CHAPTER 4

Engels, Entropy, and the Heat Death Hypothesis

Introduction

Ever since Nicholas Georgescu-Roegen wrote his magnum opus, *The Entropy Law and the Economic Process*, the entropy law (or the second law of thermodynamics) has been viewed as a *sine qua non* of ecological economics. Georgescu-Roegen argued strongly that both the entropy law and the first law of thermodynamics (conservation of matter-energy) were incompatible with orthodox neoclassical economics. The relation of ecological economics to Marxian economics, however, was much more ambiguous. Attempts to explore the history of ecological-economic ideas, following Georgescu-Roegen’s contributions, immediately brought to the fore the close relationship between those thinkers who had pioneered in ecological-economic thinking and classical Marxism.

Georgescu-Roegen himself pointed, although not uncritically, to Marx and Engels’s discussions of energetics and thermodynamic principles. It was, after all, as he noted, the “first pillar” of historical materialism that ‘the economic process is not an isolated system’. He also indicated his support for Engels’s critique of energy reductionism. Both Marx and Engels were well versed in the scientific literature on thermodynamics. As even their most persistent ecological-economics critic, J. Martinez-Alier, has acknowledged, ‘Engels ... had read everything on the fundamental studies on thermodynamics’. Anson Rabinbach claimed in his important study of nineteenth-century applications of thermodynamics to human labour that ‘the most important 19th-century thinker to absorb the insights of thermodynamics was Marx, whose later work was influenced and perhaps even decisively shaped by the new image of work as “labour power”’. Early contributors to ecological-economics thinking, such as Sergei Podolinsky and Frederick Soddy, were inspired by Marx.

---

1 Georgescu-Roegen 1971.
2 Georgescu-Roegen 1971, p. 316.
3 Georgescu-Roegen 1986, p. 9; Georgescu-Roegen’s criticisms of classical Marxism focused on the alleged ecological inadequacies of Marx’s labour theory of value and Marx’s reproduction schemas. These criticisms have been rebutted by Burkett (2004, and 2014, Chapters 6–8).
4 Quoted in Ravaioli 1995, p. 130.
5 Rabinbach 1990, pp. 69–70.
Ironically, it is perhaps because of the strong *prima facie* case for a link between classical Marxism and thermodynamic conceptions that the argument is so fervently advanced that Marx neglected thermodynamics. Some of the leading figures in ecological economics have gone to extraordinary lengths to separate at birth the Marxian and ecological critiques and then to deny any direct relationship through a series of disconnects: (a) Marx and Engels's own integration of thermodynamic concepts into their analysis (admittedly not given strong emphasis or even understood in later Marxist thought) is simply ignored; (b) circumstantial evidence is offered to suggest that Marx and Engels actively rejected some of the crucial discoveries in thermodynamics in their day; (c) it is alleged that Engels went so far as to cast doubt on the entropy law itself; and (d) the fact that early developments in ecological economics occupied the same intellectual universe as Marxism, which led to much cross-fertilisation of thought, is downplayed if not deliberately obfuscated.

The leading role in criticising Marx and Engels for neglecting and/or misunderstanding thermodynamics has been taken by Martinez-Alier, not only in his very influential book *Ecological Economics* but also in other, frequently cited, writings, appearing in such high-profile journals as *Ecological Economics*, *New Left Review*, and *Socialist Register*. Recent analyses by ecosocialists have strongly challenged these arguments with respect to Podolinsky and Marx-Engels, demonstrating that Podolinsky's perfect-human-machine model of ecological economics was fundamentally flawed from the standpoint of thermodynamics itself (a fact that the founders of historical materialism clearly recognised at the time).  

It is perhaps not surprising therefore that greater emphasis has been placed of late on the criticism that Engels (and by imputation Marx) rejected the second law of thermodynamics itself. Thus, in an article in the 2007 *Socialist Register*, Martinez-Alier underscored Engels's alleged ‘unwillingness to accept that the First and Second Laws of thermodynamics could apply together’ – a claim that was often presented previously as simply ‘another interesting point’.  

Martinez-Alier’s current reputation as the foremost historian of ecological economics makes his criticism in this regard particularly important. Nevertheless, it should be noted, he is not the only one to issue such charges. Much earlier, the renowned social theorist Daniel Bell suggested: ‘He [Engels] attacked the formulation of the second law of thermodynamics, as set forth by

---

7 See the discussion in Chapters 2 and 3 above.
8 Martinez-Alier 2006, pp. 275–6; also see Martinez-Alier 1995, p. 71; Martinez-Alier 2005, p. 5; Martinez-Alier 2007, p. 224.