

## Internal Power Recovery in Cryogenic Cooling Plants Part I: Expander Development

**Authors :** Ambra Giovannelli, Erika Maria Archilei

**Abstract :** The amount of the electrical power required by refrigeration systems is relevant worldwide. It is evaluated in the order of 15% of the total electricity production taking refrigeration and air-conditioning into consideration. For this reason, in the last years several energy saving techniques have been proposed to reduce the power demand of such plants. The paper deals with the development of an innovative internal recovery system for cryogenic cooling plants. Such a system consists in a Compressor-Expander Group (CEG) designed on the basis of the automotive turbocharging technology. In particular, the paper is focused on the design of the expander, the critical component of the CEG system. Due to the low volumetric flow entering the expander and the high expansion ratio, a commercial turbocharger expander wheel was strongly modified. It was equipped with a transonic nozzle, designed to have a radially inflow full admission. To verify the performance of such a machine and suggest improvements, two different set of nozzles have been designed and modelled by means of the commercial Ansys-CFX software. steady-state 3D CFD simulations of the second-generation prototype are presented and compared with the initial ones.

**Keywords :** vapour cCompression systems, energy saving, refrigeration plant, organic fluids, radial turbine

**Conference Title :** ICCET 2016 : International Conference on Clean Energy Technologies

**Conference Location :** London, United Kingdom

**Conference Dates :** June 23-24, 2016