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Regulatory Roadblocks to Turning Waste to Wealth

by Pierre Desrochers

The small industrial town of Kalundborg, located 75 miles from Copenhagen, shouldn't be on the radar screen of most visitors to Denmark. It has nonetheless become something of a Mecca for "sustainable development" theorists the world over.

Kalundborg's main attraction, apart from its twelfth-century cathedral, is a network of recycling linkages that have developed over the last three decades between four large industrial plants, the municipality, and a few smaller businesses. This "Industrial Symbiosis," as it is now known, originally comprised five core partners: an Asnæs 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.

Beginning in the 1970s a series of deals between these otherwise independent entities gave rise to various recycling linkages. For example, a few years ago, the Asnæs 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. The amounts of avoided wastes were significant, including 200,000 tons of fly ash and 130,000 tons of carbon dioxide, while Asnæs saved up to 30,000 tons of coal a year. While most of these linkages are still functional, a few were abandoned and new ones have since been created.[1] (See diagram.)

A Spontaneous Phenomenon

By all accounts the Kalundborg industrial symbiosis was not designed by consultants or financed by Danish government officials, but rather was the result of several distinct bilateral deals between company employees seeking, on the one hand, to reduce waste-treatment and disposal costs, and, on the other, to gain access to cheaper materials and energy while generating income from production residue. Indeed, it was only in the late 1980s that the various participants in the symbiosis first recognized the environmental implications of the partnerships and exchanges that had evolved since the early

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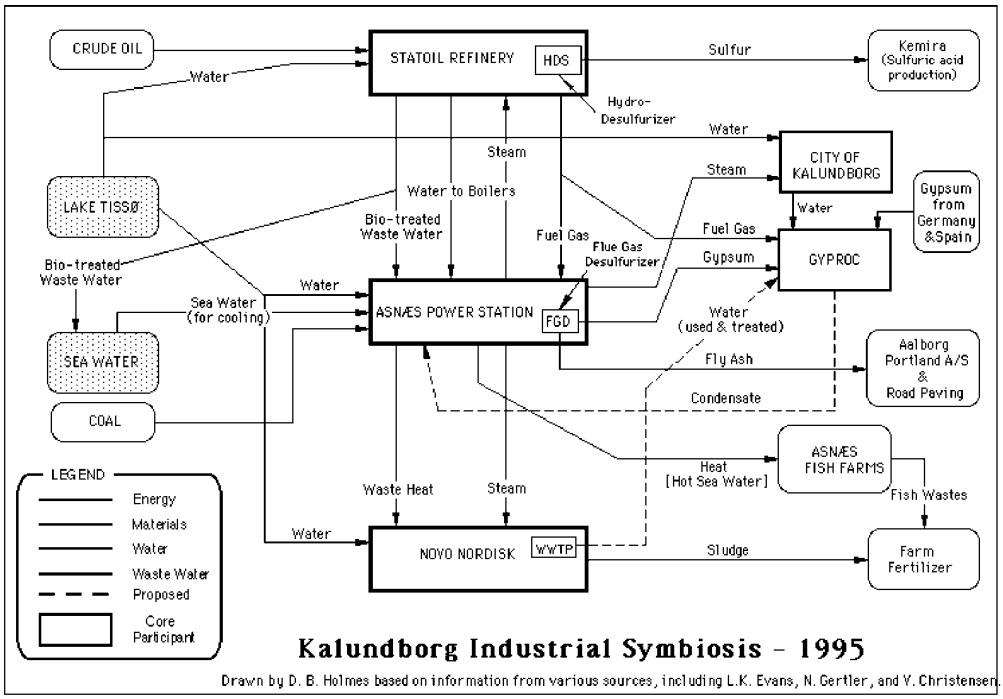

Source: www.indigodev.com/Kal.html

1970s. There remains to date no higher level of organization managing this interaction.

Jorgen Christensen, a spokesperson for Novo Nordisk, was explicit on this point when asked to describe how people in Kalundborg had "designed" their recycling linkages: "We didn't design the whole thing. It wasn't designed at all. It happened over time."

Henning Grann, a Statoil employee, reinforced this view a few years later: "The symbiosis project is originally not the result of a careful environmental planning process. It is rather the result of a gradual development of co-operation between four neighboring industries and the Kalundborg municipality." Erling Pedersen, CEO of the Industrial Development Council in the Kalundborg region, concurred with this evaluation when he wrote in 1999 that the industrial symbiosis "was not a planned network, but a series of projects initially quite independent from one another. There was no original joint management, but rather bilateral agreements between independent partners." Most interesting is his statement that "the network did not evolve with any academic knowledge of scientific environmental network theories, but as good and economical management practice. All projects required investments and resulted in revenues or savings for the parties involved."[2]

The story of the Kalundborg industrial symbiosis is interesting on at least two counts. First, it illustrates how localized inter-industry recycling linkages have spontaneously developed, most of all because they made good business sense.[3] Second, it shows how modern environmental regulations, hailed by many as the main reason why the environment has improved recently, have actually turned out to be quite unproductive.

Why Kalundborg Would Have Never Emerged in America

Traditionally, dangerous pollution problems in English-speaking countries were handled through the common-law doctrines of negligence, trespass, nuisance, and strict liability. Liability was thus imposed when-

ever harm resulting from a pollutant could be demonstrated with scientific evidence. Such a system mandated no specific conduct, but allowed private parties both to recover monetary damages for harm caused and an injunction against offenders who did not or could not reduce emissions to a nonharmful level.[4]

In the last three decades, however, this legal approach to industrial pollution has given way to a regulatory system that sets and enforces specific standards of conduct (typically dubbed "command and control"). Despite somewhat catchy names, such as the Resource Conservation and Recovery Act, modern American environmental regulations that deal with industrial waste have been built on the view that byproducts are a nuisance to be destroyed rather than potentially useful resources. The result is that many environmental statutes typically define pollution prevention in a way that excludes recycling and reclamation, while instituting pervasive biases against technological innovation. The result, not surprisingly, is that creating wealth out of industrial waste is now much more difficult than it was in the past.

Kalundborg provides an interesting lesson in this respect. As many commentators have pointed out, the flexibility of the Danish regulatory framework made possible events that would have been prohibited in America. For example, the flue gas that Statoil pipes to Gyproc and the liquid sulfur that Statoil sells to Kemira probably would not have been approved in the United States because both substances would be classified as "hazardous waste." Furthermore, the new resources created from these byproducts would also have been treated as hazardous under the so-called "mixture and derive from" rule, which classifies as "waste" new products that incorporate industrial waste. Also, the movement of sulfur from Statoil to Kemira and of scrubber-ash gypsum from Asnæs to Gyproc would have violated a 90-day-storage rule, which, as its name implies, prevents the accumulation of such material for more than 90 days. In the Danish case, the possibility of a longer storage period made the project economically viable.

The flexibility of Denmark's approach to environmental matters, coupled with the Danish Environment Ministry's encouragement regarding the use of all waste streams on a case-by-case basis, allows firms to focus on finding creative ways to become more environmentally benign instead of fighting the regulator. As a result, they can use byproducts as inputs rather than "virgin" materials that are often virtually identical in chemical composition.

There have probably always been two views of industrial byproducts. One considers residuals to be health and environmental hazards, urging people to take every step to protect both humans and the natural environment against them. The obvious solution to pollution problems then lies in reducing production and in destroying waste. The second approach considers residuals as potential resources from which marketable products can eventually be derived.

Past experience and current regulatory problems suggest that the second approach is both more sensible and economical. Perhaps, then, the development of an institutional framework that requires firms to prevent pollution, but leaves them free to develop new and profitable uses for byproducts, is the real road to sustainable development. □

1. For a concise and updated introduction to the Kalundborg Industrial Symbiosis, see www.symbiosis.dk/.

2. For the sources of these various quotes, see Pierre Desrochers, "Cities and Industrial Symbiosis: Some Historical Perspectives and Policy Implications," *Journal of Industrial Ecology*, Fall 2001, pp. 29–44.

3. Since Kalundborg first began to draw interest on these issues, similar industrial symbiosis has been "discovered" in, among other places, Austria, Germany, Finland, and various American and European petrochemical complexes. My research suggests that similar cases were probably very common throughout history. See my "Cities and Industrial Symbiosis" and "Regional Development and Inter-Industry Recycling Linkages: Some Historical Perspective," *Entrepreneurship and Regional Development*, January 2002, pp. 49–65, for a more detailed discussion of these other cases.

4. For a brief introduction to the topic and further references, see Pierre Desrochers, "Industrial Ecology and the Rediscovery of Inter-Firm Recycling Linkages: Some Historical Perspective and Policy Implications," *Industrial and Corporate Change*, November 2002, pp. 1031–57.