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Creating Energy in Nineteenth-Century Scotland

The Science of Energy: A Cultural History of Energy Physics in Victorian Britain

Crosbie Smith
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Exploring the context of scientific change has, in recent years, greatly enriched the history of science and our understanding of how technical knowledge develops. This book continues along this path to reveal the sources of the most fertile idea of nineteenth century physics: the concept of energy. On that concept, a torrent of subsequent physical science has flowed.

Yet, 'exploration and discovery' are scarcely the appropriate metaphors for this case. As the author shows, this now-universally accepted basis for understanding the physical world had very localised origins. Moreover, he demonstrates that the promotion of energy as an organising concept was stage-managed by a network of engineers and men of science. Their education, natural philosophy and careers were, for the most part, firmly linked with Scotland or, as the region was frequently denoted in those less-devolutionary times, 'North Britain'. These men included James Joule, William and James Thomson, McQuorn Rankine and James Clerk Maxwell, as well as other contributors such as Fleeming Jenkin and P. G. Tait. It was a mixed collection of interests: William Thomson was Glasgow professor of natural philosophy, and Rankine, his engineering counterpart; Tait and Jenkin later held chairs in natural philosophy and engineering, respectively, at the University of Edinburgh, and Maxwell taught natural philosophy at the Universities of Aberdeen and Cambridge. Besides the universities, energy physics was also advanced at marine engineering works and scientific societies, particularly the British Association for the Advancement of Science (BAAS). Through their collective work and commercial projects, this group advanced not only their own reputations but also that of energy physics itself from the mid nineteenth century.

(+44 (0) 1387-702038 ***fax:*** +44 (0) 1387-702005 ***Office:*** 313 ***email:*** **s.johnston@crichton.gla.ac.uk**

Scottish intellectual culture and economics played an important role in advancing the conservation of energy as 'the ONE GREAT LAW OF Physical Science', as Thomson and Tait put it. There was an evangelical tenor to their arguments. The author argues that they were very much defenders of the faith of the science of energy, and battling clear opposition from others. Among the 'others' were the men of science who subscribed to earlier generalisations – those, for example, who discussed 'conservation of force' or 'vis viva'. Michael Faraday, for instance, remained an implacable critic of the new doctrines of energy. For him, 'mechanical philosophies' based on matter and motion or matter and energy could not adequately portray God as a God of power.

As suggested by Faraday's views, religious attitudes were important in the acceptance of the science of energy. The most important philosophical objections were highlighted by religious instabilities. The so-called 'Disruption' of 1843 had divided the Scottish church into Established and Free branches. This had repercussions for the universities, which attracted a significant number of students studying for the ministry. At the very time that energy physics was becoming established, its new professors – whose income depended heavily on direct student fees – had to counter factions in the Free Kirk that were turning to biblical literalism. On the other hand, even the Established church was wavering in its support for natural philosophy, owing to university reformers seeking to abolish religious tests for academic chairs.

Equally important to the North British group was their opposition to materialism. The year after the Disruption, *Vestiges in the History of Creation* had been published. This widely discussed text suggested a naturalistic development of the physical and living world without the explicit interaction of God. Darwin's theory of evolution, published a decade later, reinforced the view that natural law could fully explain the past and future of the universe.

The author argues that, between these two extremes, the promoters of energy science were engaged in the building of a new 'moderate' Presbyterianism. They sought "to restore and enhance the reputation and credibility of the universities of the Victorian age by reasserting a strong theology and a strong natural philosophy, both in harmony with the scriptures liberally interpreted" [p. 26].

The proponents of energy physics were, by any standard, highly successful during their lifetimes. Their philosophy was expounded in seminal texts such as

Thomson and Tait's Treatise on Natural Philosophy (1867) and Clerk Maxwell's Treatise on Electricity and Magnetism (1873). Nevertheless, "far from being a timeless enterprise, its heyday was almost certainly past by the 1880s" [p. 7]. As they aged and died, the energy physicists were reinterpreted and their works reinvented. Indeed, one of their successors, Oliver Heaviside, noted in 1895 that "Maxwell was only half a Maxwellian" [p. 289]. His contemporaries, concerned with understanding electromagnetism, interpreted energy as more than merely 'the capacity to do work'. The 'Energeticist' school, centred on Wilhelm Ostwald in Germany, severed the link between matter and energy even more decisively. For them, energy was the fundamental quantity explaining not only physics, but society itself. The aged William Thomson, by then Lord Kelvin, could only privately disparage the direction that physics had taken. No legacy is permanent or unmalleable.

Sean F. Johnston
Lecturer, Science Studies
Crichton College of the University of Glasgow
Dumfries, UK
DG1 4ZL