Eur. Phys. J. Special Topics **224**, 763 (2015)

DOI: 10.1140/epjst/e2015-02424-9

THE EUROPEAN PHYSICAL JOURNAL SPECIAL TOPICS

Editorial

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Classical thermodynamics started with the industrial revolution and the production of mechanical energy by steam machines. The attempts to improve the efficiency of those devices played a central role not only for pragmatic reasons but also, somewhat unexpectedly, from a theoretical point of view. Carnot derived his principle by looking at real machines with a practical purpose and poorly accurate data for their behavior. As well known, the Carnot principle motivated Clausius to introduce the abstract concept of entropy, which led to the classical formulation of thermodynamics. A few years later, Boltzmann interpreted the entropy in the framework of statistical physics and initiated, with many other scientists, the extraordinary development of this science. Notice that Boltzmann entropy is also defined for equilibrium and non equilibrium systems, contrary to Clausius entropy; but that implies a low density classical gas.

Classical and statistical thermodynamics is central for many studies by theoreticians, experimentalists and engineers in all fields of science and technology. They made the subject of a huge number of textbooks and specialized works addressing the most recent advances. Nevertheless, part of their fundamental basis remains a lively topic of discussions and, sometimes, controversies. This is true, in particular, of Carnot principle, which has been extended in several directions and extensively discussed in the last years. As often noticed, the power produced by thermal engineering obviously vanishes for a Carnot machine working infinitely slowly in order to reach maximum efficiency for energy transformation. To the best of our knowledge, J. Yvon was the first scientist to calculate the efficiency of an engine at its maximum power production, although related problems have been considered earlier. From a simple model and Fourier-Newton law of heat transfer, Yvon – mainly known for his contribution to the celebrated BBGKY hierarchy of statistical mechanics – obtained the efficiency at maximum power and published it in 1955. This important result was rediscovered by Curzon and Ahlborn in 1975 and is often associated with their names.

Thirty more years passed until the scientific community understood the wide meaning of this result and the new perspectives it opened. Since then, it has been generalized, discussed and sometimes contested in an abundant literature. This is why we proposed to gather and compare several points of view and opinions on engine efficiency, dissipation and related concepts, including general considerations on information and entropy, one major concern for Jacques Yvon.

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