

Preliminary turbomachinery design of a power cycle integrated with a cold storage system

Giovanni MESSINA, *ENEA* & Ambra GIOVANNELLI, *Roma Tre University*

Exploiting Variable Renewable Energy Sources (VRES), like wind and solar radiation, for electric power generation poses several challenges regarding the electric grid's stability over time. Storage systems and dispatchable power plant flexibility can support VRES penetration, improving grid stability. In line with such a goal, ENEA is developing a novel CO₂ power cycle integrated with a cold storage system. The system, in principle, exploiting the capabilities of a new concept of cold storage, could be much more flexible than any other conventional power plant.. It requires ad hoc turbomachines to meet all the system constraints in nominal and off-design operational conditions. The presentation deals with the tool developed by Roma Tre for the preliminary design of such turbomachines and its application to the specific case study and the validation through 3D CFD simulations.

References

- [1] A. Giovannelli, C. Salvini, E.M. Archilei, G. Di Lorenzo, K. Kasap, G. Messina, "Analisi ai carichi parziali e analisi tecnico-economica di un ciclo a sCO₂ ibridizzato con sistemi di accumulo", Rapporto Tecnico RdS/PTR(2021)/293, 2021
- [2] G. Messina, "Definizione preliminare dei turbo-gruppi per il ciclo di potenza a s-CO₂ ibridizzato con una pompa di calore", Rapporto Tecnico RdS-PTR2019-135, 2020
- [3] A. Giovannelli, C. Salvini, E.M. Archilei, G. Messina, "Progettazione preliminare di un ciclo a sCO₂ ibridizzato con un sistema di accumulo freddo", Rapporto tecnico RdS/PTR2020/214, 2020
- [4] A. Giovannelli, C. Salvini, E.M. Archilei, G. Messina, "Design termo-fluidodinamico di turbomacchine operanti a CO₂ supercritica, Rapporto tecnico RdS/PAR2016

Acknowledgements

The authors acknowledge the Italian Ministry for Economic Development for supporting the present work under the Electric System Research Project PTR2022-24.

Moreover, the authors would like to thank the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) and the University of Roma Tre for their kind support.