Review of: "Classical Thermodynamics: Primacy of Dissymmetry Over Free Energy"

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Potential competing interests: No potential competing interests to declare.

This is a nice paper emphasizing the primary role of dissymmetry over free energy. This is an important topic because free energy is the physical quantity which facilitates the combined application of the first and second laws of thermodynamics, basing on the notion of spontaneous dissipation. The author gives a historical overview of the topic, outlining the relationship between free energy and natural dissymmetry, a question raised up and developed by Lord Kelvin in terms of the dissipation of mechanical energy. It is finally suggested and discussed as a new branch of engineering thermodynamics.

1. The abstract is in some parts not so clear. The author should rewrite some sentences to convey the message more clearly; for example, the concept of the primacy of dissymmetry over free energy should be detailed better, considering that it is at the basis of the new branch of engineering thermodynamics outlined.
2. The concept of dissymmetry should be clarified for a general reader. What does it mean exactly? What is the difference, e.g., between dissymmetry and asymmetry and broken symmetry, also widely used in the scientific language?
3. According to Kelvin, the available energy can be identified with heat energy or high thermal energy that can be dissipated. This is a step before the concept of entropy was introduced by Clausius. Free energy in the Helmholtz formulation is U - TS; therefore, there is also internal energy (kinetic energy + potential energy) as available energy. Isn't the available energy simply represented by the free energy, which includes also the entropic contribution? What is the opinion of the author about this aspect?
4. It is not easy to distinguish the part devoted to the review of some topics and the new part on classical thermodynamics and the primacy of dissymmetry over free energy. I would suggest emphasizing this distinction.
5. There are recent papers dealing with a similar subject. See, e.g., Entropy 2023, 25, 1321,*Entropy* 2022*, 24,* 392 that could be briefly discussed in relation to the topic treated in this paper.