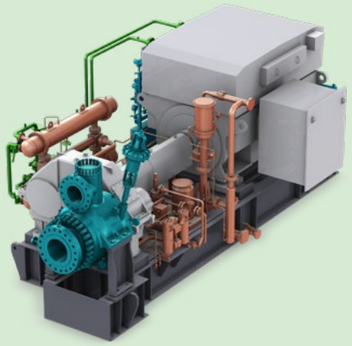
Not all equipment for H_2 liquefaction directly involves hydrogen. Whether you choose nitrogen, methane, or mixed refrigerant, Atlas Copco has the solution to optimize your LH_2 pre-cooling process.

Non-Cryo Hydrogen Solutions



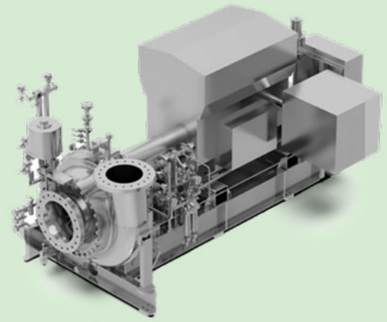
Hydrogen pipeline or feed gas booster compressors

For large flow, low pressure ratio hydrogen applications, centrifugal compressors are the preferred choice compared to reciprocating machines. The high reliability of turbomachinery technology can be applied in large pipeline or feed gas booster services.



Hydrogen pressure letdown expanders

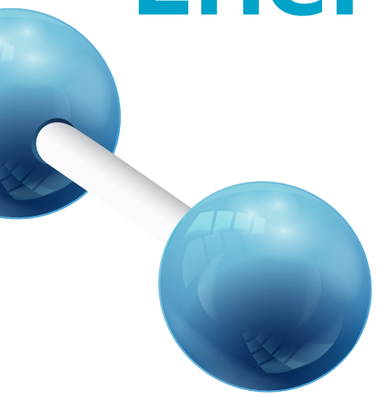
Utilizing readily available high pressure H_2, our PLD expanders harness the energy expelled in the pressure letdown process via integrally-geared expander-generators. This form of power generation produces zero carbon emissions and can help improve your plant's overall efficiency.



Oxygen compressors

Oxygen is produced alongside hydrogen during water electrolysis. For large-scale electrolysis, an oxygen compressor can enable an additional revenue stream to transport and sell the oxygen to nearby consumers. Atlas Copco is one of the only manufacturers in the world to offer EIGA compliant oxygen compressors.

Enabling the Energy Transition



Production

Hydrogen can be produced in many different ways. Low-carbon hydrogen production may come from traditional feedstocks like natural gas paired with carbon capture (CCUS), or emergjng methods like electrolysis powered by renewable energy, or even biogenic hydrogen using biomass waste to syngas. Whichever method you choose, Atlas Copco Gas and Process centrifugal compressors and turboexpanders can support your hydrogen production process.

Transportation

One economically viable method to enable hydrogen transportation is liquefaction. Turboexpanders and compressors are critical in efficient LH_2 plant designs. Our solutions enable plant operators to achieve lower specific energy consumptions. Our equipment can operate in the industry's most cryogenic working environments.

We also offer BOG compressors to capture and re-liquefy LH_2 for storage, as well as compress the gas further for use in hydrogen-fueled propulsion systems.

Usage

Hydrogen is essential as a feedstock and fuel in many applications of modern industries. This includes the mobility sector, power generation, chemical/petrochemical, fertilizer and refinery (i.e., ammonia production). Due to hydrogen's chemical makeup and extremely low process temperatures, special attention needs to be paid to the equipment that will be processing the gas / liquid.

Decarbonizing the mobility sector

Hydrogen fuel cell electric vehicles (FCEVs) will serve as an important solution to reduce CO_2 emissions for heavy-duty vehicle applications. Atlas Copco turbomachinery enables the effective liquefaction and transport of low-carbon hydrogen to distributed hydrogen refueling stations (HRS) to support this need.

International hydrogen trade routes

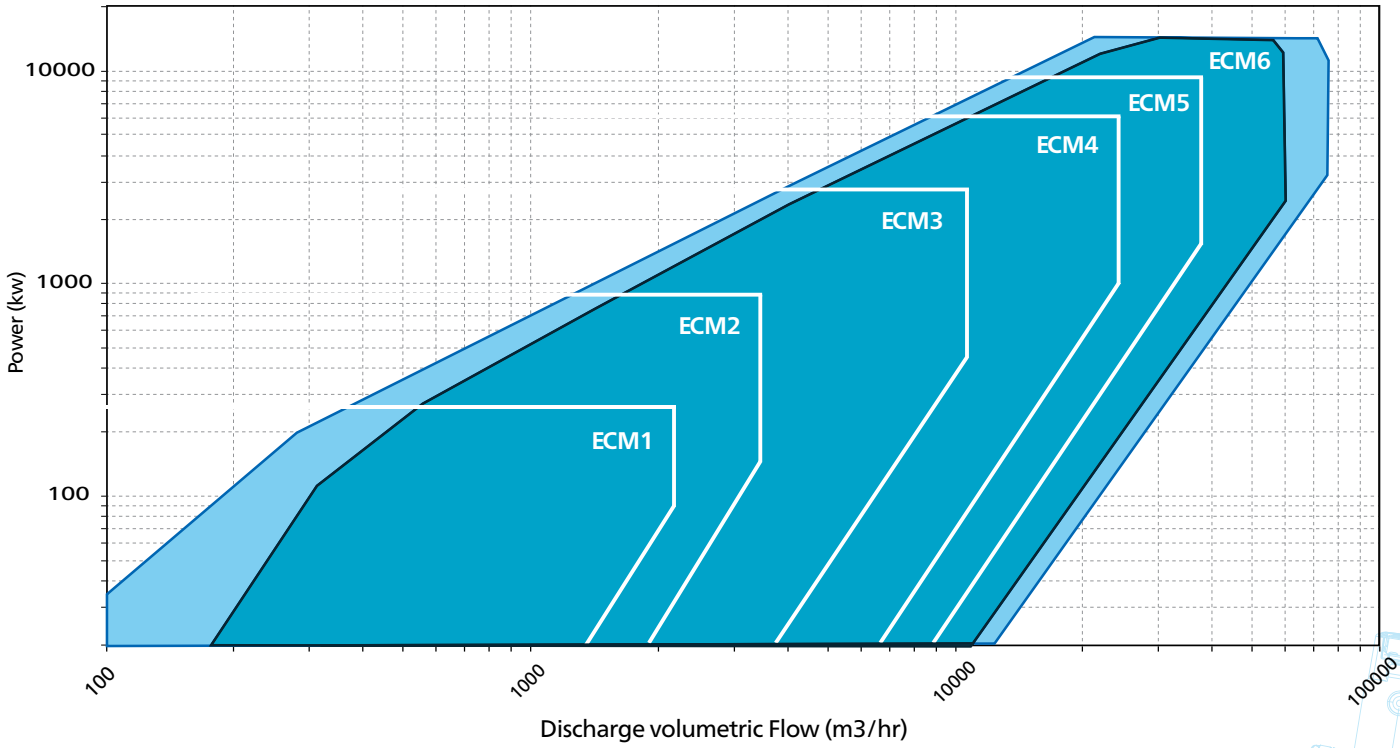
Similar to LNG, hydrogen will soon become a global commodity which is transported internationally. Regions with abundant wind and solar can produce low-carbon hydrogen for export. Importing countries will receive hydrogen via pipeline or liquid hydrogen (LH_2) carrier ships. Whatever the transport method, Atlas Copco has the turbomachinery solution to facilitate efficient and cost-effective trade of hydrogen to support the energy transition.

CUT THE CARBON

TRANSFORM • SAVE • CONTRIBUTE

Appendix - Technical Specifications

Expander selection map - hydrogen liquefaction
Process fluid: 100% hydrogen



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