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

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Two approaches to thermodynamics are compared/discussed. The first approach is anchored in the notions of energy and entropy; that is, thermodynamic systems are analyzed by applying the first and second laws. This point of view is termed the *dissymmetry proposition*. The second approach is rooted in the notion of energy alone; that is, thermodynamic systems are characterized by their internal energy along with their free or available energies. The latter point of view is termed the *primacy of energy*. The setting for the discussion is mainly historical, with accounts of how the notions of free energy and entropy evolved over time.

The historical account and the quotes from the key players are interesting, but the text is somewhat long and tends to drift quite often. Some passages are hard to follow, mainly because they deviate too far from the main subject. My recommendation is to shorten the text and refine/clarify the objectives.

Regarding the objectives, it is stated in the **Highlights** that:

> *It is suggested that engineering thermodynamics, rather than being based on the primacy of energy, should be erected on the primacy of dissymmetry rather than over free energy.*

The purpose is unclear, as the foundations of thermodynamics are already taught by focusing on the first and second laws (both in science and engineering). Moreover, the preceding dichotomy seems artificial, as free energy need not be a substitute for the notion of entropy; it is merely a complementary concept that is useful for computation in specific scenarios.

It is stated in the **Afterword** that:

> *We have argued for the superiority of the Carnot/Clausius account for Thomson's problem. And throughout the paper, we showed examples—the Carnot-Clausius cycle, Fig. 3; the example in Figs. 4 and 5; the example in Figs. 6 and 7; the reversible manifestation of Gibbs "available heat" in Fig. 8; and the example manifesting the "approximately" reversible "free flame enthalpy" as shown in Eq. (50)—all these examples demonstrate heat extraction as the dominant mechanism for effectively harnessing the driving force of the irreversible world.*

In each of these examples, it would perhaps help to clarify if more details were given on exactly how and why the primacy

of energy fails concerning the dissymmetry premise.