ECONOMIC NOTE

Montreal Economic Institute

"Regulation" Series

May 2005

Reconciling profits and sustainable development: Industrial waste recycling in market economies

In recent years, several writers have promoted the creation of linkages in industrial waste recycling between different industries, where the waste of one firm would become the valuable input of another. This is seen as a way to generate both economic and environmental dividends. Most authors nonetheless still believe that the search for increased profitability has traditionally been incompatible with this goal because it favours a short-term perspective in which manufacturers tend to lower their costs by dumping polluting emissions into nature.[1] This view, however, is based on a historically inaccurate assessment. Not only are higher profits and a cleaner environment compatible, but much historical evidence suggests that industrial recycling is a long-practised, productive and, indeed, essential element of the market system.

Past assessments of industrial waste recycling

While significant environmental damage resulted from industrial activities at various locations and times, a large semi-technical literature illustrates that market incentives, such as the price system and private property rights, have long motivated the development and adoption of economically and environmentally beneficial industrial practices. Numerous books and articles published between the first decades of the Industrial Revolution and the birth of the modern environmental movement in the late 1960s document the development of waste recovery linkages (see Table 1). Strangely enough, these works have been almost entirely forgotten, and most environmental and business researchers are not even aware of their existence.

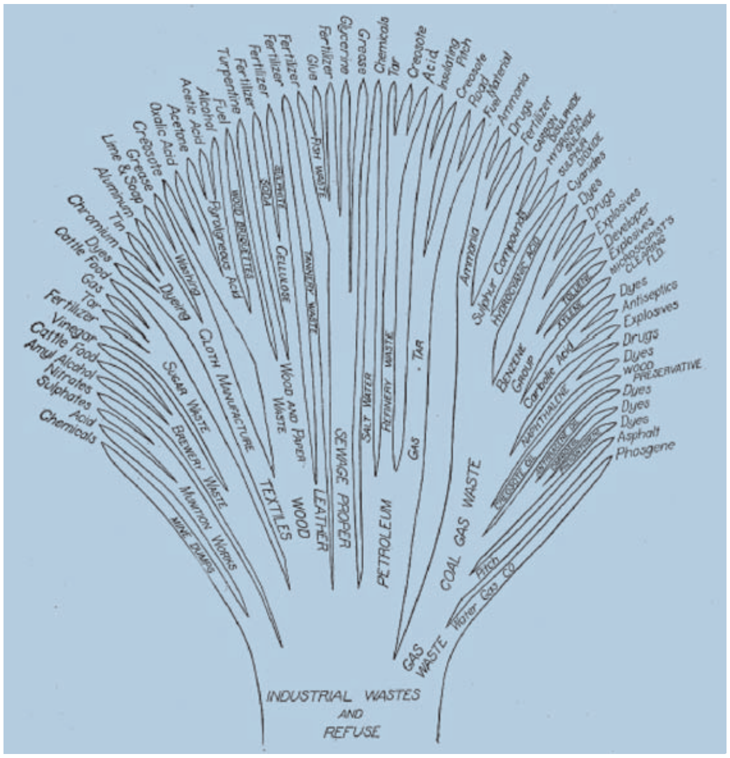

Figure 1. Diagram showing, in the form of a tree, the various wastes and the useful substances into which they may be manufactured or which may be obtained from them. Source: Victor E. Shelford, 1919.

The details and extent of past industrial recovery practices were already so overwhelming by the middle of the nineteenth century that the British journalist Peter Lund Simmonds felt compelled in 1862 to state in the introduction to his 420-page survey *Waste Product and Undeveloped Substances*: "The general subject treated of in this volume … is too extensive in its scope to be discussed successfully in detail here, since any one branch would of itself form a useful and interesting volume."[2]

1. See, for example, Paul Hawken, Amory Lovins and L. Hunter Lovins, *Natural Capitalism. Creating the Next Industrial* Revolution, (Boston: Little, Brown, 1999).
2. Peter Lund Simmonds, *Waste Products and Undeveloped Substances: or, Hints for Enterprise in Neglected Fields*, (London: Robert Hardwicke, 1862, p. v.).

Pierre Desrochers is Assistant Professor in the Department of Geography at the University of Toronto and Research Associate at the Montreal Economic Institute.

Table 1

Main English-language surveys on industrial waste recovery, 1862-1963

Author Nationality	Title	Year, last edition, number of pages; previous editions	Publisher(s)
Simmonds, Peter Lund British	*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*	1876, 491 pages (1862, 1873)	Hardwicke and Bogue (London)
Koller, Theodor German	*The Utilization of Waste Products: A Treatise on the Rational Utilization, Recovery, and Treatment of Waste Products of all Kinds*	1918, 338 pages English eds. (1902, 1915; German eds. 1880, 1900, 1921)	Scott, Greenwood & Son (London); D. Van Nostrand Company (New York)
Kershaw, John B.C. British	*The Recovery and Use of Industrial and Other Waste*	1928, 212 pages	Ernest Benn Limited (London)
Lipsett, Charles S. American	*Industrial Wastes and Salvage: Conservation and Utilization*	1963, 407 pages (1951)	Atlas Publishing Co. (New York)

The following excerpts from an article published in an 1881 issue of the American trade periodical *Manufacturer and Builder* give us a glimpse of the extent of past industrial recycling activities:

> Of the carcasses of slaughtered animals not a scrap or morsel is allowed to go to waste; and even the waste blood of the abattoir is utilized by the sugar refiners and the manufacturers of albumen. Sawdust, mixed with blood or other agglutinative substances, and compressed by powerful pressure in heated dies, is formed into door knobs, hardware and furniture trimmings, buttons, and many other useful and decorative articles … [T]he waste gases of the blast furnace are utilized to heat the blast, and to generate the steam that drives the engine that furnishes the blast; and the slag[3] of the iron furnaces that from time immemorial only served to decorate the hillsides, is now cast into building blocks, granulated to make building sand, made into cement, mixed with suitable chemicals and made into the commoner grades of glass, or blown by steam jets into the finest filaments to make the curious mineral wool for covering boilers, steam pipes, etc. And so the record might be indefinitely extended, showing how modern science with the most beneficent results is steadily teaching the world to utilize the waste substances of nature and the arts, enabling us to reap advantages where none were supposed to exist, or where, if they were suspected, they were undervalued or neglected.[4]

As the journalist Frederick Talbot observed in 1920, "To relate all the fortunes which have been amassed from the commercialization of what was once rejected and valueless would require a volume. Yet it is a story of fascinating romance and one difficult to parallel in the whole realm of human activity."[5] Perhaps the best summaries of the extent of these past practices are to be found in two figures drawn in 1919 by the American zoologist Victor E. Shelford. One shows all the deleterious effects of industrial waste when dumped into nature, such as "Eggs of Marine Animals Killed," "Bad Odors" and "Recreation Waters Destroyed." The other illustrates the same "various wastes and the useful substances into which they may be manufactured or which may be obtained from them" (see Figure 1).[6]

Two types of incentives

Writers who analyzed the incentives promoting this process highlighted the importance of two types of pressures. The first, and most important in the opinion of the majority, was the search for increased, or at least constant, profitability. The second was the necessity of removing nuisances to other parties that could result in legal actions.

Not only are higher profits and a cleaner environment compatible, but much historical evidence suggests that industrial recycling is a long-practised element of the market system.

As numerous writers observed, the profit motive has always enticed industrialists to find new ways of channelling as much of their outputs as possible through the economy instead of dumping them in the backyard, the river or the atmosphere. For example, Simmonds wrote in 1876 that competitive pressures continually forced manufacturers to identify new ways of creating wealth out of everything that came through their hand, which typically led to the conversion of "useless products into those possessed of commercial value."[7] In doing so, they were able to reduce disposal costs and to earn new revenues, both activities benefiting their bottom line.

3. Slag is the more or less completely fused and vitrified matter separated during the reduction of a metal from its ore.
4. Anonymous, "Utilization of Waste Products," *The Manufacturer and Builder* 13 (4), 1881, p. 86.
5. Frederick A. Talbot, *Millions from Waste*, (Philadelphia: J.B. Lippincott Company, 1920), pp. 17-18.
6. Victor E. Shelford, "Fortunes in Wastes and Fortunes in Fish," *The Scientific Monthly* 9 (2), 1919, p. 100.
7. Simmonds, 1876, *op. cit*., pp. 205-206.

Table 2

Typical use of the Douglas fir timber harvested on one acre of land, western Oregon 1948-1973 (cubic feet)

	1948	1963	1973
Lumber	3,600	4,600	5,000
Paper		3,800	5,900
Plywood		800	1,700
Particleboard			1,500
Total for products	3,600	9,200	14,100
Residue (fuel and waste)	14,300	8,700	3,800
Total	**17,900**	**17,900**	**17,900**

The Canadian-born economist Rudolf Clemen similarly observed in 1927 that the tremendous development of by-products from waste in previous decades had been the result of "the ever-increasing force of competition" to which firms were submitted, both from within their industry and from outside, as new substitute products were being constantly developed in other lines of work.[8]

Even Karl Marx acknowledged that turning waste products into something valuable reduced "the cost of the raw material to the extent to which it is again saleable" and that these savings increased profitability. Marx even went so far as to say that after economies of scale, waste recovery was the second big source of economy in industrial production.[9] Indeed, much historical evidence suggests that business people were often polluting against their will, not so much because they cared about the environment but because they were losing potentially profitable resources.

Industrial by-product recovery was also sometimes triggered by legal actions, or the threat of such actions, based on the common law doctrines of negligence, trespass, nuisance and strict liability for abnormally dangerous conditions and activities, or from specific laws that directly targeted industrial pollution. According to several commentators, polluting firms were often under the obligation to eliminate the environmental damage that resulted from their solid, liquid and gaseous emissions. In such cases, the idea of creating something profitable from them was not the priority. On the other hand, it was regularly observed that creative engineers, chemists and technicians were rarely satisfied with simply neutralizing their waste products and that they often succeeded in creating commercially valuable inputs in the process of trying to dispose of them safely.[10]

The idea that stricter environmental standards can spur innovations that reduce environmental harm and enhance business competitiveness has been independently rediscovered in recent years.[11] However, modern commentators have so far failed to point out that unlike the modern "command-and-control" environmental regulatory apparatus which has often been blamed for institutionalizing barriers to innovative behaviour,[12] the common law did not mandate a specific technology to deal with particular problems and did not establish an arbitrary distinction between a useful material and a waste that specifically prohibits the re-use of the latter.

Industrial waste recovery today

The detailed examination of any industrial sector quickly reveals increased efficiency in the use of the primary resource and the continuous development of by-products out of what were formerly waste products. This trend can be observed in the wood industry and the pulp and paper industry. For example, one can look at the case of old-growth Douglas fir timber in western Oregon. According to a study on a typical acre of land in this area which contained about 17,900 cubic feet of wood, in the 25-year period between 1948 and 1973, the usable products obtained from similar acres of Douglas fir increased nearly four times through the use of new technologies and the development of by-products (Table 2). In other words, a log sawn to lumber in 1948 yielded only 20% finished product and 80% wastes, which were often buried or burned simply to destroy them, while this ratio was almost exactly the opposite 25 years later (Table 2).[13]

Marx even went so far as to say that after economies of scale, waste recovery was the second big source of economy in industrial production.

8. Rudolf Clemen, *By-Products in the Packing Industry*, (Chicago: University of Chicago Press, 1927), p. 2.
9. From the non-paginated version of Karl Marx's *Capital*, Volume III, Part I, Chapter 5, available at http://www.econlib.org/library/YPDBooks/Marx/mrxCpC5.html#Part%20I,%20Chapter%205.
10. John B.C. Kershaw, *The Recovery and Use of Industrial and Other Waste*, (London: Ernest Benn Limited, 1928), pp. 2-3; Erich Zimmermann, *World Resources and Industries*, (New York: Harper & Brothers Publishers), 1933, p. 768.
11. Michael Porter, "America's Green Strategy," *Scientific American* 264 (4), 1991, p. 168.
12. Byron Swift, *Barriers to Environmental Technology Innovation and Use*, (Washington, D.C.: Environmental Law Institute, 1998).
13. Jim Bowyer, Rubin Shmulsky and John Haygreen, *Forest Products and Wood Science*, 4th Edition, (Ames: Iowa State University Press, 2003), pp. 498-504.

Numerous new technologies to reduce further the level of waste were developed in the last half-century as producers learned to get more valuable lumber from logs and to find uses for unused species of trees and for trees with irregular shapes. Wastes and discards were also increasingly used for energy production and as inputs for new products.

One of the most significant advances has been the development of numerous new types of composite products made from wood chips, sawdust and organic adhesives that now compete with, and complement, solid lumber in construction and industry. Products such as plywood, laminated veneer, medium-density fibreboard, insulation board and particleboard grew from almost nothing five decades ago to over 32 million cubic metres in 1993. According to some analysts, this development of composites spared 23 million cubic metres of roundwood in addition to reducing the amount of former waste they incorporated by about nine million cubic metres. As a result of these and other advances, the average percentage of wood residues among American millers fell from more than 26% in 1970 to just 2% in 1993.[14]

Several other creative examples of wealth created from waste could be given in this line of work. The point, however, according to wood product experts Bowyer, Shmulsky and Haygreen, is that "ongoing technology improvements, driven by competition and rising costs of raw materials, are serving to continually increase the quantity of useful products that can be obtained from a given quantity of logs. Furthermore, improvements in forestry practices are increasing the yield of raw materials from a given area of land."[15]

The average percentage of wood residues among American millers fell from more than 26% in 1970 to just 2% in 1993.

Conclusion

Despite much evidence to the contrary, the dominant view among sustainable development theorists and environmental activists is that traditional market incentives, such as profits and property rights, provided little encouragement to turn polluting waste into valuable by-products. In this view, pollution has therefore always been the price to pay for increased economic expansion and employment. As a result, business was doomed from the start to a perpetual conflict with nature, regulators, and defenders of the environment.

However, historical evidence suggests that, as a society becomes more technologically and commercially advanced, the increased diversity of the technical, managerial and trading capacities of its members will provide for many different ways of turning residuals into resources. Meanwhile, many new and different potential markets for these resources will be created. In this context, it would be inefficient to rely on unproven and uneconomic schemes that ignore the beneficial effect of market incentives. The best way to promote sustainable development is instead to remove institutional barriers to innovation, such as price-distorting subsidies that favour the use of raw materials and environmental regulations that prevent the development of by-products from waste.

14. Iddo Wernick, Paul Waggoner and Jesse Ausubel, "Searching for Leverage to Conserve Forests: The Industrial Ecology of Wood Products in the United States," *Journal of Industrial Ecology* 1 (3), 1997, pp. 125-145.
15. Bowyer *et al.*, *op.cit.* p. 504.

Montreal Economic Institute

Montreal Economic Institute
6708 Saint-Hubert Street
Montreal, Quebec
Canada H2S 2M6
Telephone: (514) 273-0969
Fax: (514) 273-0967
e-mail: info@iedm.org
Web site: www.iedm.org

The Montreal Economic Institute (MEI) is an independent, non-profit, non-partisan research and educational institute. It endeavours to promote an economic approach to the study of public policy issues.

The MEI is the product of a collaborative effort between entrepreneurs, academics and economists. The Institute does not accept any public funding.

One-year subscription to the MEI publications: $98.00.

Printed in Canada

Illustration: Benoit Lafond
Graphic Design: Valna inc.