aware of the importance of mathematical presentation of their doctrine, and the two former have in fact done more than any one else to introduce mathematics into chemistry. But they maintain that their exact treatment is not arrived at by introducing hypothetical quantities such as the atomic and other theories are founded upon, but by contenting themselves with measuring such quantities as are presented directly in observation, such as energy, mass, pressure, volume, temperature, heat, electric potential, &c., without reducing them to imaginary mechanical or kinetic quantities.[1] To what extent they

A great many aspects of physical science which have been more prominently brought forward by the modern school of "Energetics" are to be found discussed in Mach's much earlier writings. To his valuable 'Principien der Wärmelehre' (Leipzig, 1896) I have frequently had occasion to refer in this chapter.

[1] In recent discussions and treatises two distinct tendencies must be distinguished. First we have the very useful effort to bring about a correlation of the different departments of physics and chemistry, including their applications in industry and in physiology, by the introduction of the conception of energy and the principles of its conservation and transformation. This dates practically from the publication of Thomson and Tait's 'Natural Philosophy.' The theoretical foundations of this undertaking have been very fully discussed, notably in Germany. I mention only the valuable series of writings of Prof. Max Planck, a list of which is contained at the end of his 'Thermodynamik' (Leipzig, 1897). They begin with his prize essay ('Das Princip der Erhaltung der Energie,' 1887) and his earlier dissertation (Munich, 1879) "On the Second Law." Out of this another endeavour has grown. The aim is to make the conception of energy the fundamental notion, and by following its physical appearance in its different forms, to arrive at certain fundamental relations expressed in equations, which are to serve as the basis for calculation, as in conventional physics the dynamical equations formed the starting-point for the various physical theories. In this more radical scheme the quantity "energy" was to play a part similar to that which the quantity "force" played in Newtonian dynamics. This method was probably suggested by the novel mode of treatment invented originally for heat-problems by Lord Kelvin and by Clausius, and most strictly adhered to by the former. The isolated character of this classical thermo-dynamics can be got over either by introducing a kinetic hypothesis on the nature of heat or by extending the method of thermo-dynamics to other physical provinces. The former was the most plausible view; it has its origin in the writings of Rankine