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## **C2Po3D-06: The New Valve Era for Cryogenics— Design Considerations and Electric Solutions with focus on liquified Hydrogen and Helium**

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New green technologies in the energy sector will use more and more Cryogenic gases like helium, hydrogen and sometimes also with neon, nitrogen, or air. Those technical gases have gained today more attraction as enablers as well as further industrial areas as in chemistry, semiconductor, steel and glass production etc.

Cryogenic helium in all stages is used to cool superconducting devices allows efficient high energy research and fusion research. Liquefied hydrogen is a high dense energy vector and could be at the same cooling superconducting cables and power devices. Neon seems a potential candidate to enable highly efficient cryogenic processes. Subcooled liquefied nitrogen is used to cooling high temperature superconductor cables and devices in the power system. The cryogenic process of liquefying and warming up air is used to store fluctuating production renewable power.

Consequently, valve industry face techno-economic complex challenges to answer the demands of this expanding sectors that will play an essential role the upcoming decades.

On the same line the future is a fact of having smart electric driven equipment and this applies also to the valves. Traditional electropneumatic solutions requires big space and pneumatic system in the facility to supply the air to the actuator. These systems consist of compressor, air treatment system with refrigeration air dryer and condensate drain, the distribution lines and buffer tanks, manifolds with stub lines to the valves, connections, couplings and so on. All these requirements evolve to more complex facilities, high capex and mainly opex depending. As EnEffAH study also explained how low the efficiency of pneumatic drive systems is, around 6 to 8 %. Electric driven solutions are key to leverage efficiency, save space and weight, reduce the consumption and being plug and play there is no need on specific system level equipment, just plug and play. This poster describes identified techno and economic challenges for a modern cryogenic valve. Focus is on applications in liquified hydrogen but also considerations regarding the special requests for helium are highlighted and electric actuation. Some key design topics are:

- ☒ Thermal efficiency and flexibility to absorb thermal contractions in the connection piping.
- ☒ Interior and exterior high-level tightness with improvement to the low emissions to the atmosphere.
- ☒ Valve flow capacity and precise flow control
- ☒ Electric driven system with low energy consumption, electric actuator solutions.
- ☒ Suitable for industrial serial manufacturing processes that enable to achieve factor one butt welded and precise machine.

In this poster paper, AMPO POYAM VALVES will present an innovative solution concept that meets the challenges of the cryogenic service condition over the entire temperature and pressure range and brings a modern valve concept to the market considering up to date manufacturing technologies and thus offers added value to the efficiency of the high-tech electric driven cryogenic processes.

Keywords: Valves, Liquid Helium, Liquid Hydrogen, Low Heat Load, Fine Flow Control, Innovative Flex Inset, Fail Safe Electric Actuation

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