

The train of thought methodically and comprehensively followed out in Gibbs's various memoirs had its origin in the early speculations of William Thomson (Lord Kelvin) and Clausius, to which I referred above. Thomson was the first who, in adopting (after much hesitation) the mechanical view of the phenomena of heat, the doctrine of the convertibility and equivalence of the different forms of energy, recognised that, in order to describe natural phenomena correctly, this view required a qualification. The change of the different forms of energy into each other can for the most part take place only in one direction; there is a general tendency in nature towards a degradation or dissipation of energy. Energy, though not lost, becomes less useful, less available. The least available form of energy is heat; and it is in that form that in all natural changes a portion of energy becomes lost, dissipated, or hidden away. Thus we have to recognise the difference between available and unavailable, between useful and useless, energy. In the sequel Thomson showed in definite instances¹ how to calculate the available and the un-

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¹ See 'Math. and Phys. Papers,' vol. i. No. LIX., 1852, "On a Universal Tendency in Nature to the Dissipation of Mechanical Energy"; and No. LXIII., 1853, "On the Restoration of Mechanical Energy from an unequally heated Space." In Tait's 'Sketch of Thermodynamics' (1868), we read (p. 100): "It is very desirable to have a word to express the *availability* for work of the heat in a given magazine, a term for that possession the waste of which is called *Dissipation*. Unfortunately the excellent word *entropy*, which Clausius has introduced

in this connection, is applied by him to the negative of the idea we most naturally wish to express. It would only confuse the student if we were to endeavour to invent another term for our purpose." He then proceeds to use the term *entropy* in an altered sense, in which it measures the available instead of the unavailable energy, creating for some time a great confusion and some unnecessary irritation. See on this the early editions of Clerk Maxwell's excellent 'Theory of Heat,' and the footnote to p. 189, 8th ed., and Clausius 'Die