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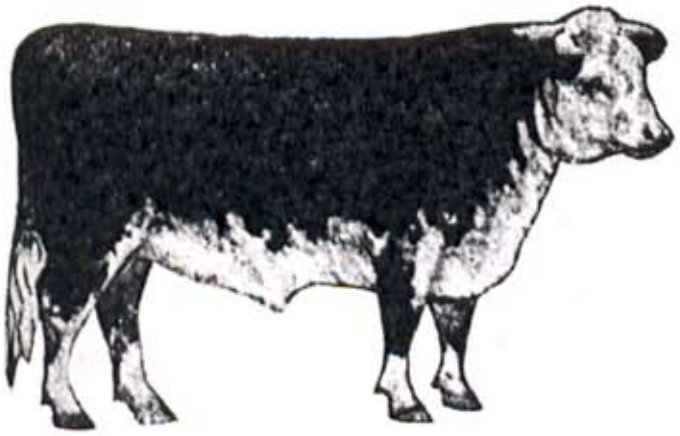

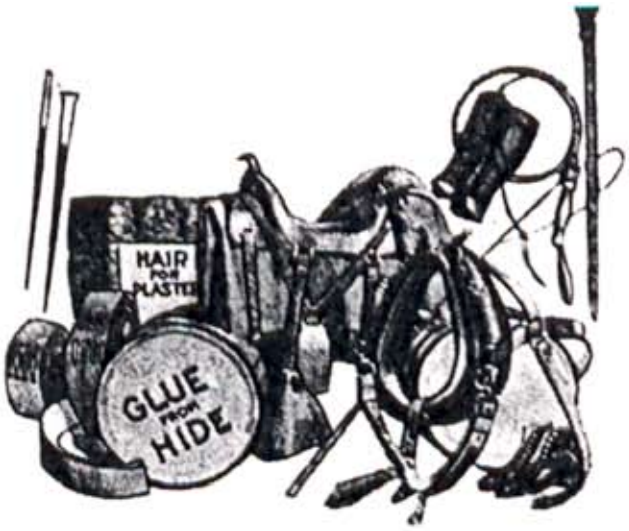

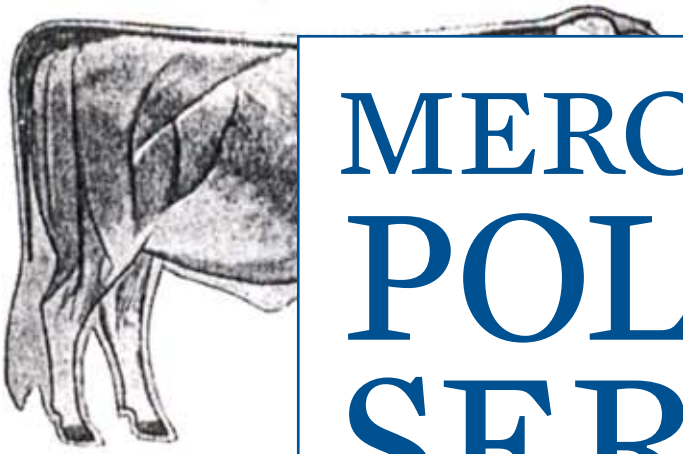

MERCATUS POLICY SERIES

POLICY PRIMER No. 7

THE INVISIBLE GREEN HAND

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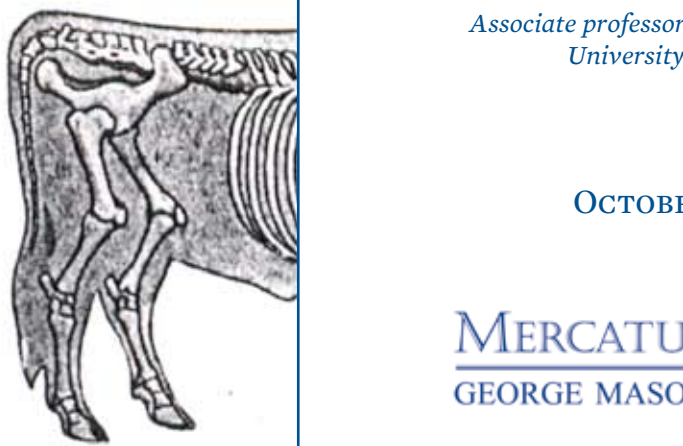

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THE INVISIBLE GREEN HAND

Andrew Reed and Pierre Desrochers

EXECUTIVE SUMMARY

Protecting the environment, both in developed and developing countries, is a popular policy topic that even crosses over into the worlds of mass media and marketing. It is hard to avoid companies advertising their green practices, but even with the surge in advertising, many see these efforts as corporations covering up their selfish actions.

This Policy Primer argues that corporate self-interest and environmental stewardship are compatible. Independent businesses and entrepreneurs acting within a context that protects property rights and encourages innovation are inherently inclined towards green practices. Although the late nineteenth century is not usually associated with environmental protection, examples from both the United States and Great Britain during this period, as well as more recent examples, illustrate how market arrangements might progressively reduce the environmental impacts of economic activities.

Given the strong link between green practices and corporate self-interest, it is important to think about future policy initiatives that reinforce this link in the context of current U.S. environmental policy. This is especially true as government-driven regulation does not consistently yield the improved environmental outcomes for which it is supposedly designed. As the hostility toward innovation embedded within many regulations limits the full environmental benefits of industrial symbiosis, the United States should reconsider some of its regulatory policies in order to capture the benefits of the invisible green hand.

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THE INVISIBLE GREEN HAND

INTRODUCTION

Companies large and small frequently advertise their concern for the environment by including information about "green" initiatives on their websites and in publicity material. Molson Coors Breweries, for example, highlight their sale of by-product ethanol, the use of brewer's mash as a livestock feed, the encouragement they give to recycling bottles and cans, and the capture and reuse of carbon dioxide and methane given off in the brewing process.[1] People often react cynically to such efforts, labeling them as "greenwashing," implying that corporations attempt to cover up their selfish actions through a few well-publicized, but ultimately inconsequential, environmentally-friendly actions.[2] Many believe that businesses are just out to make money and would ignore costs borne by society unless government regulations kept them in check.

Much evidence, however, suggests that corporate self-interest and environmental stewardship actually are compatible. Historical examples and recent environmental management research demonstrate that businesses acting in their own self-interest do—in the right institutional environment—improve both their bottom line and environmental performance.

In a market economy characterized by an unhampered price system and well-defined and enforced private-property rights, an invisible hand not only leads businesses to act in a manner beneficial to all, but this hand also exhibits "green" tendencies.[3] These tendencies arise because, in a competitive environment, businesses reap the rewards of efficiency, and reducing waste raises efficiency. In other words, environmental damage imposes costs on firms that frequently go unrecognized.

Policy makers are tasked with finding solutions to high-visibility environmental issues. However well-intentioned, government intervention frequently leads to unintended consequences, some of which harm the environment. While some regulation of private business may appear desirable—or even necessary—to protect the environment, a close look at the performance of economies characterized by freer markets and protection of property rights compared to those that are strictly controlled reveals that less-regulated economies have a better record in terms of environmental results.

This Policy Primer begins with an overview explaining why independent businesses and entrepreneurs, acting in their own economic self-interest within an institutional context that encourages innovation, are inherently inclined towards green practices. In the second section, we discuss some historical examples from periods in which entrepreneurship in business was minimally constrained by regulatory impediments—Britain and the United States in the late nineteenth and early twentieth centuries. These cases illustrate how market arrangements might progressively reduce the adverse environ-

1. Molson Coors Brewing Company, "Environmental Responsibility, Initiatives," http://cms.molsoncoors.com/responsibility/environmental-responsibility.
2. "Greenwashing" suggests initiatives that cannot be justified on a cost-benefit basis and are therefore unlikely to prove a viable business strategy.
3. See Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, 5th ed. (London: Methuen and Co., Ltd., 1904), http://econlib.org/library/Smith/smWN.html. This paper adheres to the usual interpretation of Smith's "invisible hand" metaphor while acknowledging that there is considerable controversy among economists regarding his intent when using the phrase. See Joseph Pesky, "Adam Smith's Invisible Hands," *The Journal of Economic Perspectives* 3, no. 4 (Autumn, 1989): 195-201.

mental impacts of economic activities. The third section examines the "good intentions" approach to improving environmental performance that has dominated public-policy formulation for much of the past century. A more recent example of industrial symbiosis—where the waste streams of industries are transformed into valuable by-products that are used in other profit-making ways—frames the question discussed in the fourth section of whether government direction is the most effective approach to environmental management. This section shows that regulation does not consistently yield the improved environmental outcomes for which it is supposedly designed and that, in the absence of environmental regulation, businesses continue to pursue objectives that ultimately generate beneficial environmental outcomes. The final section suggests how future policy initiatives can most effectively reinforce the invisible green hand tendencies of private sector businesses in the context of current U.S. environmental policy.

I The Green Hand in Economic Theory

In economic interactions, prices indicate relative availability of inputs or resources. These inputs include not only natural resources, but also financial capital for investment and the human capital necessary to combine other inputs into marketable products and services. Successful economic adaptation to changing economic circumstances therefore depends on a direct interaction between two interrelated processes: 1) at the level of the economy, the system in aggregate must be able to generate and accurately transmit information regarding the relative scarcity of potential resources to individual economic actors; and 2) at the level of individual firms, these signals must trigger innovations that alter "the way things are done" so that the firm's viability is enhanced. The first of these mechanisms can be thought of as the framework within which economic actors operate, including prices and rules of conduct. The second mechanism involves the process of innovation at the firm level in response to price signals and competitive pressure.

Entrepreneurship is essentially about identifying ways to do something to generate more income, to reduce production costs, or to achieve both simultaneously.[4] Prices encourage efforts to either use available resources more efficiently or discover uses for resources previously considered of little or no economic value. As pointed out thirty years ago, "[t]here is no known example of a shortage persisting over time where price was relied upon as the rationing mechanism."[5] Entrepreneurial innovation has led to long-term trends toward increasing labor productivity in agriculture, miniaturization in electronics, higher power-to-weight ratios (and hence greater fuel economy) in agricultural equipment and automobiles.[6]

As long as individual property rights were enforceable, market mechanisms encouraged innovative responses with ultimately beneficial environmental impacts as businesses responded to two serious competitive threats:

- The partial waste (i.e., incomplete usage) of natural raw materials used in the manufacturing process represented a cost to the firm. These costs were compounded if removing these non-economic residuals from the firm's premises involved additional expense.
- Infringing on the property rights of others when discarding waste could incur fines, cutting directly into a firm's profitability. In some cases, legal action against the firm might result in "cease and desist" orders, halting the production of revenue-generating output and leaving the firm with idle but costly assets.

Generation of waste from large volumes of raw material inputs was an obvious consequence of early industrial production. But anything that was not saleable constituted a cost. In a competitive environment where other firms were actively attempting to bring similar products to the market at lower cost, it was imperative to eliminate these costs as quickly and completely as possible.

The factory owners and managers who worked on turning waste residuals into commercially marketable products across a wide spectrum of industries acted in relative secrecy as attracting attention to what would

4. For a more complete discussion of the theory of entrepreneurship, see Frederic Sautet, *An Entrepreneurial Theory of the Firm* (New York: Routledge, 2006).
5. E.C. Pasour, Jr., "Austerity, Waste and Need," *The Intercollegiate Review* 13, no. 2 (Winter-Spring, 1978): 80.
6. See Jesse Ausubel, "The Environment for Future Business," *Pollution Prevention Review* 8, no. 1 (1998): 39-52.

today be considered "win-win" opportunities (i.e., having both economic and environmental benefits)[7] would compromise their competitive advantage. Nonetheless, it is clear that the drive toward cost reduction and revenue enhancement in market economies prompted the development of economically viable innovations that turned waste residuals—including pollutants—into commercially marketable products.[8]

Peter Lund Simmonds, a Victorian writer who dealt extensively with this topic, documented how manufacturers aimed "to utilize all things to the utmost possible extent." Numerous valuable articles were produced from what had previously been thrown away as a nuisance, and raw materials that got into their clutches were systematically "tortured by a score of processes to yield up all [their] virtues."[9] Simmonds even acknowledged in the introduction of his four-hundred-page book that his treatment would necessarily have to be superficial, "since any one branch would of itself form a useful and interesting volume."[10] Simmonds and his contemporaries further recognized that the ever greater utilization of industrial residuals at the time was the continuation of a well-established economic principle. For example, the chemist Lyon Playfair observed that "the whole history of manufacture was but the using up of waste materials for a long time unrecognized by capital, but which ultimately had produced the most important benefits to mankind."[11]

The importance of competitive pressure as the main driver of this process was widely understood. As Simmonds observed in 1875:

> Few among the minor tendencies of industries are more worthy of note than that shown in the utilization of waste materials. As competition becomes sharper, manufacturers have to look more closely at those items which may make the slight difference between profit and loss, and convert useless products into those possessed of commercial value.[12]

In other words, competition creates an unrelenting war on waste; feedback provided by market prices directs the process of innovation toward waste reduction.

A second motivation complemented these competitive pressures, namely, the threat that production-limiting economic sanctions might be imposed if others suffered damage attributable to a particular business activity. The mechanism of property rights had two dimensions that were critical to the attitude of factory owners and managers toward waste and emissions.

The first aspect of property rights entitled individuals to sell a commodity and to retain and enjoy the proceeds of the sale. This effectively enshrined in law the incentive to profit from commercial activity. The legal right to enjoy the profits of commercial ventures enlarged the pool of investors prepared to finance innovative initiatives.

The second, equally important, aspect of property rights was that based on the common-law doctrines of trespass and nuisance. "Trespass" refers to the physical invasion or entry by an individual onto another's property, whereas "nuisance" covers indirect or intangible invasions, such as odors and noises, or any unreasonable interference with another's use or enjoyment of his property. In this context, polluting someone else's property was no more acceptable than vandalizing it and could have resulted

7. Discussion of the implications of the "invisible hand" usually distinguish between financial benefits for the firm and benefits accruing to society as a whole. Sometimes reference is made to the "triple bottom line" (financial, social and environmental). We are concentrating on the environmental implications of the invisible hand, and hence here "win-win" outcomes refers to the environmental gains enjoyed by society at large and the competitive advantage gained by the firm.

8. See Pierre Desrochers, "How did the Invisible Hand Handle Industrial Waste? By-product Development before the Modern Environmental Era," *Enterprise and Society* 8, no. 2 (June, 2007): 348-374. A more detailed survey of this literature is available in Pierre Desrochers and Karen Lam, "Business as Usual in the Industrial Age: (Relatively) Lean, Green, and Eco-Efficient?" *Electronic Journal of Sustainable Development* 1, no. 1 (2007), http://www.ejsd.org/public/journal_article/1.

9. Peter Lund Simmonds, *Waste products and undeveloped substances: A synopsis of progress made in their economic utilization during the last quarter of a century at home and abroad*, 3rd ed. (London: Hardwicke and Bogue, 1876): 10.

10. Peter Lund Simmonds, *Waste products and undeveloped substances, or hints for enterprise in neglected fields* (London: Robert Hardwicke, 1862), 5.

11. Quoted in Anonymous, "Discussion," *Journal of the Society of Arts*, 5 (1856): 61. The recycling of brewer's mash, referred to in the Molson Coors publicity is a case in point, having a history almost as long as brewing itself.

12. Peter Lund Simmonds, *Descriptive catalogue of the collection illustrating the utilization of waste products Bethnal Green Branch of the South Kensington Museum* (London: George E. Eyre and William Spottiswoode for Her Majesty's Stationery Office, 1875), 4.

in damages being awarded or even an injunction.[13] In a highly competitive environment, the potential for serious economic penalties served as a powerful incentive for self-regulation.

The steady erosion of property rights and personal freedom during the twentieth century means that modern businesses face dramatically different constraints. Before we consider the current situation, some examples of the innovative process at work historically are provided to illustrate how businesses were motivated to "do good" (for the environment) by "doing well" (financially) despite minimal regulation.

2 Market-induced Waste Management: Scenes from Industrializing Economies

2.A: Coal Tar in Victorian Britain

At first glance, the Industrial Revolution in Victorian Britain—a period in history retrospectively associated with the belching chimneys and noxious effluents of "dark satanic mills" —seems a strange place to seek evidence of a propensity toward green practices by business. However, since this period was also one in which governments did not pursue environmental policies, it is an ideal setting to gauge the incentives encouraging businesses to restrict their environmental impact.[14]

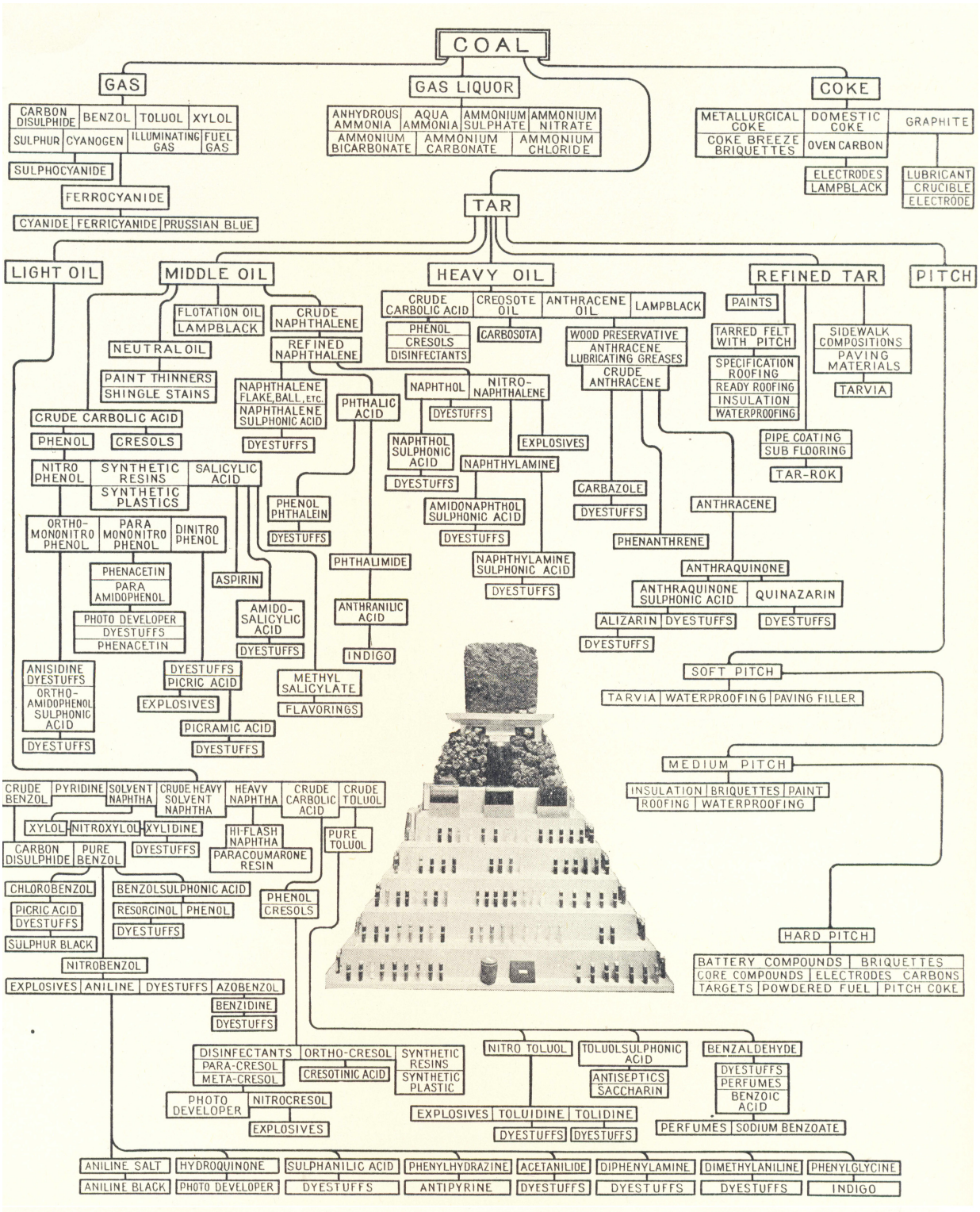
Industrialization in Victorian Britain, like that occurring in many parts of the world today, generated dramatic improvements in living standards, but sometimes resulted in what twenty-first century observers in more advanced economies would consider environmental degradation. At the time however, workers, factory owners and managers, and the population at large either did not appreciate these environmental costs or considered them relatively unimportant. The private sector responded to incentives to take commercial risks, and the widespread adoption of the factory system was one of the results. These same incentives gave impetus to scientific advances and the application of newly acquired knowledge to industrial-production problems. The development of valuable by-products out of waste both improved living standards and benefited the environment. Coal tar was a case in point.

The streets of Victorian cities in Britain were lit by lamps that burned a gas produced by heating coal. However, the process of releasing the valuable gases used in lighting and fuel created three main residues: coke, which was used as a hot-burning, practically smokeless fuel; a dirty liquid rich in ammonia that became a sought-after fertilizer; and a thick, black, viscous substance known as coal tar.

Coal tar was by far the biggest environmental headache. Huge volumes of coal tar remained despite limited applications as a sealant for roofs, ropes, and wooden hulls and as a torch fuel. Disposing of it seemed impossible at first. Burning it generated unacceptable amounts of highly toxic dark smoke; burying it killed vegetation and polluted the water table; and discharging it into water courses risked legal action. Not surprisingly, coal tar became the "bane of life" of contemporary gas engineers, "harassing them to the verge of endurance." These problems prompted entrepreneurs to expend a vast amount of resources and "prodigious thought"[15] in order to address the disposal of coal tar.

The discovery that "pickling" or "creosoting" timber in heavy oils derived from coal tar significantly increased the timber's useful life was a significant breakthrough.[16] This technology enjoyed burgeoning demand as a result of the need to treat railway sleepers and telegraph poles at a time when both lines of work were rapidly expanding. Consequently, British creosote became an important export.[17] Additional large volume uses for creosote-

13. An injunction involves an order requiring either the cessation of the activity giving offense or specifying corrective action. For an extensive discussion of this issue, see Roger E. Meiners and Andrew P. Morriss, eds. *The Common Law and the Environment. Rethinking the Statutory Basis for Modern Environmental Law* (New York: Rowan & Littlefield Publishers, Inc., 2000).
14. Although by no means a textbook example of a pure market economy, Victorian England is usually recognized as being "as good (or bad, depending on one's perspective) as it gets." See E.F. Paul, "Laissez faire in nineteenth century Britain: fact or myth?" *Literature on Liberty* 3, no. 4 (Winter, 1980): 1-71, http://www.econlib.org/library/Essays/LtrLbrty/fplLNB.html.
15. F. A. Talbot, *Millions from Waste* (Philadelphia: J. B. Lippincott Company, 1920): 15. Interestingly, the Molson Coors website referred to at the outset quotes Bill Coors, the grandson of the founder as saying "waste is a resource out of place" which is a quote from Talbot, Ibid., 11.
16. The process involved placing dried timber in a container and subjecting it to partial vacuum, by which it was impregnated with the heavy oils derived from coal tar.



Source: © 1919, the Barrett Company, New York; insert from an exhibit of coal products in the United states National Museum

like derivatives of coal tar later included cattle washes, sheep dips, general disinfectants, and fuel for engines and lights.

Similarly, the lighter (and much less voluminous) fractions of coal-tar oil initially had such limited applications that they were for some time "in much about the same industrial position as the tar itself before its application as a timber preservative."[18] However in the wake of the development of *mauve* (a bright but delicate purple dye) in 1856, the nascent synthetic dyestuffs industry soon provided a lucrative market for these residues. Significantly, the development of this industry led to the collapse of the once important demand for various types of plants, lichens, trees, insects, mollusks, minerals, and guano, simultaneously reducing extractive pressures while allowing increased food production on "liberated" land.

Perhaps even more importantly, the know-how acquired in this line of work later served as a technological springboard for the creation of tar-derived products including explosives, medicines, perfumes, artificial flavors, sweeteners, disinfectants, antitoxins, and tracing and photographic agents.[19] In this and many similar cases, when success was finally achieved, the flood gates opened, and hundreds of remunerative by-products derived from these residues became the original building blocks of our modern synthetic world. Eventually, coal tar was described as the "flower of the chemical industries."[20]

In time, by-products derived from the once problematic residuals of another raw material, petroleum, would displace many of these materials.[21]

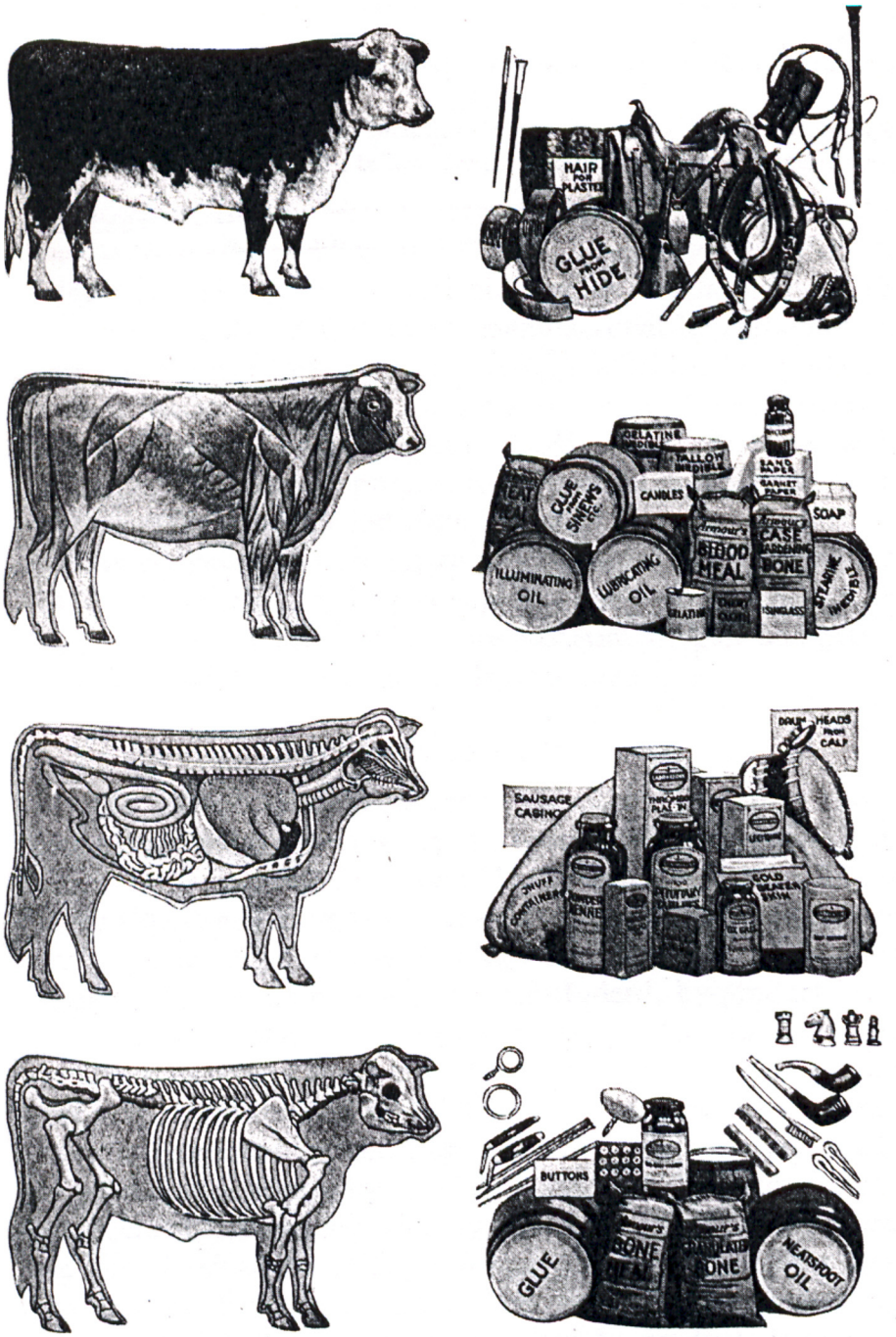
2.B: Meatpacking in Nineteenth-Century America

During the same period, American entrepreneurs shared a similar attitude toward the reduction, reuse, and recycling of wastes. Some American commentators on industrial innovations also recognized that the process of transforming waste into useful by-products was central to the vast proliferation of new products that sprang from industrialization and that investigating the process on a case-by-case basis would require many volumes.[22] Perhaps the paradigmatic American industry in this respect was meatpacking.

Prior to the middle of the nineteenth century, American meat was processed in a highly decentralized industry of small butchers serving a local market. At the time, "the offal, head, internal organs, blood, hair, and other trimmings" were considered waste material since nobody knew of the lucrative uses soon to become commonplace. In the early 1850s, however, a nationwide rail network and later innovations (such as refrigeration) paved the way for the rise of the Chicago meatpackers. Their competitive advantage lay not only in their ability to cut costs by integrating forward in marketing and backward

17. The use of creosote created problems not clearly understood at the time it was extensively used. However, it should be remembered that creosote solved a wide array of problems with serious environmental consequences, mainly by making products such as timber last much longer and thereby reducing deforestation.
18. Raphael Meldola, *Coal and What We Get from It* (London: Society for Promoting Christian Knowledge, 1905), 71.
19. Alexander Findlay, *The Treasures of Coal Tar* (New York: D. Van Nostrand Company, 1917); Meldola, *Coal*, 71.
20. Arthur G. Green, "The Relative Progress of the Coal-Tar Industry in England and Germany During the Past Fifteen Years," *Science* 15, no. 366 (1902): 7.
21. George P. Perry, *Wealth from Waste, or Gathering Up the Fragments* (New York: Fleming H. Revell Company, 1908), 73-4. While it is now easy to decry the countless products supplied by the petro-chemical industry, it should be remembered that they played a significant role in raising life expectancy (and quality) in advanced economies from about 45 years of age in 1900 to about 80 years of age today and allowed the expansion of the world population from less than 2 billion to more than 6 billion individuals. See Bjorn Lomborg, *The Skeptical Environmentalist* (Cambridge: Cambridge University Press, 2001); Xavier Sala-i-Martin, "The World Distribution of Income: Falling Poverty and . . . Convergence, Period," *Quarterly Journal of Economics* 121, no. 2 (May 2006): 351-391; Johan Norberg, *In Defense of Global Capitalism* (Oakland, CA: The Independent Institute, 2005).
22. Talbot, *Millions from Waste*, 17-18. Somewhat later, the American economist Rudolf Alexander Clemen observed that "the development of by-products in industry [was] one of the most outstanding phenomena in our economic life" and credited the fear of being overwhelmed by competitors in the same or other industrial sectors as the main force in this respect. Modern conditions, he argued, made it "almost impossible materially to cut production and distribution of expenses for the majority of commodities." In this context, "one of the most important opportunities for gaining competitive advantage, or even for enabling an industry or individual business to maintain its position in this new competition," was to reduce manufacturing expenses "by creating new credits for products previously unmarketable." Rudolf Alexander Clemen, *By-Products in the Packing Industry* (Chicago: University of Chicago Press, 1927), vii.

BY-PRODUCTS FROM CATTLE



in purchasing, but also in their unparalleled capacity to turn by-products into valuable commodities.

By the turn of the century, Chicago's meatpacking district provided an example of what would today be labelled industrial symbiosis. Inter-firm collaboration included large refineries taking the non-uniform steam-rendered lard from packers to refine and bleach for subsequent sale. Glue works used bones, sinews, and other packing-plant discards. Fertilizer plants carted off bones and blood to use as raw materials in their processes. Soap factories bought various grades of tallow. Other non-edible portions were turned into pharmaceutical products and lubrication oils. Food processors used neutral lard and oleo oil from packing plants to manufacture margarine.[23] The revenue derived from formerly waste materials led to higher prices for slaughter cattle and a significant decline in the retail price of meat, a benefit to farmers, consumers, and the environment, but a blow to local, small-scale butchers unable to compete with the larger operations.[24]

Many associate this period in American history with unethical "robber barons," but one contemporary, George Perry, commented that, upon closer inspection, "men of great business capacity and of untiring energy have been gathering up the fragments that nothing might go to waste" and that this has been "the chief source of the unprecedented fortunes of our times."[25] For example, the success of Standard Oil was in large measure due to the development of valuable by-products from refinery wastes, which, like coal tar, had been extremely costly. Solution of this particular waste-disposal bottleneck created some three hundred by-products, including paraffin, "one of the mines of wealth to the Standard Oil Company."[26]

2.C: Transforming Pollution Problems into Economic Opportunities

Coal gas and meatpacking are examples of the exploitation of the potentially useful properties of waste residuals that characterized early industrial processes. The practice was significant in a number of respects:

- First and foremost, it exemplified a sophisticated application of scientific and empirical discoveries to the problem of waste disposal. Financial incentives fueled and reinforced the innovative process.
- Second, once attention was turned from the relatively superficial physical properties of a waste residual to examination of its chemical properties, its useful potential increased exponentially.
- Third, identification of inorganic compounds in industrial waste streams that could be turned into low-cost substitutes for products previously derived from living organisms reduced the pressure that increasing standards of living placed on the natural environment.
- Fourth, although regulation in the modern sense of legislated norms and prohibitions did not figure prominently in the pre-New Deal United States or in Victorian Britain, property rights derived from the common-law tradition provided an objective, widely accepted framework defining appropriate limits on behavior. Significantly, business owners were particularly careful not to transgress the limits defined by property rights because of the economically crippling sanctions, up to and including injunctions to cease operations, which would likely result.

This is not to say, of course, that manufacturing-pollution problems were always and everywhere turned into economic opportunities. As Simmonds cautioned, "success as articles of commerce" should guide by-product development, for if "philosophically, nothing should

23. The most detailed contemporary treatment of this industry can be found in the work of Rudolf Alexander Clemen. See Clemen, *The American Livestock and Meat Packing Industry* (New York: Ronald Press Company, 1923); Clemen, *By-Products in the Packing Industry* (New York: Ronald Press Company, 1923).
24. Much of the negative perception of the large American meatpacking firms at that time can be traced back to the political campaigns launched by unsuccessful competitors who impeded the process of innovation. See Pierre Desrochers, "Natural Capitalist's Indictment of Traditional Capitalism: A Reappraisal," *Business Strategy and the Environment* 11, no. 4 (July-August, 2002): 203-220.
25. George Powell Perry, *Wealth from Waste or Gathering up the Fragments* (New York and London: Fleming H. Revell Company, 1908), 74-75.
26. Ibid., 73-74.

be lost, commercially, much may be thrown away." He argued that fortunately in most instances "what pays is for the general good" and that while "the converse may be equally as probable," much caution should be exercised when projects are based "solely on the latter consideration."[27]

What is of paramount importance at this point is that early industrial activities consumed large volumes of raw materials with a corresponding impact on the natural environment. The highly competitive environment in which entrepreneurs operated penalized the waste of resources in the production process. In instances where costs of waste disposal were high or the potential for legal action significant, businesses made considerable, concerted, and sometimes costly efforts to reduce those liabilities. Prominent among those efforts were attempts to eliminate disposal costs by generating revenue from by-products. The search, not yet constrained by regulation, for processes that used raw materials more efficiently and for less costly means of disposing of wastes yielded a broad array of innovations that both raised living standards and reduced environmental impacts.

3 Good Intentions, Negative Consequences

Interestingly, the early critics of the market system were impressed by contemporary entrepreneurial successes in reducing waste and generating valuable by-products. Karl Marx, for example, acknowledged that in its relentless pursuit of efficiency, the "capitalist mode of production extends the utilization of the excretions of production and consumption" and that "so-called waste plays an important role in almost every industry." Indeed, Marx viewed industrial waste recovery as "the second big source of economy in the conditions of production" after industrial production efficiencies from large-scale operations.[28]

However, subsequent generations of radical academics and writers came to view market economies as inherently wasteful because, without top-down direction, economic activities were seen as uncoordinated. Decentralized market decisions were believed to result in "wasteful anarchy." While some of these commentators were willing to grant that industry had achieved some good in terms of by-product development, they argued that public planners could do even better.[29]

Modern examples of industrial symbiosis frequently prompt a similar anti-market reaction. A prime example in the environmental-management literature is the small Danish industrial town of Kalundborg where various local industries established linkages that enabled them to "feed" on each other's residual wastes, generating both economic and environmental benefits in the process.[30]

While it is generally acknowledged that the Kalundborg linkages arose solely from entrepreneurial innovation revealed in bilateral business transactions, several commentators have suggested that greater government intervention in the form of regulations and subsidies would foster more extensive environmentally friendly behavior. Paul Hawken is one of the best-known proponents of this position. Referring to Kalundborg, he writes: "[I]magine

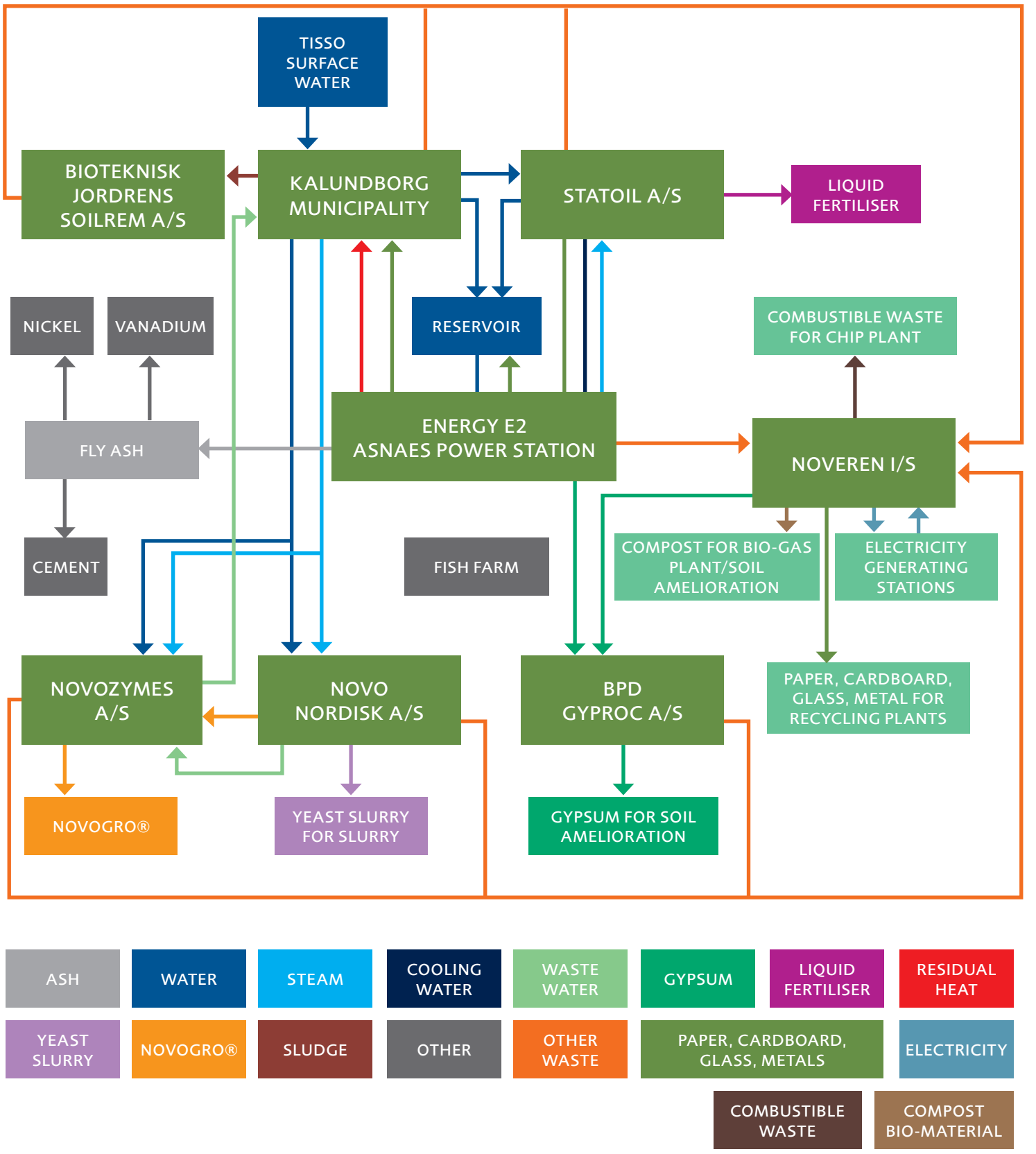
27. Simmonds, *Waste Products* 4 and 10-11. Simmonds is pointing out that while pursuing the general good may in some instances prove profitable, projects designed to generate loosely defined benefits rather than profits are to be treated with circumspection. In other words, profit is the most reliable indicator of benefit.

28. Karl Marx, *Capital* III, Part 1, (1894), chap. 5.

29. These alleged shortcomings ranged from a great diversity of production methods, the unnecessary duplication of productive units, the production of unnecessary goods and minor variations in finished goods in the same industry to seasonal layoffs, labor-management disputes, business guesswork resulting from bad government statistics, legal costs resulting from an inefficient judicial system and large discrepancies between supply and demand. See, among others, Henry J. Spooner, *Wealth from Waste. Elimination of Waste, a World Problem* (London: G. Routledge Publishers, 1918); Stuart Chase, The Tragedy of Waste (New York: MacMillan, 1925).

30. The Kalundborg example of industrial symbiosis developed around five core partners: an Asnaes power station (Denmark's largest), a Statoil refinery (Denmark's largest), a Gyproc plasterboard factory, Novo Nordisk's largest pharmaceutical and industrial-enzymes plant (which produces, among other things, 40 percent of the world's supply of insulin), and the City of Kalundborg. The Asnaes station supplied residual steam from its coal-fired power plant to the Statoil refinery in exchange for refinery gas that was formerly flared as waste. The power plant burned the refinery gas to generate electricity and steam and sent its excess steam to a fish farm, a district heating system serving 3,500 homes, and the Novo Nordisk plant. Sludge from the fish farm and pharmaceutical processes became fertilizer for nearby farms. Surplus yeast from the biotechnology plant's production of insulin was shipped to farmers for pig food. The fly ash from the power plant was sent to a cement company, while gypsum produced by the power plant's desulfurization process went to the Gyproc gypsum-wallboard plant. See Pierre Desrochers, "Regulatory Roadblocks to Turning Waste to Wealth," *Ideas on Liberty* (September, 2003): 20-23; Paul Hawken, *The Ecology of Commerce: A Declaration of Sustainability* (New York: Harper Business, 1993): 62-63.

KALUNDBORG DIAGRAM



what a team of designers could come up with if they were to start from scratch, locating and specifying industries and factories that had potentially synergistic and symbiotic relationships."[31] Similarly, while acknowledging that Kalundborg's linkages grew "organically," van Leewen and his colleagues suggest that further diffusion of the phenomenon "will probably require deliberate strategies by local policy makers."[32] Although Kalundborg is a local example, similar arguments on behalf of greater governmental and multinational agency interventions are routinely invoked in the name of sustainable development.[33] As Andrews warns, "in the name of industrial ecology, some agencies are attempting, Gosplan-like, to account for flows of materials and energy through the local, regional or national economy."[34]

Gosplan was, of course, the state planning agency in the Soviet Union charged with realizing dramatic increases in industrial output while avoiding the waste and environmental degradation attributed to "market capitalism." In the Soviet Union this objective was pursued without using prices and the incentive of profit which, as we have emphasized, are the market's key mechanisms for coordinating resource utilization. The Soviet system intentionally obliterated property rights, common-law protection, and market competition—precisely the institutional arrangements that enable the market's invisible hand to allocate resources to their most urgent use—because they undermined the planning mechanism. Soviet enterprises had every incentive to comply with the myriad rules and regulations developed in order to implement economic planning, and the Soviet economy in aggregate performed impressively in terms of its growth.[35] But in terms of all other criteria—its ability to manage environmental problems, to use its natural resources efficiently, control pollution, and raise living standards—it performed extremely poorly.[36]

Although the Soviet Union itself persisted with command-and-control mechanisms to manage its economy, efforts to improve efficiency in general, and environmental management in particular, led some Soviet Bloc countries to abandon production and waste quotas and to instead manipulate prices to influence behavior. In Hungary, where state initiatives to manage waste in a coordinated fashion have been systematically studied, the environmental damage initially attributed to the Soviet-style, direct approach to planning continued unabated when prices were manipulated with the explicit objective of encouraging environmental stewardship.[37] Although these initiatives to curtail environmental problems were well intentioned, they persistently gave rise to unintended consequences. Evidence from the former Soviet Bloc shows consistently that the net effect of using regulation or price controls to manage the economy was the same: Very limited improvements in living standards came at a huge cost to the environment from inefficient use of natural resources. Most importantly, environmental damage tended to increase, rather than decrease, over time.[38]

Although many more cases similar to Kalundborg, coal tar, and American meatpackers have been identified in recent years, the misconception persists that state inter-

31. Hawken, *Ecology of Commerce*, 63.
32. M.G. van Leeuwen, W.J.V. Vermeulen, and P. Gasbergen, "Planned Industrial Parks: An Analysis of Dutch Planning Methods," *Business Strategy and the Environment* 12 (2003): 149.
33. See, among others, Maurice Strong, "Avoiding Doomsday: A Program of Action" in *Where in the World are We Going?* (Toronto: Vintage Canada—Random House of Canada Ltd., 2001). Strong was Secretary General of the U.N. 1992 Rio de Janeiro "Earth Summit."
34. C.J. Andrews, "Putting industrial ecology into place: Evolving roles for planners," *Journal of the American Planning Association* 65, no. 4 (1999): 369. Andrews is director of the Urban Planning and Policy Development Program at the Edward J. Bloustein School of Planning and Public Policy, Rutgers University, and a past member of the Board of Directors of the Institute of Electrical and Electronic Engineers and the Society for Industrial Ecology.
35. "Growth" is taken to be the standard measure of economic activity that makes no distinction between economically useful activity and waste in its broadest possible sense. It may be contrasted with "development," which is "efficient growth," i.e., with minimal waste. From this perspective, the Soviet Union was a fast growing but poorly developed economy.
36. Environmental degradation in former Eastern Bloc countries is well documented and readily apparent to anyone who visits. See Murray Fesbach and Alfred Friendly, Jr., *Ecocide in the USSR: Health and Nature Under Siege* (New York: Harper Collins, 1992); Ann-Mari Satre Ahlander, *Environmental Problems in the Shortage Economy: The Legacy of Soviet Environmental Policy* (Hampshire, UK: Edward Elgar Publishing Company, 1994).
37. Zsuza Gille, "Legacy of waste or wasted legacy? The end of industrial ecology in post-socialist Hungary," *Environmental Politics* 9, no. 1 (2000): 203-31.
38. Mikhael S. Bernstam, "The Wealth of Nations and the Environment," *Population and Development Review* 16 (Supplement: Resources, Environment, and Population: Present Knowledge, Future Options): 333-73.

vention improves on the outcomes that the market generates.[39] Ultimately, societies face a policy choice between a system where innovation in a competitive environment rewards firms for minimizing waste and one where regulation and planning waste resources and increase pollution and contamination.

4 Is Green Entrepreneurship Still Possible Today?

The influence of government in the economy takes many forms, including taxation, subsidies, regulations, prohibitions, health and safety requirements, and labor laws in general. Even with such regulatory constraints, the market imposes discipline that pressures businesses to reduce costs. Government initiatives to protect the environment may, however, curtail the capacity of businesses to act in environmentally beneficial ways. Businesses do comply with environmental regulation but there is a trade off between regulatory compliance and innovation. To create industrial symbiosis linkages, businesses must have both the incentive and the freedom to act. Unfortunately, American policy has evolved in a manner that sharply curbs both.[40]

First, the trend in American law has been to weaken personal-property rights, making it extremely difficult for those affected by pollution to obtain redress through the legal system.[41] By removing one of the chief stimuli to environmentally friendly innovation, the erosion of property rights has perpetuated much less sustainable practices than would otherwise have been the case. Regulations can override property rights in cases where several minor sources of pollution are jointly inflicting a nuisance on the wider population. This frequently (and often purposefully) leads to "legalizing pollution by stripping nuisance claims of their deterrent ability and by preventing injunctions." From the perspective of the errant firm, a regulation becomes a "license to pollute and a license to pollute for free."[42]

The 1969 fire in the Cuyahoga River, which runs through the heart of Cleveland, Ohio, is an extreme example of this mechanism at work. Although typically portrayed as corporate greed run amok, the case has been made that the disaster was actually a striking illustration of shortsighted public policy. Out-of-date federal legislation had not been enforced, and local authorities had been unable to enforce nuisance claims against polluters who had obtained immunity from prosecution under state law. These combined factors had, by the 1960s, essentially created "industrial streams" that industries could use for waste disposal with impunity.[43] Yet instead of reinstating property rights at the local level, the response was national regulation in the form of the Clean Water Act.[44]

39. A prime example is Hawken, Lovins, and Lovins, *Natural Capitalism*, which argues that traditional capitalism, as it has evolved since the Industrial Revolution, should now be replaced by "natural capitalism," in which environmental considerations take precedence.
40. As a consequence, *The Economist*, a respected U.K. publication once concluded that "in all sorts of ways, American policy rigs market incentives in favour of pollution." "Green my Lips: The way to a cleaner America need not be strewn with red tape," *The Economist* (February 17, 1990): 19.
41. Richard Pipes, *Property and Freedom* (New York: Alfred A. Knopf, 2000) provides a comprehensive examination of the development and importance of property rights in Britain, the absence of such rights in Russia and its implications, and the general erosion of these rights in the West during the twentieth century and the consequences.
42. Marshall Berger and others, "Providing Economic Incentives in Environmental Regulation," *Yale Journal on Regulation* 8, no. 2 (1991): 470.
43. Adler's thorough examination of the Cuyahoga incident emphasizes its pivotal nature in U.S. water-pollution regulation. Even though the Cuyahoga and many other U.S. rivers had caught fire previously, causing considerably more damage, the well-publicized Cuyahoga incident in 1969 coincided with increasing awareness of the ecological consequences of water pollution that prompted local authorities to start addressing the issue. Federal legislation governing pollution of interstate navigable waterways dating from 1899 (The Rivers and Harbors Act) was originally designed to prevent accumulation of oily debris that would damage commercial infrastructure and shipping if it ignited. The first successful prosecution under this Act occurred only in 1970. The recreational, aesthetic, or broader ecological dimensions of water quality were issues as unimportant in the U.S. in the 1950s as smoking chimneys and polluted soil and water had been in Victorian Britain. Thus it was not until 1969 that public opinion made it feasible for the federal level to co-opt the Cuyahoga incident to justify increased spending by agencies such as the EPA. Ironically the shift in public opinion had already spurred bottom-up initiatives that Cleveland had spearheaded and whose effectiveness were impeded by state and federal legislation. The lesson from the Cuyahoga case seems to be that bottom-up environmental action motivated by self-interested concern on the part of business and the general public is significantly more effective than top-down initiatives that in both their formulation and enforcement are susceptible to the influence of special interests. Jonathan H. Adler, "Fables of the Cuyahoga: Reconstructing a History of Environmental Protection," *Fordham Environmental Law Journal* 14, no. 1 (Fall, 2002). A corresponding air-pollution example is found in the Clean Air Act of 1963, under which oil refineries along the Texas Coast that used obsolete air pollution-abatement technology were "grandfathered," exempting them from compliance with the new emissions standards.
44. The Federal Pollution Control Act of 1972 and its subsequent amendments are often referred to as the "Clean Water Act."

Second, U.S. policy now actively discourages spontaneous, Kalundborg-type linkages through its preference for regulations mandating specific actions to deal with waste streams routinely classified as pollutants. Unlike common-law remedies for negligence, trespass, nuisance, and strict liability—which all increase the economic risks inherent in discharging wastes without mandating specific remedial action—modern American waste regulations implicitly treat industrial by-products as nuisances to be destroyed rather than recycled and reclaimed as useful resources.[45] Regulatory interventions have therefore erected barriers against a formerly popular avenue of innovation, making it more difficult to create wealth out of industrial waste.

Although the Kalundborg linkages were not a direct result of public planning, their development benefited from Danish environmental policy that actively encourages firms to find creative ways to use waste. In the United States, however, many of those linkages would be prohibited. For example, the flue gas that Statoil pipes to Gyproc and the liquid sulfur that the local oil refinery supplies to other businesses probably would both be classified as "hazardous waste," which U.S. law prevents subsequent industrial processes from using as an input. Furthermore, the new resources created from these by-products would also be treated as hazardous under the so-called "mixture and derive from" rule, which classifies as "waste" new products that incorporate industrial waste. The transfer of sulfur and scrubber-ash gypsum from another business would also be precluded by U.S. regulations designed to prevent the accumulation and storage of wastes. Regulations like these—however well-intended—are likely to do more harm than good since they obstruct efforts to develop innovative and economically attractive solutions to pollution.

A defining characteristic of industrialization was the utilization—initially at least—of huge volumes of raw materials,[46] a fact that fueled a perception that the market does not properly conserve natural resources. In the United States, this fear prompted the creation of a host of conservation agencies within the government.[47] While their original goal might have seemed laudable, these agencies generally accelerate resource depletion by subsidizing the industries they are supposed to regulate.[48] Hence grazing rights on public lands are available at a fraction of the cost charged on private land, and the Forest Service loses hundreds of millions of dollars a year building roads and fighting fires so that private-sector timber harvesters can pass on a substantial portion of their costs to taxpayers.[49] Developed nations are by no means alone in this; estimates indicate that developing countries subsidize their energy sectors by an amount approximately double the total of the foreign aid they receive.[50]

To create industrial symbiosis linkages, businesses must have both the incentive and the freedom to act. Unfortunately, American policy has evolved in a manner that sharply curbs both.

45. See Pierre Desrochers, "Industrial Ecology and the Rediscovery of Inter-Firm Recycling Linkages: Some Historical Perspective and Policy Implications," *Industrial and Corporate Change* 11, no. 5 (November, 2002): 1031-57.
46. We have shown that competitive markets quickly encouraged more economical use of raw materials, which reduced both the volumes used and the unutilized residues.
47. Chief among these are the Department of Energy, the Soil Conservation Service, the U.S. Bureau of Lands, the U.S. Forest Service, the Bureau of Mines, and the Fish and Wildlife Service. See John R. E. Bliese, "The Conservative Case for the Environment," *The Intercollegiate Review* 22, no. 1 (Fall, 1986): 28-36; and Garrett Hardin, *Living within Limits: Ecology, Economics and Population Taboos* (New York: Oxford University Press, 1993), 237-46. In addition to the negative unintended consequences outlined, conservation and environmental-protection agencies themselves consume public funds and represent a substantial environmental footprint that is not offset by any corresponding improvement in living standards for society as a whole.
48. Although conservation regulations generally achieve an effect opposite to that intended, regulation of this type is inevitably a losing proposition: Even if they were to succeed, conservation efforts would be inefficient in economic terms because delaying consumption distorts the temporal pattern of resource use. E.C. Pasour, Jr., "Conservation, 'X-inefficiency' and Efficient Use of Natural Resources," *Journal of Libertarian Studies* 3, no. 4: 373, 376.
49. According to Bliese in "The Conservative Case for the Environment," the late Senator Herman Talmadge routinely referred to Forest Service practices as "idiot forestry."
50. Strong, *Where in the World are We Going?* 364.

Such subsidies—given to a variety of industries including agriculture, energy production, and transportation—are frequently counterproductive. Not only do they encourage less restraint in consumption, but often the policy objectives of one set of subsidies is completely inconsistent with those of other government subsidies. Usually this is due to the different mandates of the various branches of an administration. But astonishingly, counterproductive subsidies sometimes originate in the *same* government bureau.[51] Of course, with all of this comes a real cost: In 1997, the damage to both the environment and the economy from these "environmentally harmful subsidies" was estimated at 700 billion dollars globally.[52] In sharp contrast to the consequences of regulatory efforts, markets have a tendency to *over-estimate* future scarcity of natural resources and hence to *under* consume or *over* conserve.[53] This is basically because in a competitive environment that punishes ineffective resource use, business decisions taken in the face of uncertainty regarding future outcomes and conditions have a built-in incentive to be over-cautious. Government initiatives targeted at reducing the impact of business on the environment are, on the other hand, the result of a political process in which policy makers play a crucial role. The fact that so many of these initiatives are ineffective or counterproductive, and all of them costly, raises the question as to what policy makers should be doing to remedy the situation. The fundamental issue is to realize that market arrangements can achieve high levels of environmental protection through entrepreneurial activity when the right institutional context is in place. There is a pressing need to shift the focus of policy making from achieving short-term goals to creating an enabling environment for entrepreneurial discovery.

5 Policy Recommendations: Toward Truly Responsible Government

On-going efforts to refine environmental policy imply dissatisfaction with current policy's effectiveness. Public concern over a broad spectrum of environmental issues, from climate change to pollution, are placing related policy issues under greater scrutiny.

One view is that the appropriate policy approach is government regulation to increase the incidence of Kalundborg-type industrial symbiosis and to achieve urgent environmental priorities (including combating climate change) by modifying the behavior of businesses.[54] This Policy Primer, however, points in a quite different direction. It argues that, over the past eighty years in particular, special interests have increasingly influenced the

51. One analysis of the U.S. Farm Program shows that in 2002, $38 billion was spent on farm programs to increase farm gate prices, and about a third of that amount was spent on programs to decrease producer prices. This suggests that if all the programs involved were equally efficient (or inefficient) $22 billion would have been spent on activities having little or no impact on food costs, farm prices or total farm incomes. E. C. Pasour, Jr. and Randal R. Rucker, *Plowshares & Pork Barrels: The Political Economy of Agriculture* (Oakland, CA: The Independent Institute, 2005): 308.

52. De Moore and Calamai, "Subsidizing Unsustainable Development: Undermining the Earth with Public Funds, a study commissioned by the Earth Council," quoted in Strong, "*Where in the World Are We Going?*": 364; Peter M. Kjellingbro and Maria Skotte, *Environmentally Harmful Subsidies: Linkages between Subsidies, the Environment and the Economy* (Copenhagen: Environmental Assessment Institute, 2005); OECD, Subsidy Reform and Sustainable Development: Economic Environmental and Social Aspects (Paris: OECD, 2006).

53. A. A. Alchian and W.R. Allen, *Exchange and Production: Competition, Coordination, and Control*, 2nd ed. (Belmont, CA: Wadsworth, 1977), 159; A. A. Alchian, "Uncertainty, Evolution and Economic Theory," *Journal of Political Economy* 58, no. 3 (June, 1950): 211-21. These ideas are expanded by E.C. Pasour, Jr., "Conservation, 'X-Inefficiency' and Efficient Use of Natural Resources;" E.C. Pasour, Jr., "Austerity, Waste, and Need," *The Freeman: Ideas on Liberty* 28, no. 12 (December, 1978), http://www.fee.org; E.C. Pasour, "Cost and Choice—Austrian vs. Conventional Views," *Journal of Libertarian Studies* 2, no. 4 (Winter, 1978): 327-36. These and other important articles on the subject were precipitated by the energy crisis in the 1970s.

54. Modification of the behavior of individual consumers is also advocated under this approach, primarily through the introduction of green taxes, although when it comes to climate change, some go so far as to suggest that coercive measures may be required. For example, see David Shearman, "Climate change, is democracy enough?" www.onlineopinion.com.au/print.asp?article=6878, in which environmental problems in Australia are attributed to a "surfeit of democracy" and Chinese authoritarianisms—an example of an edict to ban use of plastic shopping bags is cited—is praised. This is notwithstanding the acknowledgement that China is about to become the world's largest emitter of greenhouse gases. Further elaboration of this position is to be found in David Shearman and Joseph Wayne Smith, *The Climate Change Challenge and the Failure of Democracy* (Westport, CT: Praeger Publishers/Greenwood Publishing Group, 2007).

U.S. government to act against the common good as far as environmental stewardship is concerned.[55] Protracted top-down efforts to influence business behavior in the public interest have compromised the innovative process to such an extent that its inherent tendency to address potential shortages is significantly impaired, locking society into consumption patterns that drive up input costs faster than would otherwise be the case.

Businesses are driven by competition to create value while striving to control costs and constantly search out new ways of doing so. If businesses earn a higher return on investment from "subsidies, externalizing their costs, avoiding transparency, and monopolizing the market,"[56] and from lobbying for rules that suit their own particular needs than the returns they get from innovating in response to competitive pressure, the fault lies with the structure that makes these opportunities available rather than with the firms that exploit them. Many large companies find it worthwhile to divert massive amounts of money into lobbying for legislation instead of developing new products and more efficient business practices.

This section describes policy alternatives that directly encourage the propensity of business to innovate in a way that yields both environmental and financial benefits, as well as some suggestions for indirectly supporting this tendency through the appropriate institutional framework.[57] Rather than superimpose another layer of government incentives ostensibly intended to generate environmental benefits, we instead argue that the most effective remedy would be to remove the current distortions of market mechanisms that exacerbate environmental problems. Some of the existing policies targeted are environmentally harmful subsidies, regulatory barriers to green innovation, and public ownership and management of natural resources. Institutional recommendations focus on the desirability of recreating a framework minimally influenced by regulatory "behavior modification" in which the invisible hand can fully realize its green potential.

5.A: Environmentally Harmful Subsidies

It is encouraging that a consensus is emerging that the subsidies mentioned in the previous section are environmentally damaging. The difficulty with eliminating subsidies is that while each subsidy provides benefits to a few and costs to many, usually the beneficiaries are louder, richer, and politically better-connected than those who bear the costs. Policy makers therefore should clearly understand the underlying intent of any regulatory reform and not merely accept at face value the arguments proponents offer.

Politicians are easily tempted to use subsidies to prop up any business that employs voters. But businesses that depend on public funds for viability tend to be more wasteful of resources than their competitors and therefore more environmentally harmful. Government handouts constitute a revenue stream that diminishes the incentive to innovate and cut costs, including those minimizing waste and raw material use.

Regulations can also function as subsidies when they mitigate the risk of individuals or businesses, concentrating benefits and dissipating costs. Federal insurance for floodplain developers, state insurance pools against hurricane damage for coastal residents, and government crop insurance are similar interventions that accelerate resource depletion.[58] Examples of this are repeatedly

55. Changes, dating from the middle of the nineteenth century and encouraged by business interests, gave rise to a legal philosophy putting "the greater good" of the nation (usually meaning industrialization at any cost) before private-property rights. Courts came to accept the view that pollution was just a fact of modern life and hence necessary for progress to occur, successively diminishing the environmental incentive role of private-property rights and effectively legalized pollution. This legalization led to the consideration of environmental impacts as external to industries and households, to the growth of various bureaucracies with an essentially negative view of residuals, and to business practices biased against assessing the opportunity costs of wasted resources, and moved toward compliance and exerting influence on the regulatory process.

56. Hawken, Lovins, and Lovins, *Natural Capitalism*, 265.

57. In a general sense, recommendations under the first category echo those made by advocates of "natural capitalism" because they also acknowledge the desirability of market-based solutions and policy failures resulting from over "two hundred years of policies in taxes, labor, industry, and trade meant to encourage extraction, depletion and disposal" and the earmarking of "hundreds of billions of dollars of taxpayers' money ... to promote inefficient and unproductive material and energy use." Hawken, Lovins, and Lovins, *Natural Capitalism*, 13 and 319. Divergence comes in the second category: They are arguing for regulatory behavior modification (the basis for the "new" industrial revolution in their subtitle) while we disagree with the "natural capitalists'" claim that any alternative regulatory regime will prove effective at achieving environmental stewardship and standard-of-living objectives simultaneously. We are arguing that the institutional arrangements under which the original Industrial Revolution took place are not only necessary, but also sufficient to generate the "triple bottom line" that includes steady improvements in environmental stewardship.

rebuilding housing destroyed by floods or hurricanes and facilitating the cropping of land where natural conditions render it uneconomic. Taxes that bias innovation away from frugal natural-resource use and waste reutilization have the same effect.

Eliminating subsidies is bound to be difficult given the incentives woven into the political process. Self-interest on the part of government bodies, inter-governmental agencies, and multi-national institutions drives them toward diametrically opposite objectives to those sought by business managers. While business has an underlying incentive to economize on resources, public-sector success is measured by the amount of resources controlled, and there are usually penalties for not fully utilizing allotted resources in the budget period. Administering subsidies and enforcing regulations is currently the business of many large government agencies; thus, they are unlikely to support efforts to undermine their mandates. Only when electorates exert pressure do governments address the environmental consequences of public policy.[59] The challenge facing policy makers is to steer decisions away from the short-term fixes involving additional top-down regulation and toward longer term, bottom-up solutions that preserve individual freedoms and encourage innovation.

5.B: Regulatory Impediments

Regulatory intervention distorts market feedback and frequently leads to adverse impacts on the environment. This is because regulations often limit the scope of innovative possibilities by, for example, mandating particular processes or arbitrarily classifing materials as waste. Although eco-industrial parks along the lines of Kalundborg have been endorsed by the President's Council on Sustainable Development, the Department of Energy's Center for Excellence for Sustainable Development, and the Environmental Protection Agency, most similar initiatives in the U.S. would be prevented by a broad spectrum of regulations developed and enforced by these same agencies. Another regulatory barrier would be such local ordinances as those that outlaw air-drying laundry outside and requiring the use of electric instead of solar power. Obviously, between these extremes considerable scope exists for reworking public policy so that it fosters innovation with environmental as well as commercial benefits.

In general terms, government is prone to defend the *status quo* and difficult to convince that creative destruction—the need to let uncompetitive firms fade away and new firms take their place—is essential for sustaining economic viability. Businesses threatened by competitors have often been able to slow—but rarely halt—the innovative process by exploiting concerns over competitors' monopoly power, as the antitrust actions targeting the Chicago meatpackers illustrate. Monopolies are rarely sustainable unless they can enlist government cooperation in setting up regulations and other restrictions that prevent new entrants from introducing product alternatives to the market. Whether the regulations were sought by uncompetitive firms or a monopoly, such rules further discourage new entrants with a burden of compliance that is disproportionately heavier for smaller enterprises.

Top-down, regulatory approaches are based on past experience and thus reduce the range of action within which future solutions can be devised. This is like driving while looking in the rear-view mirror. When governments make regulatory decisions, they tend toward a small number of large-scale adjustments. In a competitive environment, business decisions are independently assessed in the market, and as such, markets have an inherent mechanism for self-correction. There is no comparable mechanism for assessing the effectiveness of government decisions, so the prevalent tendency is to develop policy that addresses only the consequences of previous policy failures.

58. With respect to hurricane insurance, see Daniel Sutter, *Ensuring Disaster: State Insurance Regulation, Coastal Development, and Hurricanes* (Arlington, VA: The Mercatus Center at George Mason University, 2007), http://www.mercatus.org/PublicationDetails.aspx?id=16176.

59. Adler's discussion of pollution of the Cuyahoga in *Fables of the Cuyahoga* points out that the local government responded most rapidly to public concern and targeted initiatives at cleaning up the river before national media attention focused on the 1969 fire that brought about federal intervention. Environmental objectives were the fifth of six core elements in Sweden's market-oriented agricultural reforms implemented in 1990. See David Vail, "Sweden's 1990 Food Policy Reform," in *The Global Restructuring of Agro-Food Systems*, Philip McMichael, ed. (Ithaca, NY: Cornell University Press, 1994): 53-75. These reforms took place two years after the Greens became the first new party to win seats in the Swedish Parliament in 70 years and were passed with support from all parties except the Greens. However, good intentions alone are insufficient to generate favorable environmental outcomes. Significant agricultural reforms to date in New Zealand and Australia and less significant reforms in Canadian and Swedish agriculture were motivated primarily by electoral dissatisfaction with high levels of government spending, and environmental benefits were a by-product of efforts to curb that spending.

5.C: Public Ownership of Natural Resources

Public ownership of natural resources, supposedly to counteract the perceived tendency of capitalists to deplete them too rapidly, almost invariably constitutes a subsidy that transfers a portion of the extraction costs of favored business enterprises to the taxpayers. The U.S. Forest Service and Bureau of Land Management have already been mentioned. In this sense, public ownership of natural resources constitutes a special category of subsidies with environmentally deleterious consequences. The underlying theme, however, remains this: Only a market mechanism can determine the optimal level of resource use. Private owners operating in the context of private property rights, take better care of resources than public owners because private owners benefit directly from their actions and are free from political pressure. Multiple decisions regarding optimal use rates by individual owners with long-term economic incentives to make correct (or, as we have already indicated, somewhat conservative estimates) holds considerably better potential for favorable environmental outcomes than a very small number of decisions, made on behalf of "society as a whole" through a political process with a short-term incentive structure.

Similarly, as it becomes increasingly likely that individual property rights for a specified resource can be arbitrarily trumped in the name of the "common good," it also becomes increasingly attractive for quasi-private owners to treat that asset as a common-property resource, as incentives erode the high standards of environmental stewardship associated with private-property rights.[60] Stated slightly differently, any multiple-user, multiple-purpose view of natural resources is inconsistent with the freedom of individual decision-makers; hence the solution to environmental problems lies in defining and enforcing private-property rights, and each recurring eruption of concern over resource scarcity essentsially derives from prior government interventions undermining those rights.[61]

5.D: Institutional Framework

Liberating the invisible hand from its regulatory gauntlet will benefit the environment, but it is also critical to recognize that the green hand operates most effectively when businesses are free to innovate in their own self interests and when an efficient and impartial legal system (designed to enforce property and common-law rights) protects the public and the environment.[62] The institutional framework that best facilitates win-win innovations requires both a level playing field and prices that provide accurate feedback regarding supply constraints and market competition. Sustainable development can only occur when prices accurately reflect market feedback, when incentives justify inherently risky innovations, and when competition drives the innovative process by penalizing failure to keep up.

Unfortunately, the U.S. policy environment has departed considerably from the framework that best supports the sustainability scenario. The ability of both public and private nuisance claims under common law to protect the environment has been largely nullified. Property rights of individuals have been diluted to facilitate regulation, which in turn has diminished incentives to innovate. Subsidies and taxes distort prices to such an extent that prices no longer adequately perform their feedback roles. Regulatory hurdles increase the cost of environmentally appropriate innovation and frequently tip the balance of business decisions in favor of practices that increase, rather than diminish, environmental impact. Government intervention has tended to reduce competition, diminish business risk, and divert business resources away from activities such as product development, engineering, and research and development, and shift them instead toward regulatory compliance and lobbying. Regulatory turf-wars among agencies with different geographic jurisdictions and overlapping mandates compound this problem.

The competitive environment in which most businesses operate changes slowly over time as individual firms incrementally modify their production processes or

60. The Soviet Union and its satellites were a caricature of this same problem: State ownership of land and most property "on behalf of all the people" became a license for pervasive, if surreptitious, privatization.

61. Pasour, "Conservation, 'X-Inefficiency' and Efficient Use of Natural Resources," 381-5.

62. This approach to looking at environmental problems is sometimes labeled the "New Resource Economics." Early work in this tradition includes Fred L. Smith Jr., "Markets and the Environment: A Critical Reappraisal," *Contemporary Economic Policy* 13, no. 1 (1995): 62-73; Roger Meiners and Bruce Yandle, eds., *Taking the Environment Seriously* (Lanham, MD: Rowman & Littlefield Publishers, 1993); Terry Anderson and Donald Leal, *Free Market Environmentalism* (San Francisco, CA: Pacific Research Institute, 1991); Robert H. Nelson, *Free Market Environmentalism: A Brief History and Overview* (Washington, DC: Competitive Enterprise Institute, 2001), http://www.publicpolicy.umd.edu/faculty/nelson/CEI%20-Free%20Market%20Environmentalism.pdf.

product offerings in response to changing market needs. A relatively stable policy environment with minimal regulatory barriers encourages the innovation and entrepreneurship evident historically in the pre-New Deal U.S. and Victorian Britain. However, the policy environment in which businesses currently operate is subject to drastic, abrupt, and potentially devastating change (unless it is actively managed by individual firms or trade associations for their own ends) that diverts attention away from longer-term competitive strategy and toward short-term tactics. A market economy operating uniformly across all jurisdictional scales, under clearly defined rules beyond the influence of special interests, and with property rights that provide an incentive structure that encourages risk-taking but penalizes costs imposed on others, is both necessary and sufficient for sustainable development.

The often adversarial relationship between government bodies and business (particularly at the level of employees tasked with enforcing regulations) is a major obstacle to more constructive dialogue. This Primer has argued that the private sector is the most potent force for resource stewardship and waste utilization because these things enhance the firm's viability in a competitive environment. Nonetheless, the perception that business is inherently inclined to act against the public interest is deeply ingrained in public bodies. One serious consequence is the tendency of American environmental legislation to adopt a "guilty until proven innocent" stance when dealing with businesses.[63] The Kalundborg example, its historical antecedents, and many more recent examples of industrial symbiosis demonstrate that this approach is neither necessary nor desirable. They show that government can best achieve its public-interest objectives by creating an institutional environment conducive to innovation, rather than frustrating it with bureaucratic procedures that are extremely costly to all.

An institutional environment that maximizes the ability of the invisible hand to be green returns the responsibility for managing waste to those entities that produce it. This obliges them to bear the full cost of their actions, but also provides them with the freedom to come up with innovative solutions to environmental problems. Wherever possible, common-law remedies and citizen action, under the law of private and public nuisances, should replace centralized, top-down regulation.

Public policy innovations in this direction will be difficult at the outset. The first adopters will likely be off-shore jurisdictions with relatively light regulatory burdens that recognize rapid innovation as a valuable competitive advantage in an increasingly interconnected world. Ultimately, however, the allies in efforts to reduce administrative interference with the innovative process should be the taxpayers and voters. Ultimately they pay not only for the perverse subsides and the associated administrative costs, but also enjoy the lower standard of living resulting from higher resource and product prices and bear the adverse costs inflicted on the environment in the form of the unnecessarily widespread degradation of natural landscapes. Helping consumers understand the opportunity costs of environmentally damaging government spending, as well as identifying the special interests that benefit from this spending, will help generate the political support necessary for policy reform.[64]

6 Conclusion

This Policy Primer has investigated the circumstances under which living standards can continue to improve without squandering our children's environmental capital. Examination of the coal-tar problem in Victorian Britain and U.S. meatpacking in the late nineteenth century, examples where innovation under competitive pressure rewarded firms for minimizing waste, highlighted the fundamental importance of freedom to innovate. These historical examples provide encouraging evidence that when businesses operate in a competitive environment and are given latitude to innovate, they adapt to changing circumstances in the way that generates the best feasible outcome for the environment while simultaneously achieving selfish goals.

Modern examples of industrial symbiosis—such as Kalundborg and the transformation of waste into by-products with economic value, including the development of gasoline, synthetic dyes, and a vast array of chemical ingredients—all occurred in jurisdictions that encouraged businesses and entrepreneurs to innovate for their own profit. Whenever inputs and residuals entail a cost, businesses have an incentive to reduce those costs

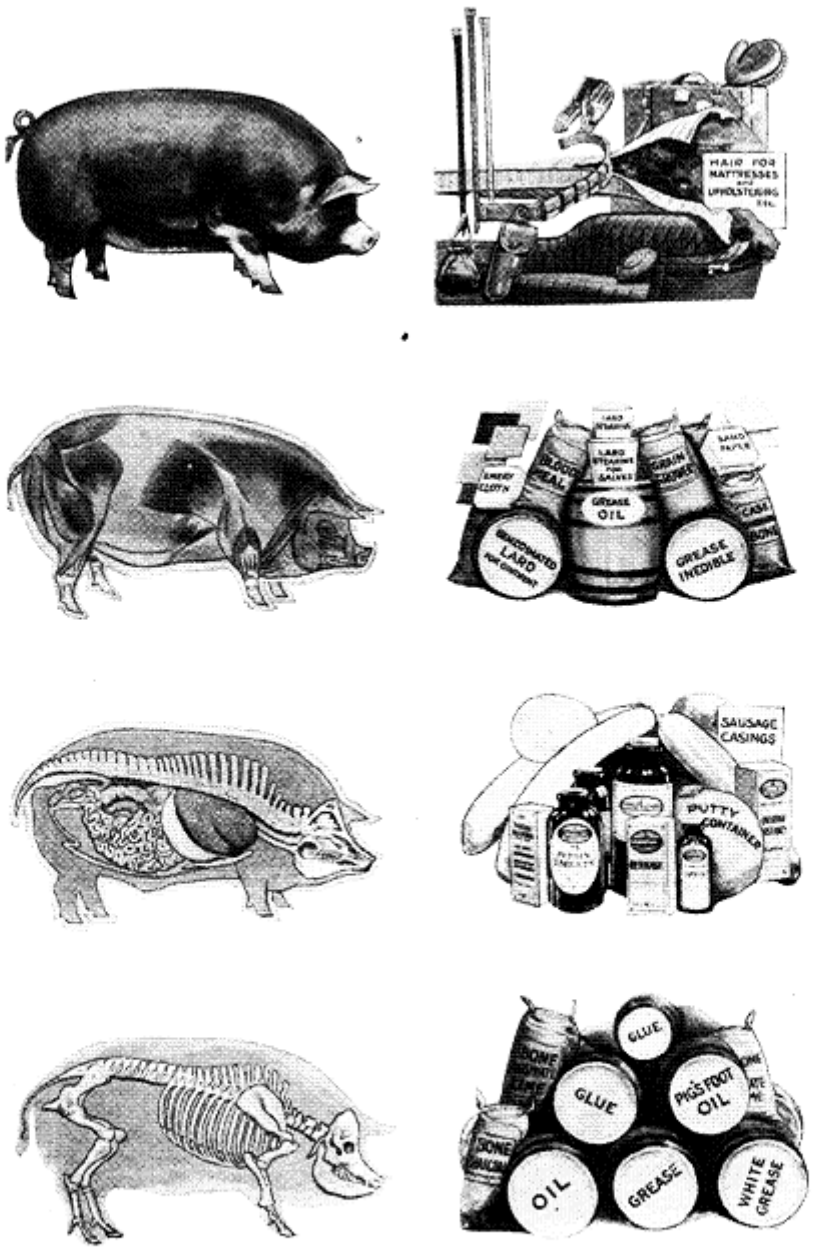
63. The National Environmental Protection Act of 1970 extended the "guilty until proven innocent" principle to environment-altering or threatening activities that fell under the purview of the EPA. Prior to this, it had applied only to the food and drug laws under an amendment introduced in 1962.
64. The only other alternative is for "unanimous disarmament" on the part of special interest groups, discussed by J.M. Buchanan and G. Tullock in *The Calculus of Consent—Logical Foundations of Constitutional Democracy* (Ann Arbor, MI: The University of Michigan Press, 1962), 29.

and tend to economize in the strictest sense of the word. Market mechanisms are not only a necessary condition for environmental stewardship; they are a sufficient condition, and regulatory interference is bound to generate sub-optimal outcomes.

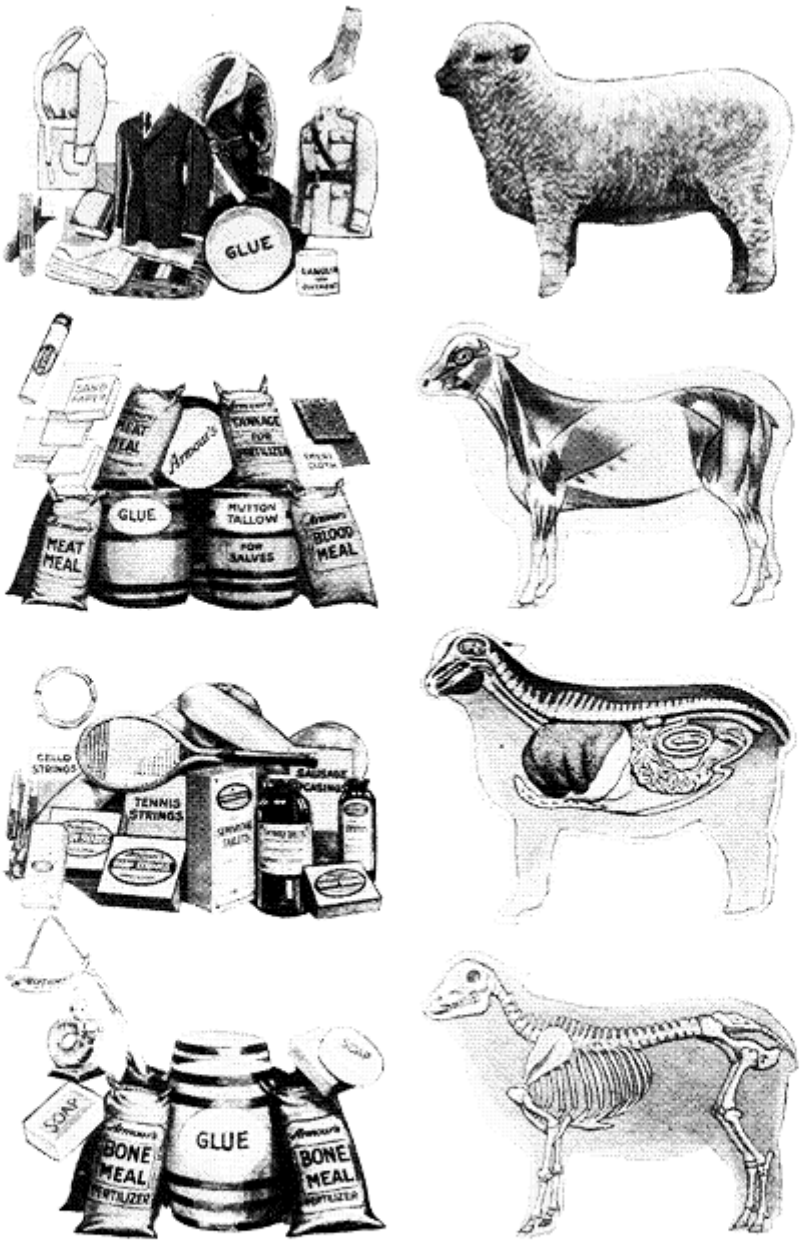
Living standards and environmental stewardship have both improved dramatically in market economies since the Industrial Revolution, despite mounting regulations, perverse subsidies and diminished incentives. While many observers are prepared to attribute improved living standards to market mechanisms, very few make the same association with the concomitant improvement in environmental impact. Here we have made the case that improved living standards and diminished environmental impact result from businesses pursuing their own self interest. We further argue that these benefits have been achieved by firms despite, rather than because of, being fettered by a steady erosion of property rights, an increasingly tangled web of regulatory requirements, and severely constrained opportunities for entrepreneurial innovation. Over the years, prices of inputs have fluctuated, but businesses and entrepreneurs have continually adapted to these changes, developing win-win solutions that have maintained or enhanced the competitiveness of their products and reduced their impacts on the environment.

Policy makers must recognize how the policy environment they are crafting affects business innovation. The current United States regulatory environment's hostility toward innovation means that the full environmental benefits of industrial symbiosis and numerous other existing and potential win-win innovations are now off-limits. Despite recent media enthusiasm over examples of "sustainable behavior," business managers have not suddenly adopted a new environmental ethic. It is just business as usual. Businesses are merely continuing the struggle to remain competitive, a process that has a long but under-appreciated history of generating outcomes that are optimal—in the broadest possible sense—for society as a whole. Because innovation is steered by feedback provided by prices, policies that ensure the integrity of the feedback between markets and suppliers are the best way to promote sustainability.

BY-PRODUCTS FROM HOGS



BY-PRODUCTS FROM SHEEP



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