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Saving the Environment for a Profit, Victorian-Style

by Pierre Desrochers

In the mind of the 21st-century environmentalist, Victorian cities and towns evoke images of black coal smoke and unsanitary conditions. For most people of the time though, they were one of humanity's supreme achievements. Not as clean as the countryside, no doubt, but thriving places where millions of rural poor had been lifted out of their miserable condition.

Pollution might have seemed an acceptable price to pay for such progress, but a surprisingly large number of Victorians thought it reasonable to expect both a higher standard of living *and* improved environmental amenities, if some trends that they witnessed in their day continued in years and decades ahead. First among these were the tremendous successes of entrepreneurs and technologists in creating valuable byproducts from industrial waste.

While many writers collected bits and pieces of information on these achievements, the journalist Peter Lund Simmonds (1814–1897) published a massive synthesis on the topic, first in 1862 and in a significantly revised form in 1873, which he titled *Waste Products and Undeveloped Substances; or, Hints for Enterprise in Neglected Fields*.[1] Simmonds's books discussed the profitable re-use of virtually all types of industrial and other waste. A point he never tired of making was that not only had considerable wealth been extracted from formerly wasted residuals, but also that the environment was typically better off as a result. A few such cases will give a glimpse of the achievements of Victorian manufacturers.

As Simmonds reminded his readers, what should be done with the fifth quarter of the animal, or the "offal," was a question that "formerly used to be perpetually assailing Boards of Health, and other sanitary bodies who have the supervision of slaughter-houses, meat-markets, &c." By the time he wrote his books, however, the offal of cattle suited for food, the waste from dressing skins and preparing leather, and other animal refuse had all found "distinctive and remunerative uses." A contemporary of Simmonds, the polymath Charles Babbage, thus described in 1832 the profitable uses of horn byproducts: "The tanner who has purchased the raw hides, separates the horns, and sells them to the maker of combs and lanterns. The horn consists of two parts, an outward horny case, and an inward conical substance, somewhat intermediate between indurated hair and bone. The first process consists in separating these two parts, by means of a blow against a block of wood. The horny exterior is then cut into three portions with a frame-saw."

Babbage proceeded to enumerate the various processes used to turn parts of the horn into combs, a glass substitute for lanterns,

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knife handles, soap, glue to stiffen cloth, and fertilizer. "Besides these various purposes to which the different parts of the horn are applied," Babbage wrote, "the clippings, which arise in comb-making, are sold to the farmer for manure [fertilizer]. . . . The shavings, which form the refuse of the lantern-maker, are of a much thinner texture: some of them are cut into various figures and painted, and used as toys. . . . But the greater part of these shavings also are sold for manure."[2]

As Simmonds pointed out, if "such skill and ingenuity" had not also been exhibited in the case of bones, and if bones had been left to rot, "producing fever and disease," there would indeed have been "cause for anxiety amongst sanitary authorities." Yet, this was not the case, and it was there for all to see "how the danger is dispelled, and a source of evil becomes the agent of much good, and the subject of a thriving and prosperous industry."[3]

Recycled Water and Other Byproducts

What was true for animal byproducts was true for most other industries. Simmonds thus describes a process developed at the Kinghole woolen mills, near Dumfries, by which the refuse water of the washing houses had been converted into valuable commercial material. "By means of mechanical appliances and chemical action," he wrote, "the refuse formerly turned into the river Nith to the injury of the salmon, is made to produce stearine, which forms the basis of composite candles, as well as a cake manure that sells at 40s per ton."

A friend of Simmonds, the chemist Lyon Playfair, similarly described progress at another textile mill where the recovery of used madder (the residual of a plant that formed the basis for a dye) provided both economic and environmental benefits. "The large quantities of spent madder constantly accumulating," he wrote, "were found exceedingly inconvenient." Used madder was not valuable enough to be turned into fertilizer and, as a result, this waste material was at first thrown into rivers. But, Playfair observed, it came to the attention of chemists that one-third of the coloring matter was thus thrown away. A simple treatment with a hot acid was soon devised and again rendered it available as a dye. The result, he observed, was that the "waste heaps are now sources of wealth, and the dyer no longer poisons the rivers with spent madder, but carefully collects it in order that the chemist may make it again fit for his use."[4]

The slag from iron furnaces provides another interesting illustration. This waste matter was on the mind of several Victorians and led to numerous proposals and experiments. For instance, on the evening of March 25, 1855, a Dr. William Smith of Philadelphia read a paper at a London meeting of the Society of Arts on "The Utilization of the Molten Mineral Products of Smelting Furnaces," in which he discussed a new technology that he had developed to turn slag into bricks or blocks for the construction industry. In the discussion that followed, one Mr. Nesbit said that even though the paper was of great importance, he thought that the subject was not new. Actually, he had himself labored much on the topic almost a decade earlier and, as he pointed out, his experiments took him to numerous works in southern France, south Wales, and parts of England and Scotland.

Other interesting remarks were made during this meeting on the cost to manufacturers of getting rid of this byproduct and on the fact that it could therefore be obtained cheaply from them. A Mr. Austin noted that he had known some iron masters who paid a lot to convey the slag away, which increased the price of iron, and that this would not be the case if it were convertible to useful purposes. This, he was convinced, "only required the spirit and energy which Englishmen possessed, to carry it out to a very profitable result."[5]

Smith's proposal, like many others before and after him, did not prove commercially successful. An innovative solution to the problem of slag was nonetheless found a few decades later when it became largely used as a substitute for stone in concrete and for sand in cement mortar. The British engineer John Kershaw described the major improvement that this brought to the British landscape: "Not only has this new manufacture solved the problem of slag disposal in Staffordshire, and in the other iron-producing districts of this country, but . . . the immense accumulations of slag, due to the past activities of the blast-furnaces, are being gradually removed, and the outward aspect of what in the past has been known as the 'Black Country' is undergoing a gradual change for the better, as a result of the success of this new manufacture."[6]

Perhaps the most spectacular case of profitable byproducts recovery in the Victorian era resulted from the purification of coal gas. As Playfair wrote, coal gas was only reluctantly accepted at the beginning of the nineteenth century because of its noxious side effects: "It was no mean innovation to replace tallow candles and oil lamps by an air streaming through pipes, but the difficulties attending its purification from noxious ingredients appeared even more insuperable than to reconcile the public to the innovation: the gas had an insupportably foetid odour, and certainly injured health when burned; it discoloured the curtains, tarnished the metals, ate off the backs of books, and covered everything with its fuming smoke."[7] According to Playfair, "it required a man of courage, as indomitable as [Frederic] Winsor, its great advocate, to persuade the public to continue its use until means were found for the removal of these noxious qualities."

The negative side effects of coal gas resulted from the presence of substances such as sulfureted hydrogen, which tarnished the metals and, with sulfuret of carbon, produced sulfurous fumes; ammoniac compounds, which changed the colors of dyes and acted on leather; and tarry vapors, which deposited soot. In time, however, chemists were able to turn the sources of these problems into profitable byproducts.

As Playfair put it, "the waste and badly-smelling products of gas-making appeared almost too bad and foetid for utilization, and yet every one of them, Chemistry, in its thriftiness, has made almost indispensable to human progress."

Among other examples, the bad-smelling tar yielded benzole, an "ethereal body" that proved valuable as a solvent and for preparing varnishes, making oil of bitter almonds, removing grease spots, and cleansing soiled white kid gloves. The same tar gave naphtha, a solvent of Indian rubber and gutta percha. Coal tar also furnished the chief ingredient of printer's ink in the form of lampblack. It also substituted for asphalt in pavements. When the tar was mixed with coal dust (previously wasted in mining operations), it formed by pressure an excellent and compact artificial fuel. The water, condensed with the tar, contained much ammonia and was readily convertible into sulfate of ammonia, which was used as a fertilizer and in many other lines of work. Cyanides were also present among the products of distillation and were converted into the dye known as Prussian blue. The naphthaline, which used to choke the pipes, was also made into a beautiful red dye, closely resembling the color previously obtained from madder. Coal, when distilled at a lower temperature than that required to form gas, turned into an oil containing paraffin, which was largely used as an antifrictional oil for light machinery.

Learning from the Victorians

Most "sustainable development" theorists show little faith in the incentive structure of market economies to do well financially and environmentally at the same time. Yet many Victorian commentators who were more familiar with commerce and industry saw a direct connection between increased competitive pressures and improved environmental amenities. In their judgment, technological innovation and entrepreneurial behavior insured both a better standard of living and solutions to serious pollution problems.

This is not to say, of course, that Victorian firms were more efficient or cleaner than current manufacturing operations whose foundations are built on more than a century of subsequent innovations. The criteria by which the environmental consciousness or environmental performance of Victorian entrepreneurs should be judged are therefore not 21st-century standards of cleanliness, but rather the improvements that they brought over previous practices. As the economist Thomas DeGregori writes, innovation and progress are never defined in terms of ultimate or final solutions, but rather in terms of "creating smaller or less important [problems] than those we solve."[8]

Even though the evidence presented here only deals with the United Kingdom during the Victorian era, similar processes can be found in all past advanced economies. Simmonds said: "Great Britain was the first to carry out this utilisation on an extensive scale, and her example is now being followed largely on the Continent, in Australia, the United States, and even in the River Plate States [Argentina and Uruguay], where numerous substances, formerly wasted, have now become profitable articles of commerce."[9] If Simmonds's assessment was correct—and it is corroborated by the fact that a few decades later treatises similar to his were written by French, German, and American authors[10]—a case can be made that economic development and improved environmental amenities have not only never been incompatible, but that economic progress has always *mandated* the development of more efficient practices and the discovery of profitable new uses for industrial waste. ☐

1. Peter Lund Simmonds, *Waste Products and Undeveloped Substances; or, Hints for Enterprise in Neglected Fields* (London: Robert Hardwicke, 1862), and Peter Lund Simmonds, *Waste Products and Undeveloped Substances: A Synopsis of Progress Made in Their Economic Utilisation During the Last Quarter of a Century at Home and Abroad*, 3rd ed. (London: Hardwicke and Bogue, 1876 [1873]).
2. Charles Babbage, *On the Economy of Machinery and Manufactures* (1832). Available at http://socserv.socsci.mcmaster.ca/~econ/ugcm/3ll3/babbage/babb2.
3. Bethnal Green Branch of the South Kensington Museum, *Descriptive Catalogue of the Collection Illustrating the Utilization of Waste Products* (London: George E. Eyre and William Spottiswoode for Her Majesty's Stationery Office, 1875), p. 36.
4. Lyon Playfair, *On the Chemical Principles Involved in the Manufactures of the Exhibition as Indicating the Necessity of Industrial Instruction* (London: Royal Society for the Encouragement of Arts, Manufactures and Commerce, 1852), pp. 173–74.
5. "The Utilization of the Molten Mineral Products of Smelting Furnaces," *Journal of the Society of Arts,* March 30, 1855, pp. 335–41.
6. John B.C. Kershaw, *The Recovery and Use of Industrial and Other Waste* (London: Ernest Benn Limited, 1928), pp. 3–4.
7. Playfair, pp. 186–88.
8. Thomas R. DeGregori, *A Theory of Technology: Continuity and Changes in Human Development* (Ames, Iowa: Iowa State University Press, 1985), p. 5.
9. Peter Lund Simmonds, *Animal Products, Their Preparation, Commercial Uses and Value* (New York: Scribner, Welford and Armstrong, 1875), p. iii.
10. For more detail on this issue, see Pierre Desrochers, "Industrial Ecology and the Rediscovery of Inter-Firm Recycling Linkages: Some Historical Perspective and Policy Implications," *Industrial and Corporate Change*, November 2002, pp. 1031–57.