

An EcoIndustrial Assessment of Roxbury

by

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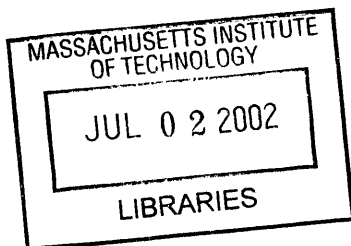
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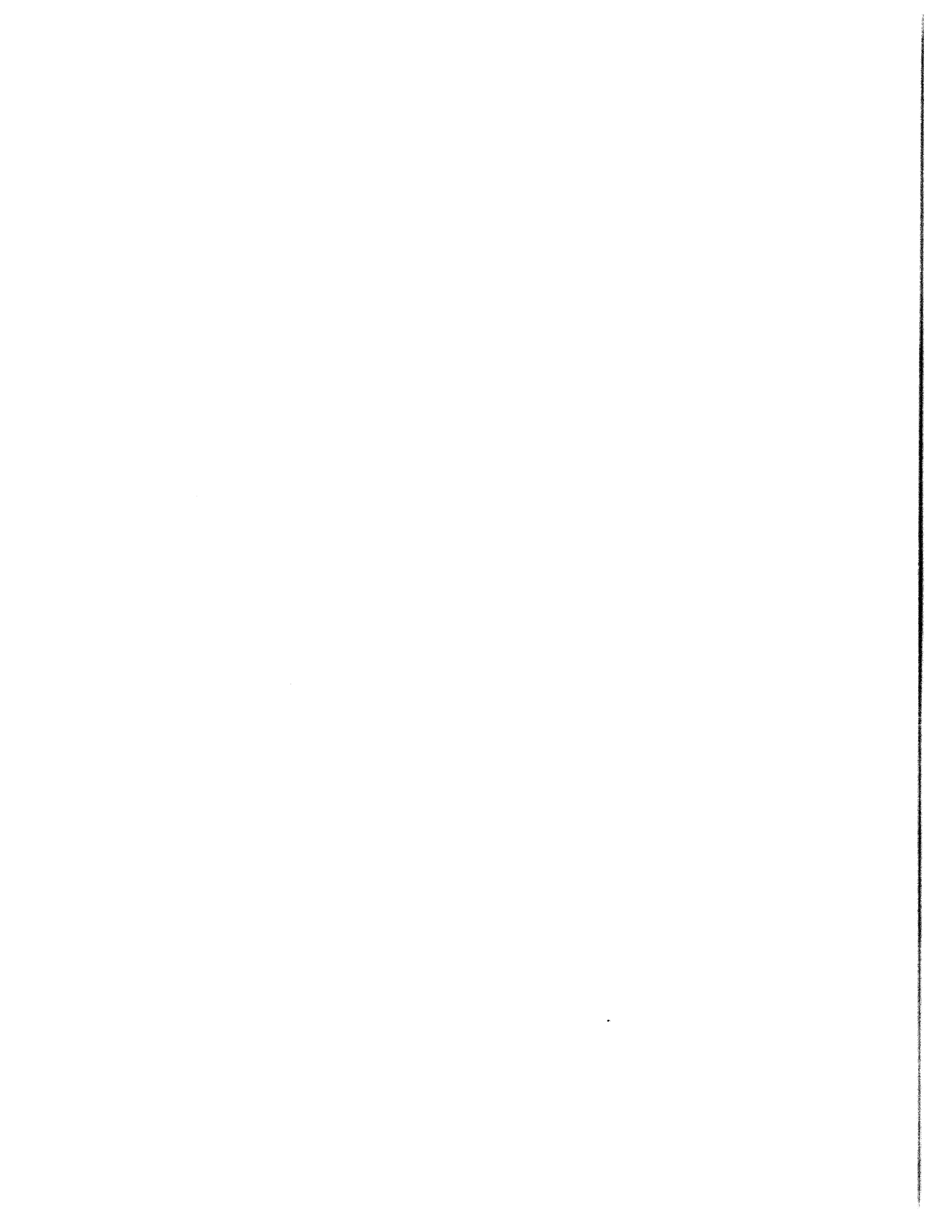
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ABSTRACT

Industrial Ecology (IE) is a growing body of knowledge and theories regarding the environmental impacts of human activities. It is intended to bring some lessons from the natural ecology to bear on the functioning of our industrial and economic systems. Materials exchange is a specific kind of IE where the waste output of one business becomes the input material for another, reducing disposal into landfills and resulting in positive benefits, economic and otherwise, for those involved.

This study was intended to examine the opportunities for a materials exchange program among local businesses in the locality of Roxbury, Massachusetts. It was conducted in concert with Dudley Street Neighborhood Initiative, a local community group; New Ecology, Inc., an environmental consultant; and a team of Tufts graduate students. Methods of analysis included a survey distributed to local businesses, follow-up conversations and interviews, and a simple database and exchange model derived from generic materials data. Software packages can provide a useful tool for identifying exchange possibilities.

However, none of the surveys sent to businesses were returned. This, among other issues observed during follow up interviews, suggested that the groundwork for such exchanges must first be laid by developing relationships between these businesses and a third organizing entity, which can then facilitate collaboration. A review of similar studies and literature indicated that indeed, relationship building between community stakeholders and other institutions is vital to setting the background for such exchanges. The conclusions center on a number of suggested steps local groups can take to begin setting up such exchange programs, revolving around relationship-building between community stakeholders and local government.

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Table of Contents

TABLE OF CONTENTS	5
PART 1: INTRODUCTION	7
PART 2: INDUSTRIAL ECOLOGY AND MATERIALS EXCHANGE.....	13
PART 3: MASSACHUSETTS - AN IE-FRIENDLY STATE?.....	19
PART 4: ROXBURY AND THE DUDLEY STREET AREA	25
PART 5 - IE IN ROXBURY?	33
PART 6: DSNI PROJECT AND RESULTS	37
PART 7: USING SOFTWARE TO AUGMENT IE PLANNING.....	45
PART 8: RELATIONSHIP-BUILDING	51
PART 9: CONCLUSIONS AND STEPS FOR MOVING FORWARD	57
BIBLIOGRAPHY	67
APPENDIX	69

Part 1: Introduction

“Modern man does not experience himself as part of nature but as an outside force destined to dominate and conquer it. He even talks of a battle with nature, forgetting that, if he ever won the battle he would find himself on the losing side.” - E. F. Schumacher

Thunderclouds on the horizon

In 1992, a document entitled “World Scientist’s Warning to Humanity” was released by a Cambridge, Massachusetts-based group called the Union of Concerned Scientists. It included more than 1,600 prominent signatories, including a majority of the Nobel laureates in the sciences, and outlined a variety of major threats that our society poses to the earth’s environment. It warned that “If not checked, many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know.” It also predicted that “not more than one or a few decades remain before the chance to avert the threats we now confront will be lost and the prospects for humanity immeasurably diminished.”¹

Consider the following facts:

- Only one fifth of the world's original forest remains as large tracts of ancient forest, and much of what remains is threatened by logging and other activities such as mining, infrastructure development and conversion to agriculture. An estimated 10 million hectares of ancient forest are degraded or destroyed each year. (A football field is .41 hectares. This works out to about 3/4 of a football field per second.)²

¹ See <http://www.ucsusa.org/about/warning.html> for the World Scientist’s Warning

² From “Buying destruction? A Greenpeace report for corporate consumers of forest products”

- By 2025 there will be approximately 6.5 times as many people, or 3.5 billion, living in water-stressed countries than in 2000.³ Based on a UN population projection, this will be more than 40% of the world's population.⁴
- In 1999, U.S. residents, businesses, and institutions produced more than 230 million tons of municipal solid waste, which is approximately 4.6 pounds of waste per person per day. This is up from 2.7 pounds per person per day in 1960 - a rise of more than 70%.⁵

Our ingenuity as a species has allowed us to multiply and develop technologies that have greatly magnified both our consumption of resources and the amount and toxicity of wastes that our society produces. Many of the most toxic and persistent byproducts of our society are completely synthetic, and thus have no place in the natural ecology. Rachel Carson confronted this issue in the seminal environmental book "Silent Spring". She documented the massive use of herbicides, pesticides, and other chemicals in modern agriculture, and their increasing concentration in animal tissue as they travel up the food chain. Some have credited her book with sparking the modern environmentalist movement.

Industrial Ecology

Industrial Ecology (IE) is a relatively recent field concerned with developing industrial models and practices that reflect the natural ecosystem. By modeling our practices after the natural world, it is theorized, we can greatly reduce our impact and eventually eliminate the threats that our consumption and pollution pose to our environment, and actually begin helping to repair the damage that has accumulated thus far.

Ecoindustrial Parks (EIP's) are one attempt to implement such models of ecologically oriented industrial practice. These are clustered groups of businesses that share resources in order to reduce their resource consumption and waste production.

³ UN Secretary general report, "Water: a key resource for sustainable development", 3/2/2001

⁴ UN report, "World Population prospects," revised in 2000

EIP's have been cultivated in a variety of localities, including Londonderry, New Hampshire; Brownsville, Texas; and Chattanooga, Tennessee. Perhaps the most well known and mature of such parks is located in Kalundborg, Denmark. Here, an insulin plant, a fish farm, oil refinery and plasterboard factory are run partially on waste and materials exchanges between the various industries. The park has operated successfully for more than 25 years, and is now estimated to save more than \$600 million a year in waste disposal and fuel costs.⁶

However, many of these facilities - Kalundborg being a notable exception - were designed from the beginning to be EIP's. The industries are clustered or "co-located," on a designated site. Before construction began, thought was put into the site layout, what would constitute a symbiotic mix of industries, necessary infrastructure, and other such details. A more challenging task is to convert an already mature industrial infrastructure into a model of "green" production. This is what is called creating a "virtual" eco-park (VEP). Rather than creating such a set of interactions from the ground up, ecological relationships between established businesses are found and cultivated, hopefully with concurrent shifts in environmental regulation. As a Cornell-produced handbook puts it, "By linking materials flows and exploring other regional connections, this latter approach allows communities with large existing industrial bases to apply eco-industrial principles to create a more sustainable business practices without having to relocate companies."⁷ The United States already has a massive industrial infrastructure with only minimal eco-interaction. The EPA estimates that "there are 7.6 billion tons of industrial non-hazardous waste generated annually in the United States by 12,000 facilities, and disposed of on-site in surface impoundments, landfills, land application units, or waste piles."⁸ Thus, while future industrial development can, and should, take advantage of ecoindustrial principles, the real challenges lay in reforming the existing industries.

⁵ EPA website facts page : <http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm>

⁶ Gettler, "Waste can be an asset to business," *TheAge.com*, 3/26/2001

⁷ "Handbook on Codes, Covenants, Conditions, and Restrictions for Eco-Industrial Parks," Cornell Center for the Environment

⁸ EPA guide, "Introduction to: RCRA Solid Waste Programs" Updated October 2001. See <http://www.epa.gov/epaoswer/non-hw/muncpl/topics.htm#industrial>

Regulation and the Almighty Dollar

Many countries in Europe, such as Denmark and Germany, are leading the world in reforming their practices using eco-industrial principles. In much of Europe, the ecological ideals behind such practices are more ingrained in the popular consciousness and in the environmental regulations than they are in the United States. As a result, such practices don't find the degree of political and business-related opposition that they do here. In the U.S., the economic benefits of environmentalism become far more important, as businesses are relentlessly focused on the bottom line. They feel more compelled to justify environmental changes in their practices with projections of improved business, either from savings (due to, for example, decreased energy use) or because they enhance the company's image. This has been much of the driving force behind the "Natural Capitalism" movement, which attempts to justify all environmental progress through economic rationales.

This is typified by the current Cheney/Bush administration's stance on the Kyoto climate treaty. When Clinton was president and actively seeking participation, Dick Cheney - along with other members of the uber-conservative COM.P.A.S.S. group (Committee to Preserve American Security and Sovereignty) sent a letter to Clinton arguing to end the U.S. participation. It worried that the treaty "threatens to limit the exercise of American military power," and called it a "feel good public relations ploy."⁹ Now that Cheney is vice president, the United States - by far the world's largest producer of greenhouse gases - has decided to unilaterally remove itself from initiative.

Clearly, the "do it for the environment" argument has little if any force with such decision-makers, and must be supported by other, more profit-oriented reasons for industry to have any interest. As Australian journalist Leon Gettler puts it, "projects [like Kalundborg] are not about tree-hugging altruism. The big driver is for business to make money more efficiently, with a return on assets of 30-50 per cent."¹⁰ Barbs at tree-

⁹ See <http://www.marshall.org/Kyotonationalsecurity.htm> for a copy of the COMPASS letter

¹⁰ Gettler, "Waste can be an asset to business," TheAge.com, 3/26/2001

hugging altruists aside, Gettler is right in stating that economics drove the relationship-building that resulted in the Kalundborg EIP. He ignores the fact that it was environmental principles that led to the regulations that made it so expensive to pollute. The Danish companies thus had a strong incentive to find mutually beneficial relationships, for economic reasons. In the United States, such regulations have yet to be adopted, as they are often decried as bad for business - and so in meantime, the economic benefits must be more inventively created.

However, some businesses identify themselves as members of a community. They have a commitment to “buying local,” and create neighborhood business associations to meet and discuss mutual issues. These interactions, a form of social capital - may be able to be leveraged in a way that can mitigate the need for clear economic gain. Indeed, it was the informal relationships between the businesses at Kalundborg that paved the way for their eventual IE partnerships. This issue will be discussed further in Part Eight.

The Local Case in Roxbury

Dudley Street Neighborhood Initiative (DSNI), a community group located in Roxbury’s central Dudley Street neighborhood, is concerned with both the environment and the economic vitality in its environs. DSNI began as a movement to end illegal dumping in its neighborhoods and rebuild its housing and open space. Over the years, it has continued and broadened its mission, which is now “To empower Dudley residents to organize, plan for, create and control a vibrant, diverse and high quality neighborhood in collaboration with community partners.”¹¹ DSNI, in collaboration with environmental groups and students, has recently undertaken an ambitious project - to facilitate the creation of ecoindustrial linkages in Roxbury/Dorchester as both an environmental improvement and as a method of economic development.

My thesis is concerned with this process of establishing an ecoindustrial movement in the Roxbury area, and analyzing its potential opportunities. How can a coalition of local groups like DSNI, environmentalists, local government, and local business interact to shift the industrial paradigm in the area towards a more ecological

model? How practical is a materials exchange approach for mature industries and businesses that already exist in the Roxbury area? Can this be used to set up immediate linkages (assuming that they do not already exist)? If not, what is preventing such exchanges from occurring, and what can help facilitate them?

¹¹ <http://www.dsni.org>

Part 2: Industrial Ecology and Materials Exchange

“... if the society toward which we are developing is not to be a nightmare of exhaustion, we must use the interlude of the present era to develop a new technology which is based on a circular flow of materials such that the only sources of man's provisions will be his own waste products.” - Kenneth E. Boulding, “Economics as a Science,” 1970

Industrial Ecology

IE has been defined as “the multidisciplinary study of industrial systems and economic activities, and their links to fundamental natural systems.”¹² Put another way, it is “the blending of ecological systems and industrial economies. The ecological side offers possibilities to learn from observing resilient, robust, long-lived ecological communities as examples of sustainable systems. The industrial side suggests that society can move toward sustainable economies by imbedding the principles learned from ecological systems in the design of firms and larger social institutions.”¹³

Though IE is a relatively recent term, some of its ideas are based in very ancient concepts, and civilizations throughout history have practiced some of its principles. For instance, since papyrus was expensive in Greco-Roman Egypt, “the used papyrus scrolls were collected and they usually became recyclable papyri.”¹⁴ Marcus Cato, a Roman scientist and farmer more than 2,000 years ago, developed what some claim to be the first recorded compost formula. He insisted that all raw materials such as animal manures and vegetation be composted to build soil fertility throughout the Roman Empire.¹⁵ While it is doubtful that these practices stemmed from a fear of disrupting the global ecology, the mentality that has spawned the saying “waste not want not” is as old as antiquity.

¹² Allenby, B., “Overview of Industrial Ecology Intellectual Framework,” Ch. 2 in *Industrial Ecology : Policy Framework and Implementation*, Prentice Hall, 1999, p.12

¹³ Ehrenfeld, J., “Cultural Structure and the Challenge of Sustainability,” in Sexton et al. *Better Environmental Decisions*, Island Press, p. 240

¹⁴ From Finnish museum exhibit. See : <http://www.heureka.fi/ancientcultures/ex02.html>

¹⁵ Dennis Jurries, PE, “Environmental Protection and Enhancement with Compost,” Oregon Department of Environmental Quality, 2001, p.5

However, since the industrial revolution this adage has taken on a new meaning and urgency. Both the consumption of resources and the amount of waste generated by human society have increased by orders of magnitude, and continue to grow. As described in the introduction, current industrial practices result in a variety of negative environmental impacts. From resource depletion to waste generation, our industrial model, while conducive to generating economic and consumptive growth, is not sustainable in the long-term. This is because the model is based on a “linear” or “open” model of material flows, rather than a “closed loop” system like the natural ecology.

Linear vs. Closed Loop Systems

Linear model of industry

One way of viewing our society’s industrial activity is as a simple linear “extract and dump” process of “drawing raw materials from the environment and returning vast amounts of unused by-products in the form of pollution and waste.”¹⁶ Little, if any, attention is paid to the impacts of this extraction or disposal. The implied assumption behind such thinking is that the natural environment is practically infinite, with limitless supplies of resources and a limitless capacity to absorb our society’s waste. It has resulted in an industrial system that is “petrochemically dependent and materials-intensive, and require[s] large flows of toxic and hazardous chemicals. These industrial ‘empty calories’ end up as pollution, acid rain, and greenhouse gases, harming environmental, social, and financial systems.”¹⁷ With such a system, if the damage it causes outpaces the global ecology’s capacity to restore itself, it will eventually cease to function as a viable ecosystem.

Closed loop systems

The world’s natural ecology, on the other hand, operates as a closed loop system. The primary energy source is sunlight, and all wastes are returned to the ecosystem to be eventually used again, in a cyclic loop. A microcosmic example of this concept can be

¹⁶ Ehrenfeld, Gertler, “Industrial Ecology in Practice,” *Journal of Industrial Ecology*, Volume 1, Number 1, p.68

found in the small glass “eco-spheres” that one can buy through mail order. The sealed glass sphere contains salt water, air, aquatic plants and algae, microorganisms, and tiny shrimp. All that is required to sustain life in the sphere is light, which provides the necessary energy input. The algae thrive on the solid and gas wastes of the microbes and shrimp; the shrimp eat the algae and microbes (and deceased shrimp); the microbes decompose the wastes, and both the microbes and shrimp breathe the oxygen emitted by the plants. Given a constant and moderate light supply, the inhabitants do not contaminate or overpopulate their small system and it remains in ecological balance for years. Unlike the Earth, in the spheres there is no weather to redistribute the chemical constituents, and the shrimp do not reproduce, so the eco-spheres don’t stay viable forever. Nonetheless, it’s an elegant demonstration of the mutual interdependency - and fragility - of our planet’s ecosystem. If one constituent gets too far out of balance (for example the algae grows too populous because of excess light) it can catastrophically disrupt the cycle of life in the sphere leading to death for all organisms inside.¹⁸

Operationalizing IE & Materials Exchange

It doesn’t take much imagination to apply the eco-sphere example to our current treatment of the earth’s ecosystem and the potential disastrous consequences, as outlined in the introduction. Industrial ecology is a field that attempts to bring these ecological lessons to practice and alter the consumption and pollution patterns of our society. IE can take a number of forms in practice. Wasserman suggests a taxonomy of IE practices that include land stewardship, green building design, individual firm environmental practices, and byproduct exchange.¹⁹ Some literature focuses on the last - byproduct exchange, also known as “materials exchange” - as though it is the totality of IE theory, or at least the foundation of it. At the risk of doing so myself, I intend to focus on this aspect of IE, as it is an undeniably central focus of the field, and also the focus of the DSNI IE project in Roxbury.

¹⁷ Hawken, P. A. Lovins, “The Next Industrial Revolution,” *Natural Capitalism*, 1999, p.14

¹⁸ See the eco-sphere website for more information: <http://www.eco-sphere.com/>

Materials exchange, or the sharing of waste materials, involves cultivating symbiotic relationships between businesses, a la Kalundborg, where one industry's waste output becomes another industry's feedstock. By diverting that output from the waste stream (i.e. the landfill) into the other industry, everyone benefits.

1. The waste producer gets its waste disposed of at a lower cost.
2. The recipient gets resources more cheaply than if it were to use virgin materials.
3. The environment avoids both further waste accumulation and resource depletion.

Ideally, such exchanges taken to their full potential could eliminate the very notion of "waste" - in a closed-loop industrial system, *all* byproducts of industry are useful to either another industry or to the natural environment, and all consumption is from such "waste" or from renewable resources.

Requirements for Materials Exchange

Ecoindustrial Baseline Study

As mentioned, most EIP's have been designed with such exchanges in mind. Kalundborg's exchanges developed from established informal relationships, spurred on by regulatory incentives. In cases where the mix of industries in a certain area can not be chosen in the design phase, establishing a number of waste-sharing relationships requires that one first develop an overall picture of the "materials flows" in the area. For an ideal ecoindustrial assessment, each business/industry in a certain area is surveyed, and its resource inputs (both material and energy) and waste outputs are determined. Once this information is databased, matches are made between compatible industries, and waste-to-input linkages are created. DSNI's attempt at such a study will be discussed in Part 6.

Of course, even assuming that any barriers (political, economic, or otherwise) to such relationships were mitigated, the amount of matching that can take place is limited by the accuracy of the assessment. In other words, the results can only be as good as the data. This can be a barrier, as "Discovery costs, the costs required to learn of the existence of an opportunity for exchange, can be high, and may be the major impediment

¹⁹ Wasserman, "Sustainable Development: The Case of Implementing Industrial Ecology," MIT master's thesis, p.87

for material exchange...”²⁰ It’s for this reason that communities have performed these valuable assessments as first steps towards establishing such exchanges.

Inter-business Relationships

Of course, if such materials exchanges are taking place, then the firms involved by definition have entered a form of economic relationship. However, the experiences of many communities and the opinions of many writers indicate that strong relationships between the firms must go beyond those related to their normal economic operations. They must enter into a mode of communication and collaboration that may often need facilitation from other parties. This will be discussed much more in Part Eight.

Regulatory Environment

Key to encouraging ecoindustrial relationships is a regulatory environment that helps urge businesses down the environmental path. According to Valdemar Christensen, manager of the Asnæs power plant at Kalundborg, “economies alone will bring you a certain amount of symbiosis – the low lying fruit. To go further, you need political impetus – to require pollution control technologies and/or to adjust prices to make symbiotic arrangements economically viable.”²¹

The regulatory climate in Denmark provides this political impetus. “Compared to the United States, the Danish regulatory system is consultative, open, and flexible. Instead of being put on the defensive as is a characteristic of a command-and-control framework, firms are required to be proactive by submitting plans to the overseeing county government detailing their efforts to continually reduce their environmental impact.”²² The extent to which the regulatory environment in Massachusetts encourages such activities will be examined next in Part Three.

²⁰ Ehrenfeld, Gertler, “Industrial Ecology in Practice,” *Journal of Industrial Ecology*, Volume 1, Number 1, p.73

²¹ Wasserman, chap 3 note 36

²² Ehrenfeld, Gertler, “Industrial Ecology in Practice,” *Journal of Industrial Ecology*, Volume 1, Number 1, p.75

Part 3: Massachusetts - An IE-Friendly State?

“This country must make every effort to stem the rising tide of garbage and industrial waste through a more aggressive use of waste minimization and recycling practices. America as a nation is filling landfills faster than it can establish new ones. The waste problem is not going away, and it can no longer be neglected.” - George H.W. Bush, Message to Congress, 23 June, 1989

There are some obstacles to implementing IE practices embedded in the national and state policy. While not insurmountable, they should be identified as areas of concern for local businesses and community groups who wish to encourage IE practices in their areas. Some examples such counterproductive policy include:

Extraction of raw resources is indirectly subsidized by the government, through minimal-cost leasing of federal lands for timber, mining, and oil drilling.²³

The current administration’s strong push to open up the Arctic National Wildlife Refuge to oil drilling is one of the more clear examples of such a dynamic. When virgin resources can be obtained cheaply, there is less impetus to find alternative or recycled sources.

Waste disposal costs in the US, while not as low as in Asia, are nonetheless much lower than those in Europe.

Even when certain states within the US mandate high costs for disposal, others with struggling economies minimize their own so that they can be paid to be the recipients of inter-state waste. On the international level, many developing countries have become the destinations of vast amounts of waste from the developed world. The point is, regardless of the final destination, disposal often remains a cheap option, limiting the incentive to divert wastes into reuse.

Waste regulations are written in such a way as to discourage the adoption of IE practices.

²³ Interview with Suzanne Giannini Spohn, 4/18/02

The Federal Resource Conservation and Recovery Act (RCRA) has very strict standards for the handling of "hazardous waste" that can lead to impediments for those attempting to recycle or engage in materials exchanges. Various shifts over the years in these laws - partially to protect against "sham recycling" - have resulted in "a very intricate, confusing, and inconsistent set of regulations."²⁴ Because exactly what is hazardous and what isn't, and what regulations apply to which wastes can appear so convoluted to those attempting to recycle wastes, they prefer to simply give them over to professional waste disposal.

Businesses have found interpreting these regulations so difficult that the Environmental Law Institute has published a book entitled "RCRA Demystified: The Professional's Guide to Hazardous Waste Law."²⁵ Clearly, this is a complex and inefficient way to address what is a mutually agreed upon problem - too much waste, and especially hazardous waste. Having been devised without IE in mind, these laws can provide a disincentive to those attempting to set up exchanges. Especially for smaller firms, the effort to comply with monitoring and reporting requirements may prohibit looking into materials exchanges as alternatives to disposal.

While the intricacies of national and international environmental law are far too voluminous to discuss here, suffice to say that a restructuring of the way our society regulates waste and industry is in order, to take into account advances in IE and related fields. At the state level, some changes are already taking place that may serve as a guide for more macroscopic policy.

DEP Policy plans

In 2000, the Massachusetts Department of Environmental Protection (DEP) released a comprehensive plan for the reduction of solid waste over the next decade. Entitled the "Beyond 2000 Solid Waste Master Plan" (SWMP), it not only lays out a

²⁴ Gertler, "Industrial Ecosystems: Developing Sustainable Industrial Structures" see: <http://www.sustainable.doe.gov/business/gertler2.shtml>

²⁵ David Kopel, 1996

series of general goals, but also a set of specific policies and regulations designed to help facilitate the changes. It has set the following goals for waste handling by 2010:²⁶

- 70% total waste reduction
- 88% non-Municipal Solid Waste (MSW) reduction
- 60% MSW reduction

The DEP intends to help guide Massachusetts towards this more ecological future via some of the following policies:

Source Reduction, Materials Exchange, and RCRA

There are hopeful signs that the problems with RCRA have been acknowledged, and this awareness is being implemented into the crafting of future policy. In an EPA draft policy report entitled “Beyond RCRA: Prospects for Waste and Materials Management In the Year 2020,” there is a section entitled “Need for more sustainable use of resources.” Regarding resource consumption, it admits that while “while the economic value of some of these resources may increase, the more important (but often hidden) price to be paid may well be an environmental one. Extracting, producing and using ever-increasing volumes of material resources—most of which are finite - will inevitably have important environmental consequences.”²⁷

In its proposals for the future, the report maintains that “a fully realized transition from a RCRA-style waste management program to a broader materials management system has the potential for substantially reducing the volumes of wastes that are generated by the nation’s businesses and households ... Ideally, of course, all wastes would be used and reused in a continuous cycle, in much the same way as natural ecological systems work.”²⁸

Accordingly, in its SWMP, the DEP has committed itself to:

- Promote material exchanges and reuse networks targeting building materials, industrial waste, household materials and electronic equipment.

²⁶ SWMP fact sheet

²⁷ Massachusetts DEP, “Beyond RCRA: Prospects for Waste and Materials Management In the Year 2020”, Draft White Paper, February, 2001, p.6

²⁸ *ibid.* p.16

- Provide technical assistance, including training and networking.
- Provide equipment grants to reuse organizations (for trucks, facilities, computers).
- Develop an inventory of reuse organizations and services for dissemination via the DEP web site and other means.
- Conduct pilot projects to identify best outreach and transportation practices.
- Provide consumer education grants to municipalities.²⁹

Bringing flexibility to the regulatory approach - 2003 Materials Ban

The master plan announced the DEP's intention to phase in a ban on a number of materials in the waste stream, beginning in 2003. This would make it illegal to dispose of them into landfills, for some, eventually illegal even to handle in waste transfer facilities - they will need to be diverted at the source. The specific material ban will fall under a larger ban on unprocessed construction and demolition (C&D) waste in general.

The proposed phase-in of bans on certain wastes will make it more than expensive not to divert these materials; it will make it illegal. This is the most effective way of ensuring the diversion of wastes, as the option is not left up to a fickle market. However, it must be practical - if another option for use of the waste doesn't exist - if there literally is no recipient with capacity to convert it to another use - then the law is useless. It cannot change reality, and will only turn many hapless businesses with nowhere to turn into lawbreakers.

This is why the DEP says it has also committed itself to working with businesses and soliciting input from various stakeholders in determining how it will phase in the ban.³⁰ As the SWMP puts it, "DEP recognizes that a broad-based coalition of environmentalists, municipalities, businesses, recycling advocates, and other stakeholders is needed to help guide implementation of the *Plan* over the next ten years. To promote active and balanced stakeholder participation, DEP will formalize the membership of the Solid Waste Advisory Committee. By formalizing this Committee, DEP will ensure that

²⁹ SWMP, p.22

³⁰ Interview, Steve McGuire, DEP C&D contact

all interests are represented and have clear opportunities to be involved in advising DEP on implementing the *Plan*.”³¹

In Kalundborg, the regulatory environment helped to facilitate the linkages between the businesses, as meeting the stringent requirements made it economically and legally advantageous to do so. But it was also the case that the government worked with businesses to help them set and meet goals. The DEP policy initiatives are a beginning step towards creating a similar climate in Massachusetts, with strict requirements but a responsive and participatory, and supportive government role.

State Commitment to Environmental Justice

America has a history of unequally applying policy, regardless of a stated commitment to fairness. Too often, poor and minority communities find themselves to be the last to see the benefits of progressive government policy, and sometimes the victims of it. The history and events that created the community of Roxbury - described in the next chapter - are a case in point. Thus, it becomes essential that the various policies discussed above be implemented in such a way that they improve the overall quality of life for everyone. This is one definition of environmental justice.

Article 97 of the Constitution of the Commonwealth of Massachusetts states: “The people shall have the right to clean air and water, freedom from excessive and unnecessary noise, and the natural, scenic, historic, and esthetic qualities of their environment; and the protection of the people in their right to the conservation, development and utilization of the agricultural, mineral, forest, water, air and other natural resources is hereby declared to be a public purpose.”

The Executive Office of Environmental Affairs (EOEA) has drafted an environmental justice policy, which maintains that the “EOEA believes that no segment of the population should bear a disproportionate burden of environmental impacts or receive a disproportionate allocation of environmental benefits, including access to the Commonwealth’s open space and parks. This document memorializes that belief in written policy and provides specific parameters for EOEA departments and offices to

³¹ SWMP, p.11

implement the policy to reduce environmental disparities, and to prevent and reduce pollution overall.”³²

The Massachusetts Department of Environmental Protection (DEP) has weighed in with its full support, and has committed to “work to ensure that the principles established in EOEA’s environmental justice policy are upheld, and will actively promote the mandates of Title VI of the Federal Civil Rights Act of 1964 in the siting and permitting of solid waste facilities, as well as other types of facilities.”³³

These are all very strong declarations by various sectors of government in support of environmental justice and waste reduction. I have focused primarily on these statements of awareness, of institutional commitment to environmental principles, since they are the guide by which the institution moves forward over the long term. Of course, history has shown that all too often, such lofty policy statements don’t translate into a corresponding reality on the ground. Too often, poor communities and communities of color have been the victims of environmental injustice over the years, and the conditions in these areas have not reflected the vision enshrined in the passages above. This is why community groups and advocates throughout Massachusetts should ensure that these guidelines are being followed in the implementation of the discussed policies and initiatives in their areas. It is these groups that provide the political pressure and/or impetus to drive change, and hold elected representatives - as well as local industry - accountable. Such has been the case in Roxbury, as will be discussed in Part Four.

³² EOEA Environmental Justice Policy Public Comment Draft, December 19, 2000

³³ SWMP p.15

Part 4: Roxbury and the Dudley Street Area

“Why should all this empty land be here to have people come to dump their refrigerators and do their drug deals? That’s why people who don’t live in the area will have their land taken.” - Che Madyun, Dudley organizer

Environmental Problems and Community Organizing

The Dudley Street Neighborhood - at the geographic heart of Roxbury - is an area of approximately 1.5 square miles, less than two miles southwest of downtown Boston. Originally, it was a largely composed of Italian and Irish residents, but during the well documented and well subsidized “white flight” that began in the 1950’s, many of these groups moved out, heading towards suburban areas or other areas of Boston. People of color – many of them Hispanic or black immigrants (often Cape Verdean) moved in to replace the outflow. As is so often the case in the United States, the changing demographics of the Dudley Street neighborhood (see section on demographics below) also changed the land value, which declined along with the percentage of white residents. Banks refused to give loans for prospective businesses, and the area’s economy went into a tailspin.

In the 1970’s and 80’s, many of the property owners, disillusioned with the declining land values, decided to take their real estate issues into their own hands. They realized that if the houses “somehow” burned down, they could collect the insurance money, sell the land and wash their hands of what they felt was a losing investment. Roxbury’s Highland Park area neighborhood had been designated “Arson Capital of the Nation” in 1981. A report by the Boston Arson prevention Commission detailed the wave of intentional burnings that hit the Dudley neighborhood, finding the arson rates to be even higher than those in Highland Park. Many residents died in the fires, and the period has been a serious blight on Boston’s history.³⁴

The more than 1,300 vacant lots left in the wake of these burnings then became a magnet for trash dumping. At least three illegal trash transfer stations - festering with

rats, mosquitoes, and bad odors - were operating in the community, along with another two licensed (but still noxious) facilities. In addition, the Boston Redevelopment Authority, responding in 1984 to the eroding quality of the neighborhood, proposed a “New Town” plan, which included a “complex of office towers, hotels, housing, historical parks and light manufacturing.”³⁵ The housing was targeted towards families making \$20,000 and up - this in an area where one of two families earned under \$11,750.³⁶ For many in Roxbury, the BRA plan was tantamount to the “urban renewal” policies of the 1960’s. Some called urban renewal “Negro removal” because it had a history of often displacing residents in areas like Roxbury, where in the Dudley core the population was 53.8% black in 1980.³⁷

Some Community Groups in Roxbury

The Dudley Street Neighborhood Initiative (DSNI)

DSNI was born in the early 1980’s out of this maelstrom of conflicting interests. Community residents began organizing for an alternative “Urban Village” plan to revitalize their neighborhood, which focused on cleaning up the vacant lots, shutting down the illegal trash transfer stations, and building quality housing affordable for the area’s low-income residents. It pioneered the use of eminent domain by a community group to acquire lots and begin their redevelopment. Since this time, DSNI has worked on a variety of projects in the area, ranging from park revitalization to community gardens, from soil safety sampling to economic power campaigns. It is most recently involved in an ecoindustrial study of the Dudley Street area, which will be discussed in Part Six.

Alternatives for Community and Environment (ACE)

ACE is another community group that has evolved to confront social, environmental, and economic issues in Roxbury. Founded in 1993 as a nonprofit, it was

³⁴ See Medoff & Sklar, “Streets of Hope” (1994) for a general history of this decline.

³⁵ Ibid., p.50

³⁶ Ibid., p.51

³⁷ Ibid., p.321

“dedicated to helping residents of lower-income neighborhoods and neighborhoods of color in and around Boston protect and improve their environment as a means of helping revitalize and reclaim their communities.”³⁸

ACE's mission includes the following three priorities:

- Educating citizens on their rights and opportunities for involvement in environmental and public health decision making.
- Developing the capacity of neighborhoods to take control over problems affecting their health and environment.
- Creating systemic solutions to address the unequal distribution of environmental burdens and to promote safe, sustainable economic development.³⁹

ACE currently operates through four programs:

- Community Representation Project: “ACE works in close partnership with community organizations in greater Boston and eastern Massachusetts, providing direct legal, educational, and organizing assistance.”
- Massachusetts Environmental Justice Network: “a network of over 170 attorneys, public health professionals, and environmental consultants, to provide pro bono assistance to other neighborhood groups throughout the state.”
- Roxbury Environmental Empowerment Project : “seeks to develop youth and adult leadership in our home neighborhood through a public school curriculum, community service projects, and local town meetings on environment and health.”
- Alternatives Resource Center: “provides research and technical resources for community activists and disseminates model legal and technical strategies through workshops and publications.”⁴⁰

Nuestra Comunidad Development Corporation (NCDC)

From the NCDC website: “In 1981, residents of the Dudley neighborhood created Nuestra Comunidad Development Corporation to take control of the land, build new

³⁸ William Shutkin, “The Land That Could Be” , p.4

³⁹ ACE website : <http://www.ace-ej.org/>

⁴⁰ ACE website : <http://www.ace-ej.org/programs.html>

housing, and leverage their combined energies for a better future.”⁴¹ In addition to housing development, NCDC organizes “Crime Watch Groups, resident associations, neighborhood clean-ups, voter registration drives, a Farmer's Market, the development of community gardens and tot lots, an afterschool youth programs, and internship and job opportunities for youth.”⁴² IE seems a natural fit with the overall mission that NCDC has pursued through the years.

Boston and Roxbury Demographics⁴³

Population by race (1999)

	Roxbury	% total	Boston	% total
White (inc. Hispanics)	8,926	18.23%	329,094	59.40%
Black (inc. Hispanics)	35,344	72.18%	156,213	28.19%
Am. Indian, Eskimo, Aleut(inc. Hispanics)	205	0.42%	1,735	0.31%
Asian or Pacific Islander(inc. Hispanics)	708	1.45%	37,746	6.81%
Other (inc. Hispanics)	3,786	7.73%	29,267	5.28%
hispanics	9,880	20.18%	82,285	14.85%
totals	48,969	100.00%	554,055	100.00%

Roxbury, with a 72.18% black population, contained 8.7% of Boston's population, but contained more than a fifth of Boston's entire black population - a significant racial concentration. This is a major factor in the history of Roxbury's economic and infrastructural disintegration, as it has been in so many urban communities. Historically, residents of black neighborhoods have faced extreme discrimination in housing and

⁴¹ Nuestra Comunidad website : <http://home.earthlink.net/~nuestra/index.htm>

⁴² *ibid.*

⁴³ Roxbury Strategic Master Plan

business loans, real-estate redlining, and other such problems; Roxbury has been no exception.⁴⁴

Local Business

Newmarket Business Association

The Newmarket Business Association (NBA) is a nonprofit founded in 1977 to provide a forum for communication and collaboration among a number of businesses located throughout South Boston. Its goals are:⁴⁵

- The continued growth of business in the Newmarket area.
- Promoting business to business interaction.
- Communicating the interests of [NBA] members to City and State officials and working with those officials to create a better business climate.
- Working as the primary advocate and voice of its membership for the betterment of the Newmarket District.

The NBA’s membership page lists 190 businesses, and the number is growing.

The following is a breakdown of businesses in the Dudley area included in a directory published by DSNI in 1996:⁴⁶

Business Type	Number	Percentage
Automotive	44	19.05
Clothing/Accessories	14	6.06
Construction & plumbing	20	8.66
Dry Cleaning & Laundry	5	2.16
Financial Services	2	0.87
Florists	2	0.87
Food	47	20.35
Funeral homes	3	1.30

⁴⁴ Medoff & Sklar, “Streets of Hope” (1994), p.24-25

⁴⁵ http://www.newmarketboston.org/about_nba.htm

⁴⁶ DSNI Business Directory : A Guide to Businesses in the Dudley Street Neighborhood (Roxbury & Dorchester)

Furniture	8	3.46
Hair/Beauty	16	6.93
Hardware	4	1.73
Healthcare	3	1.30
Heating, Maintenance	7	3.03
Insurance	7	3.03
Legal	3	1.30
Liquor	5	2.16
Media	4	1.73
Printing/Copying	3	1.30
Services	22	9.52
Travel	2	0.87
Video, TV, radio	4	1.73
Waste Disposal	6	2.60
Total	231	100%

What is striking about this business composition is that almost a fifth of the businesses were auto-related. Auto businesses - while not desirable from a neighborhood beauty standpoint - also are major sources of noxious byproducts that have historically been difficult to confront - waste oil, rubber tires, and solvents, to name a few. Finding a productive use for these outputs - given the sizable presence of auto businesses in Roxbury - should be high on the list of materials-exchange priorities. This can be difficult within the confines of Roxbury.

Nonetheless, there are a huge variety of businesses throughout the Boston area. Even if extremely short-range exchanges are uncommon within the Dudley or Roxbury areas, extending the radius a few miles out - say to the Newmarket businesses - could reveal many new opportunities.

As discussed, the Roxbury community has had a long history of struggling to overcome problems related to waste-related activities, both legal and illegal. It thus seems fitting that it should now be looking towards EI principles as solutions to these problems and the much larger ones discussed in the introduction. DSNI is attempting to do just that via an initial baseline study of Roxbury's materials flow.

Though DSNI has developed a productive relationship with some of the waste businesses in the area, it had also gone to court to fight the expansion (or presence) of others. Much of DSNI's time and effort has been directed at ridding the area of these operations and their impact. This poses somewhat of a dilemma, because in attempting to establish an eco-industrial program by (in part) working with the waste businesses, it risks further institutionalizing and expanding the presence of waste-related commerce and development. Thus, DSNI walks a narrow line of attempting to improve the way the community and its businesses deal with waste, and to provide ecoindustrial savings and economic stimulation - without further establishing Roxbury as the locus of the region's trash. As Kit Perkins of NEI puts it, DSNI's project is discussed next, in Part 5.

Part 5 - IE in Roxbury?

“Boston must conduct the creative experiments and the abolition of ghettos which will point the way to other communities.” - Martin Luther King, Jr.

Given the established presence of waste-related and manufacturing businesses in the area, Roxbury provides an uncommonly “rich” environment for the development of ecoindustrial projects that can greatly improve the environmental performance of the local economy. Because there is little data about the local materials flows other than that theorized by the computer model, I can’t yet definitively discuss the prospects for materials exchanges. However, what follows are some possibilities for waste diversion in general, based on activities already underway in Roxbury.

Disposal companies as centers for waste diversion

The waste hauling and disposal businesses in Roxbury could potentially be prime candidates as centers for by-product exchange and waste diversion. A large percentage of the waste generated in the area passes through these local centers, and they have the transportation capacity to move large amounts of material. There are barriers that make assuming this new role more difficult, but also innovative solutions being practiced. Jet-A-Way, the only licensed construction and demolition (C&D) waste transfer station in the Boston area, is a case in point.

Jet-A-Way relies on the rapid movement of waste through its systems, and advertises its ability to expedite the process of waste disposal, with a turnaround time under 20 minutes per truck.⁴⁷ In addition, they don’t have the land capacity to warehouse large amounts of waste for processing, nor would the community want them to. This makes sorting of the waste more difficult and time-sensitive.

However, interesting solutions are being implemented. Jet-A-Way uses powerful magnets at the tipping floor (where the trucks unload) to quickly remove the ferrous metals from the waste stream. A grapple is used to remove large pieces of wood and non-ferrous metal. The rest of the waste passes through a picking line where conveyor belts are used to sort the flow. Jet-A-Way is also acquiring a chipper to render the wood it

⁴⁷ See Jet-A-Way website: <http://www.Jet-A-Way.com/>

removes suitable for input into other industries, diverting it in different directions depending on its type. "Clean wood" - wood not contaminated by paint, lacquer, or other substances - is a suitable input for a variety of processes and products. "Dirty wood," which is contaminated, and some other hard-to-recycle substances are reduced to chips and used either as an alternative to dirt for landfill cover, fuel, or as an absorbent material. Between the removal of the concrete, metal, and wood, Jet-A-Way estimates that it will be diverting more than 70% of its waste stream from the landfill by December 2002. It must be remembered that this is largely in response to the DEP's planned banning of unprocessed C&D waste.⁴⁸

Source Reduction

*"Source reduction is the most environmentally preferable and potentially least costly alternative to waste management."*⁴⁹

Once waste reaches Jet-A-Way or a similar business, it is at the end of the line in terms of the process of disposal. It will either be diverted at that point, or will go into a landfill. While such businesses are making strides in diversion, an even more preemptive way of reducing the flow of waste is to focus on preventing it at its source - the businesses and building sites that produce it.

Deconstruction

Deconstruction is a term applied to selective dismantling of buildings instead of outright demolition. The materials can then be recycled, or reused in other buildings. Jet-A-Way estimates that 80-90% of their business comes from disposing of construction and demolition materials - much of it into the landfill.⁵⁰ Clearly, focusing on this one issue can have a large impact on the amount of waste destined for the dump.

There are two methods of deconstruction, depending on the allowances at the site. If space permits, the various components of the building can be separated and stored on

⁴⁸ Phone interview with John Kelso, 4/18/02

⁴⁹ SWMP, p.18

site until they can be sold and hauled away, but this requires enough land to accommodate storage bins and space to navigate through. In areas where this is not feasible, deconstruction contractors can line up buyers for the products ahead of time. When desired pieces are removed - windows, doors, fireplaces - the buyer shows up and hauls it straight from the site.

Deconstruction is labor-intensive, and those in the best position to undertake such work - general contractors - would often have to pay unionized workers for the process, cutting into the profit margin and making such efforts less attractive than simply demolishing the building with large machinery. Though one could actively seek to create non-unionized jobs and/or train non living-wage workers specifically for deconstruction (it requires minimal training), this is hardly the type of economic development that the neighborhood seeks to encourage.

Business Clustering

In Springfield, Massachusetts, “Indian Orchard community members expressed concern about the number of auto repair shops in their neighborhoods and the environmental impact of improper disposal, poor storage, and illegal operations.”⁵¹ Springfield hosted more than 490 registered auto repair establishments. Some proposed clustering these businesses so that not only would their impact be confined, but they could derive the benefits of sharing facilities.

As was shown in Part Four, auto businesses are a heavy presence in Roxbury. They are scattered throughout the area, widely distributing what is considered to be an unattractive neighborhood presence. When the Dudley Neighborhood implemented its Urban Village plan, it included a facility called “Swifty Auto Mall,” which brought “five independent auto repair operators together in one facility, thus reducing the use of toxic materials while increasing energy efficiency and recycling options to promote a more healthy environment.” The Swifty project was overseen by Nuestra Comunidad, which received city block grant funding. The tenants of the auto mall must submit environmental management plans to Nuestra, which provides training “in pollution

⁵⁰ Phone interview with John Kelso, 4/18/02

⁵¹ Springfield Ecoindustrial Baseline Study

prevention, waste minimization, employee safety procedures, and environmental regulation compliance.”⁵² If this model could be replicated, it could further reduce the negative impacts of Roxbury’s auto related industries.

Composting

Food waste is a significant portion of the MSW that flows into landfills. The Food Project, located in Roxbury, is dedicated to growing organic produce and distributing it through food banks, shelters, and their own farmer’s market. They involve youth, imparting environmental, social, and business-related knowledge. Through waste from the food they produce, they create approximately 150 cubic yards of compost per year, which they then use to fertilize the gardens. However, they require 300 cubic yards, and so must buy the remaining 150 at ~\$25/cubic yard, which adds up to nearly \$4000 per year.⁵³ What if the compost could be produced by local homes and businesses and donated to the food project? The SWMP has provisions for the promotion of backyard composting. Local businesses and residences, if they began to compost their food waste in small bins, could direct it to the food project, saving them money and allowing them to reinvest it in the community. It would be almost as simple as recycling for the businesses, and so would not be appreciably more labor involved in separating wastes.

Inter-business Materials Exchanges

These kinds of mutual collaborations, I will argue in Parts 8 and 9, are essential for the future of Roxbury and its environment. Too often, local businesses, government, and community groups have worked isolated from each other, or even antagonistically. By breaking through these barriers, perhaps some cooperative possibilities can be explored. It was with this notion in mind that DSNI embarked on a project to determine whether such collaborations existed, and if not, whether potential for exchanges existed in their local area. This project will be discussed next, in Part 6.

⁵² Boston City Press release, June 29, 2001, “Mayor Menino Cuts Ribbon for Swifty Auto Mall”

⁵³ Interview with Kristen Brennan of the Food Project

Part 6: DSNI Project and Results

“We’re trying to set up a business enterprise with the focus of remanufacturing, to recycling, to materials exchange. I still think that’s a possibility, but it’s going to take a lot more education.” - Kit Perkins, NEI

Some environmental improvements can take the form of changes in business practices, to lessen the negative impact of the waste operations on the surrounding neighborhood. For example, DSNI has worked with Jet-A-Way and BFI - a solid waste transfer station - to help them implement a set of solid waste “best practices.” Misting while dumping waste, washing down trucks to minimize dust production, and other changes in operation have reduced some of the problems and improved the environmental impact of the operations.

However, the focus of DSNI’s project was to explore the potential for by-product exchange in-between businesses. The project is essentially the community group’s initial foray into establishing such exchange relationships. As such, it is as much an organizing and relationship-building tool as a data-gathering one. As will be discussed in Part 8, previous experience with such exchanges have shown that developing informal relationships between businesses in the area is key to encouraging cooperation. Participants in the project included New Ecology, Inc. (NEI) as a consultant, Tufts graduate students, and myself.

First Steps

After DSNI designated a study area including a number of blocks surrounding its office, the Tufts students compiled a list of 162 businesses therein, verifying phone numbers and addresses. These businesses were to be the focus of the study, with a few - such as Jet-A-Way - receiving special attention as they have worked with DSNI in the past. As the businesses were visited, they were given brief explanations of the project, and asked their level of interest in participation. A list of the businesses has been included in the appendix.

Development of the survey

The survey was derived primarily from two sources, and supported by some advice from the Springfield city planning office. The first was a similar survey used in the city of Springfield for their own ecoindustrial baseline study, which contained mostly qualitative questions about the nature of their businesses and environmental practices. The second was a survey developed by the Chelsea Center for Recycling and Economic Development (CCRED) as the information gathering tool for use with an “Industrial Materials database” also produced by them (discussed below).

The CCRED survey is geared primarily towards collecting information about outputs rather than inputs. It has questions about use of recycled feedstock and manufacturing processes employed (which implicitly communicates certain feedstocks), but no emphasis on specific amounts. However, both provide good templates for drafting a survey more targeted to materials exchange in Roxbury.

The goal was to develop a set of questions that would do two things:

- gather qualitative and quantitative data about the material inputs and outputs of each business, as well as the method of disposal (recycling or trashing)
- Get qualitative data about the willingness of the business to participate in ecoindustrial programs, and what kinds of other businesses would be beneficial for theirs if located nearby.

This required a bit of a balancing act. The survey had to be detailed enough to capture usable quantitative data, but simple enough that it would not seem prohibitive to someone attempting to fill it out. In other words, it seemed to be a trade-off between data quality and survey response rate.

The graduate students developed an updated list of 162 businesses in and around the Roxbury Industrial Development Area. Most were informed about the upcoming study, and asked about their interest in participating in such a materials-exchange program. The great majority said they would need more information, though four simply refused to participate.

Survey Response

The surveys were mailed out in mid-March. However, three weeks after the surveys had been sent, none had been returned. There are a number of issues that may have contributed to this lack of response:

We sampled by area rather than business type

The designated study area was essentially a small radius around DSNI's headquarters; all businesses within this zone were included. The problem with such an approach is that the businesses in the zone may or may not be good candidates for materials exchanges. An alternative is to decide on a set of business types with a known high potential for materials exchange, and then target them for the survey; this was the method used in the Springfield study.

Businesses chosen have fewer interactions with city/academia

The study area chosen falls outside of three "Main Streets" districts that border it on all sides. "Main Streets" is a program of city assistance for revitalizing local businesses. A Main Streets district may have been a good place to start with such a study because they are already used to interactions with city officials, local community groups, and graduate students from local universities, all of whom have been participants in studying and helping implement the program. By avoiding such businesses, the study focused on establishments that have no such relationships and are often "skeptical, and a little defiant"⁵⁴ towards unknown people scrutinizing their business practices.

Some businesses have a tenuous relationship with DSNI

Because DSNI has had an adversarial interaction with some businesses in Roxbury, their letterhead may have in some cases ensured a lack of response rather than encouraged one. This only highlights the need for building positive relationships between DSNI and the neighborhood's businesses. It also suggests the need for institutional backing from city agencies or other institutions seen as more pro-business by the business community. A similar ecoindustrial baseline study conducted in Springfield - with a similar number of

targeted businesses - had a 24% response rate. They attribute this largely to the “active support of the [Springfield] Chamber of Commerce and the use of its letterhead.”⁵⁵ For instance, a similar institution that DSNI could have sought the assistance of is the NBA. 39 of the 162 businesses are members of the NBA, and had the survey been distributed through that institution, it might have gotten a much better response.

Communication and collaboration between the city, the organizations, and the community seem necessary to ensure that every business has the support it needs to participate in the study. Most businesses, especially smaller ones, do not itemize their waste, they just contract with a disposal company and have it hauled off. It may be necessary to visit the businesses on site and perform a materials audit in the same way that free energy audits are performed by Industrial Assessment Center Programs (perhaps they could be performed simultaneously) - this will be discussed in Part 9.

Conclusions based on follow-up conversations⁵⁶

DSNI requested the use of its business directory booklet for the follow-up calls, which was a different set of businesses than the list used for the survey mailing, although there was a great deal of overlap between the two. The Tufts students split the calls among themselves, a DSNI staff member, and myself. I selected approximately 25 businesses from the end of said booklet, focusing on those that seemed likely to foster exchanges (liquor stores and beauty parlors were low on the priority list.)

Subsequent follow-up calls to the surveyed businesses showed that in fact few were even aware of the survey’s existence. Some expressed interest in seeing it, and asked us to forward another copy, but the overwhelming sense - as articulated by one of the Tufts graduate students - was that it was though “the survey had never been sent.”⁵⁷ This is unsurprising considering the fact the despite the overlap, many of the businesses in the directory had not been sent the survey, a fact that seemed to evade notice until after

⁵⁴ Interview with Nicole Flynt of DSNI

⁵⁵ Springfield Baseline Study, p.8

⁵⁶ Interviews with businesses conducted by myself, Tufts students, and a DSNI intern

⁵⁷ Tufts graduate student, meeting at NEI

many calls had been made. Nonetheless, enough of the survey-targeted businesses were called to make its obscurity noteworthy.

More than a third of the businesses I called asked me to leave a number or had only a machine. Only two of them called me back, the rest have yet to respond. Another third essentially said they didn't feel they had anything worth contributing to such a program (or any way of benefiting from it) and left it at that. The rest gave limited responses to open-ended questions about their materials handling and interest in IE possibilities.

Conversations with local businesspeople indicated that few had any substantive knowledge of materials exchange practices or potential. Some expressed interest, but also expressed skepticism about the viability of the IE project. Some of the following opinions and attitudes typify those found:

- The effort required to track waste and move it to other businesses (rather than the dumpster) would outweigh the benefits. Small businesses are not willing to expend the labor necessary.
- The project is likely to fail (or struggle getting off of the ground) because the business participation is likely to be minimal - the profit incentives are not clear enough.
- Many businesses are not in a position to use by-products - they prefer to buy their inputs from an established vendor.
- Most businesses are not likely to take the study seriously until they see more information, and may not trust the students asking for data.

These responses have made it clear that a process of community education must first take place to help introduce IE concepts and practices, and that it must be implemented through organizations that have an established relationship with the community. For instance, as part of the DSNI project, and in reaction to the lack of response, the Tufts graduate students have developed an IE Guidebook, which will be edited by DSNI and then printed and distributed to local businesses. In straightforward terms, it explains the benefits associated with IE practices, both economic and

environmental. This is not only a way of introducing the project to the community but a gesture of initial relationship building between DSNI and these businesses.

Do exchange relationships exist in Roxbury?

It would seem that there are few, if any, byproduct-exchange relationships in Roxbury, based on the following evidence:

- None of the surveys were returned. It seems likely that were the businesses motivated to find such relationships, or were already engaged in them, at least a few would take advantage of participating in such a study.
- In the follow-up calls with many of the businesses in the Dudley directory by the Tufts students and myself, not one instance of such collaborations was discovered.
- Contacts at ACE, DSNI, NEI, and CCRED that I spoke with were unaware of any such collaborations taking place in the area.
- In a check (on May 11, 2002) of the various businesses listed in the www.MaterialsExchange.org website, none were located in Roxbury.
- In 1999, CCRED compiled a listing of various businesses in the wider Boston area that use recycled inputs as their feedstock. Of all those listed, only one was located in Roxbury (despite the heavy industrial presence): Nova Chemicals, which receives polystyrene waste from a wide area.
- A member of the NBA board, when asked if such discussions took place at NBA meetings, replied that “the short answer is no.”⁵⁸ Another member could not recall ever hearing such conversations.⁵⁹

Clearly, there may be - and most likely are - any number of interactions that have somehow been missed, as none of these sources is by any means an extensive review of the businesses in the Roxbury area. As the examples in part 5 showed, there are some IE activities happening, in terms of waste diversion or best practices. Nonetheless, the

⁵⁸ Phone interview with Marlowe Sigal, Solutek, 5/9/02

⁵⁹ Phone interview with Jesse Jeter, Jet-A-Way, 5/9/02

inability to find any inter-business materials exchanges, despite our efforts, would certainly indicate that they are at least not common practice or a very substantial piece of the economic/ecological climate in Roxbury.

Part 7: Using Software to Augment IE Planning

“Computer guys don't have to be practical - they need a systems vision.” - Computer consultant in Springfield

The list of materials flowing through Roxbury on any given day is beyond expansive. Even when sampling for a small amount of data, as in the DSNI project, the number of businesses and potential exchanges becomes daunting. Some software packages have been developed to help with the process, but they themselves have problems in terms of their application to developing a materials exchange program in Roxbury.

FaST, DIET, and ReaLiTy

These three programs are part of a software package distributed by the EPA, and were developed by Industrial Economics, Inc. The ecoindustrial park at Londonderry, NH used this software suite to plan some of its facilities, as did the PRIME project in the Philippines.

- **FaST (Facility Synergy Tool):** This is a database template for the material inputs and outputs. It includes some pre-entered generic profiles of businesses and materials as well. This tool can be used to find materials-based linkages between existing industries (to create a VEP), or to find a set of symbiotic exchanges in planning for an EIP.
- **DIET (Designing Industrial Ecosystems Tool):** DIET is a linear programming tool for optimizing combinations of different facilities to balance and maximize performance, jobs, and profitability. This is mainly for development of EIP's, though could potentially be used to further refine future VEP arrangements.
- **ReaLiTy (Regulatory, Economics, and Logistics Tool):** Just as the name implies, this tool adds a few more dimensions to the analysis of an existing or proposed ecoindustrial network, ensuring that it is legal, economically feasible, and

logistically realistic. It is the “stamp of approval” on the optimized solution produced by the DIET tool.

Unfortunately, the EPA Division of Urban and Economic Development was unable to maintain funding for continuation of the software past 1999. Thus, the FaST database has not been updated in some time, and the software package as a whole has not been refined to reflect the evolving nature of IE.

Additionally, while FaST comes packaged with a small number of generic business profiles, I found the small number present in the FaST database to be insufficient to reflect the diverse range of businesses and industries in Roxbury. Also, the detail of the data - the number of materials listed for each business - was in most cases small, and so may miss many potential opportunities.

Finally, FaST is a rather opaque tool, which would require either advanced knowledge of MS Access or training to use fully and effectively. In a similar community materials assessment, the Center for Ecological Technology concluded that FaST wasn't compatible with their project's needs because it had “basic formatting flaws and a complicated design that is not user friendly.”⁶⁰

Analysis of the Roxbury Businesses

Because I felt FaST was not a good fit with the nature of the project, I decided to look for an alternative to do a bare-bones comparison of the estimated materials flows in the sample businesses. Facility type, material inputs, and material outputs will be the only relevant fields, and ideally the simplicity of the interface should be less prohibitive than that of the more professional (and subsequently complex) tools.

Industrial Materials Database

The IMD is a Microsoft Access Database originally designed for analyzing recycling market opportunities in the City of Taunton, Massachusetts. The Chelsea

⁶⁰ Chelsea Center for Recycling and Economic Development, “Materials Flow Through the Community : Creating New Resource Opportunities,” p.5

Center for Recycling and Economic Development (CCRED), with help from the consultant on the Taunton project, further refined the database to be used generally by communities it works in. It is being tested in two Recycling Based Economic Development grant projects, in Greater New Bedford and Amherst, and allows for collection of a company's background information (contacts, # of employees), feedstock composition, manufacturing processes, and waste composition. One can then print reports that break down the information by tonnage, material type, and company.

The IMD would seem to be an excellent tool for storing and accessing the exchange data, with a couple of exceptions. First, feedstock information is not at the same level of detail as waste outputs. This is because the survey was geared towards recycling possibilities, where the reuse of the material involved changing it into something else, and so only the type of substance mattered (i.e., "wood," rather than "wood pallets." To delve into exchange possibilities, the detail level should be equal on both ends. Second, there is no simple function to search for matches. This makes the process of linking businesses far more tedious than necessary. Rather than undertake the complex task of modifying the IMD for what is a very preliminary search, I decided to make a bare-bones database in Access. The only fields are company name, inputs, and outputs, and one can search by material type to see all companies with that particular input or output. I have tentatively dubbed it "Jesse's Ecoindustrial Resource Kiosk" (JERK).

As discussed, we did not receive any significant data from the surveys, and so I could not build a workable database of business profiles in Roxbury to enter into JERK. The next best thing is to acquire a database of typical business profiles, with generic materials data that can be used to approximate what we would expect to find from the businesses in Roxbury. This is not as ideal as collecting primary source data, but can at least give an idea of the potential kinds of exchange relationships.

Readily available sources for such databases are difficult to find. While a number of such studies have been done, some are the result of paid consultant work and are considered to be proprietary. However, the Triangle J council of governments in North Carolina performed a similar survey of the materials flows, and documented the inputs

and outputs of 182 businesses classified by SIC code. It gives the materials flow of these businesses in great detail, and is a suitable substitute data source.

Because I did not have SIC codes for the businesses selected by the DSNI study, I instead opted to gather a set of businesses from the Business & Company Resource Center database via the Boston Public Library website.⁶¹ The database's list of businesses within Roxbury was limited, so I expanded the pool to businesses within Roxbury, Dorchester, and Jamaica Plain - communities bordering Roxbury on the east and west, respectively. Both are also included in the Newmarket Business Association area.

The database furnished a list of 45 potential businesses in these three communities. Only 17 of these had SIC codes that existed in the Triangle J listings, and I also added Swifty Auto mall as a representative of an automotive business (conspicuously absent from the list, given the presence of auto businesses in Roxbury) using a number of obvious materials (i.e., motor oil, solvents.) Three of these 18 were redundant businesses - they had the same SIC code as another in the list and added no new data to the exchange pool. Removing these, I was left with 15 businesses for potential exchanges, representing 22 different SIC codes. I began entering these businesses, with their suggested material inputs and outputs, into JERK.

The material types listed in the Triangle J study were open ended - in other words, whatever words the survey respondents had used to describe their materials. In order to do matching, I had to classify their materials into more general categories. This is where a great deal of the data resolution gets lost, but is necessary to have any functional matching (at least, if the matching is done via computer). The triangle J study listed 49 materials that were found to have high exchange potential among the 182 businesses surveyed.⁶² Using this list as a guide, I compiled a similar list of 38 material types.

What I found upon looking for matches was that all 15 businesses had potential exchanges of one kind or another. This was unsurprising, as the Triangle J study initially found a very high number of matches as well. Because detailed "specifications regarding particular materials are necessary in order to determine whether partnerships are possible,

⁶¹ http://www.bpl.org/electronic/frame_bcrc-a.htm

yet this requisite level of detail was usually not provided in survey responses” (i.e., a 50% HNO₃ solution with contaminants may be simply listed as “acid”), “follow-up phone calls or visits to facilities of interest are necessary to further explore each exchange.”⁶³ In addition, many of the businesses have a material listed as both an input and an output. This does not mean that they can simply start supplying themselves and close the loop (if only!) but rather that the form the material takes as a byproduct - while still the same material - is no longer suitable as an input. What form the material is in - as input or output - must often be determined by conversations with the relevant business.

Certain material types seemed to be prime candidates for exchange, or at least very common input/outputs. Some examples:⁶⁴

<u>Material</u>	<u>Businesses using it for I/O</u>
Acids:	5 of 15
Metal drums	5 of 15
Oil (lubricant)	9 of 15
Wood Pallets	9 of 15

It should be reiterated that nothing definitive could be drawn from these preliminary matches. Through the process of first screening by feasibility, and then contacting businesses for more information, the theoretical exchanges can be whittled down to a few realistic possibilities. At that point, a process of relationship building begins, with these exchange possibilities providing a “focus for the discussion”⁶⁵ among interested parties. This is discussed next, in Part 8.

⁶² Judy Kincaid, “Industrial Ecosystem Development Project Report.” Triangle J Council of Governments, May 1999. See <http://www.tjco.gdst.nc.us>

⁶³ *ibid.* p.22

⁶⁴ See appendix for screenshots and tables from the database.

⁶⁵ Interview with Judy Kincaid, 5/13/02

Part 8: Relationship-building

“It’s a matter of doing this with all the stakeholders sitting at a table, and bringing everyone together. Whatever solution we came up with ourselves would be missing some critical piece.” - Trish Settles, DSNI

Relationship-building is key for exchanges

One resounding theme has arisen throughout this study: ***relationships are key to IE***. Relationships between the neighborhood businesses provide the foundation upon which materials exchanges (or other IE practices) can be built. It’s through the relationships between community groups (such as ACE, DSNI, and Nuestra Comunidad) and the surrounding business community that these groups provide the advocacy and assistance to foster these progressive changes. CDCs and other institutions - through their relationship with the neighborhood residents - can help educate people about source reduction strategies (like trash separation into MSW and recyclables or composting). Relationships between all of these community actors and the city and state institutions are essential if EJ principles are to be implemented across the board and government assistance is to be fully utilized.

That may sound obvious, but there is a tendency to view these ecoindustrial networks as essentially simple input/output equations. It’s tempting to hope - as I did at the beginning of the DSNI project - that the main barrier to developing a VEP is just the identification of potential exchanges. This, of course, is easy once we have viable data (why, just send out a survey and wait for results to come in!) and a workable computer model. In the rush to acquire data, the human side to the issue can be ignored, to the detriment of the project. Many in the IE field focus on this mechanistic aspect, and so “as a body of literature, industrial ecology is divided between those favoring engineered systems and [those advocating] less prescribed network behavior.”⁶⁶ While the former group focuses on informational or technological solutions, the latter “emphasizes fostering partnerships and networks to manage energy, water, and material resources in more sustainable ways ... In this domain, industrial ecology is a social construct. The key

element is not technological solutions, but the social relationships and creativity generated by people.”⁶⁷

Gertler’s oft-cited study of Kalundborg also found that these relationships are essential to fostering exchange flows. He writes that since “industrial symbiosis requires interaction and trust among companies that goes well beyond normal business practice, such expanded collaboration is both a component and necessary precursor of industrial ecosystem development.”⁶⁸

Wasserman, too, found that “developing industrial ecosystems requires strong inter-firm relationships ... The industrial ecosystem model of implementing IE requires relationship building between firms within a specific industrial development. Relationships can result in higher levels of byproduct and energy exchange as well as cooperation over ways to improve environmental performance and meet or exceed regulations.”⁶⁹

The Springfield city planning office also concluded that an “effective byproduct exchange program requires the facilitation of networking among businesses and with the community,” and they “recommend convening workshops with industry cluster representatives to discuss potential partnerships...”⁷⁰

Suzanne Giannini-Spohn, of the EPA, agrees. She related the example of ecoindustrial activities in Brownsville, Texas and adjoining Matamorosa, Mexico. There, a refinery, stone company, asphalt company, and tank farms are finding interactions to curb local environmental problems. Giannini-Spohn felt that an essential part of the success there has been “getting business owners into a room to talk to one another.”⁷¹ She also felt that the problem with attempting to initiate such programs without first forming such relationships was one of trust. When outside entities attempt to gather materials flow information and instigate exchanges, businesses are wary because “they

⁶⁶ Mary Schlarb, M.P.S, “Eco-Industrial Development: A Strategy for Building Sustainable Communities,” Work and Environment Initiative, Cornell University

⁶⁷ *ibid.* Also see : Cohen-Rosenthal, Ed. 2000. “A Walk on the Human Side of Industrial Ecology.” *American Behavioral Scientist.* 44:2: 245-264. (October)

⁶⁸ Gertler, Nicholas. *Industrial Ecosystems: Developing Sustainable Industrial Structures.* Cambridge: Masters Thesis, Massachusetts Institute of Technology, 1995. p. 7

⁶⁹ Wasserman, “Sustainable Development: The Case of Implementing Industrial Ecology,” MIT master’s thesis,, p.18

⁷⁰ Springfield Ecoindustrial study, p.32

don't know us, or each other, and they may not want us to know what they are putting in their trash.”⁷² This sheds some light on the zero-response rate to the DSNI project's survey, and reiterates the need for building a climate of cooperation and trust - otherwise known as “social capital.”

Building Trust : Social Capital vs. the Almighty Dollar

I have quoted people who insist that the “low-hanging fruit” economic drivers are necessary for the establishment of EIP and even VEP relationships, and that short of an outright ban on certain wastes (such as that planned by the DEP), or clear and immediate economic advantages, businesses will rarely, if ever, implement such changes.

However, at the local level, social capital can often make up for a lack of profit motive. Social capital has been defined as “features of social organization, such as networks, norms, and trust, that facilitate coordination and cooperation for mutual benefit.”⁷³ Many businesses, while concerned about profits, also identify themselves as part of a community, and attempt to demonstrate this by supporting other local businesses and working with the community advocacy groups in their areas. For instance, the Newmarket Business Association has an explicitly stated community focus. The NBA has a partnership with the Samuel W. Mason Elementary School, in which it has donated computers and books, as well as other activities. According to their website, “*the NBA also:*

- *Provides assistance to worthy causes in the community.*
- *Provides organizational/ financial support for neighborhood renovations and clean-up project[s]*
- *Participates in area economic development and safety programs*
- *Gives annual awards to area non-profit organizations”⁷⁴*

⁷¹ Interview with Suzanne Giannini Spohn, 4/18/02

⁷² Ibid.

⁷³ Putnam, Robert : “The Prosperous Community: Social Capital and Community Life.” *The American Prospect* (Spring) p.36

⁷⁴ http://www.newmarketboston.org/new_page_2.htm

This social capital, while difficult or perhaps impossible to measure in financial terms, can nonetheless be a powerful factor in helping bring community initiatives and projects to reality. This can be seen by the amount of change that the community groups like DSNI have been able to accomplish in the last 15 years, usually with the support and collaboration of local government. It also casts doubt on the notion that only economics can facilitate inter-business collaboration. In their interviews, the Tufts students found that some businesspeople felt that “the community has a valued social capital that needs to be disclosed, and the implementation of collaborative programs such as materials exchange may be an effective strategy toward real community empowerment.”⁷⁵

Community Groups as Facilitators

How can these networks be cultivated? Wasserman concludes that in areas where strong inter-business “relationships do not exist, a third-party organization is needed to identify potential waste exchange opportunities. Once opportunities are identified, an organization must be responsible for bringing businesses together to begin planning exchanges between firms. The role of the third-party organization could also be to facilitate the development of relationships between firms so that future linkages are recognized via discussions between managers.”⁷⁶

This was the finding in Springfield as well. “Springfield’s eco-industrial development program can play a central role in gathering information and raising business awareness,” says the report. “A continued program requires the development of a physical and information exchange infrastructure plan ... a facilitator is perhaps the most important element, because without one, companies will not be as likely to identify or pursue partnership opportunities.”⁷⁷

Ernest Lowe, of Indigo Development, concurs in a paper written for a sustainability symposium. He maintains that for ecoindustrial networks to occur, a set of

⁷⁵ du Moulin, Radicci, Teter, Wozniak, “Waste materials exchange at the community level: Building readiness and awareness,” Tufts University Dept. of UEP, May 2002, p.10

⁷⁶Wasserman, “Sustainable Development: The Case of Implementing Industrial Ecology,” MIT master’s thesis, p.95

⁷⁷ Springfield Baseline Study, p.33

conditions must be present which include “access to information on discard resource streams” and “opportunities for personal communication among players.” This is where community groups come in, as “Different private and public entities will take the coordinating roles required to establish these conditions, depending upon the community and region. Clearly trade associations, chambers of commerce, and educational institutions have a role in creating an effective forum for public communication and vision building, as well as in researching the regional resource flows.”⁷⁸

In the Triangle J study from which the modeling data in Part 7 was derived, the team came to similar conclusions about the necessity of such a facilitator. “What is lacking in most communities,” they found, “is an agent to promote the vision of a web of materials, water, and energy flowing between neighbors and to gather the local information about by-products available or raw material requirements needed to build this web. Without a local champion, it is difficult for businesses to go beyond their buyer and supplier networks and establish profitable relationships with other neighbors, even if such partnerships might be cost effective.”⁷⁹

ACE, DSNI, NCDC, and other groups have a long history in the area of activities to improve the economic and ecological vitality of Roxbury and its environs. They are well poised to be the facilitators mentioned in the passages above, as is clear from their stated missions:

4. ACE: “ACE provides legal and technical support, educational programs, and organizing assistance to community groups throughout New England to solve environmental problems and develop local environmental leadership.”⁸⁰
5. DSNI: “To empower Dudley residents to organize, plan for, create and control a vibrant, diverse and high quality neighborhood in collaboration with community partners.”⁸¹
6. NCDC: “NCDC is devoted to building the wealth and enhancing the physical, economic and social well-being of Roxbury, through a community driven process which promotes self-sufficiency and neighborhood revitalization.”⁸²

⁷⁸ Ernest Lowe, “Regional Resource Recovery, and Eco-Industrial Parks, An Integrated Strategy” See website : <http://www.indigodev.com/Eipresrecov.html>

⁷⁹ Kincaid, Overcash, “Industrial Ecosystem Development at the Metropolitan Level,” *Journal of Industrial Ecology*, Volume 5, Number 1, p.126

⁸⁰ <http://www.ace-ej.org/>

These groups could potentially develop productive relationships with a much larger number of businesses in the region through such routes as a community education campaign (like the “Buy Local” movement that DSNI has already undertaken), continuation of the ecoindustrial study, and - importantly - partnerships with existing (or future) business associations like the NBA. The real question is: what could be accomplished if these various community groups were to combine efforts, and work in a concerted fashion towards IE? These groups have collaborated in the past on a number of issues; this represents an opportunity to build a lasting inter-community coalition.

Of course, we shouldn't rely on simply developing relationships between various community actors to produce progressive change either. As discussed, a conducive regulatory environment, informed IE principles and strategies, supportive software (like JERK/FaST), and other resources can be essential factors as well. What follows in Part 9 is a discussion of strategies and next steps to take towards a more ecoindustrial future for Roxbury.

⁸¹ <http://www.dsni.org/>

⁸² <http://home.earthlink.net/~nuestra/mission.htm>

Part 9: Conclusions and steps for moving forward

“Think globally; act locally.” - Rene Dubos

So what are the next steps to take for the residents and institutions in Roxbury? Part 8 discussed the need for a variety of relationships to facilitate change. This section focuses on a list of priorities and concrete steps that can be taken by the Roxbury community to begin building such relationships around a materials exchange framework. I’ve based my conclusions and recommendations on the information and findings discussed thus far, the experiences of the other communities grappling with similar issues, and my own observations as an observer and participant in this whole process. These are, of course, simply suggestions - what is most applicable to Roxbury should be decided by community members themselves, in collaborative settings, with all of the facts at their disposal.

First, to sum it all up, what are the barriers, and what are the assets? The following are some trends that currently discourage the development of these exchange relationships:

Waste regulations are simultaneously too loose and too restrictive. Waste regulations in the US permit disposal at a fraction of the cost levied in European countries, providing little incentive to look for exchanges. At the same time, RCRA’s nebulous definition of “hazardous waste” has restricted the possibilities for materials exchange.

Lack of community knowledge of ecoindustrial principles/practices. The business community (and especially small businesses) had little to no knowledge of materials exchange. They considered it an extra cost, a charitable activity, or a “feel good” environmental measure, but not a viable asset of their business. This not only reduces the willingness of businesses to participate in exchanges, but even initial information gathering for such a project.

Lack of inter-business relationships and trust. The Newmarket business association notwithstanding, there is little organized cooperation and exchange of IE ideas between the majority of local businesses. Though many consider themselves part of the

community, it is in an abstract sense, and not through participation in organized business or community institutions. As Jesse Jeter, sales director for Jet-A-Way put it, there is a lot of local business in the community, but “people don’t know each other.”⁸³ Many also have little trust of people seeking information about their business practices, making data gathering difficult.

Lack of capacity or desire, especially for small businesses. Small businesses often feel they lack the time and labor capacity to devote to ecoindustrial ideas that (considering the lack of knowledge about such practices) seems to be of dubious value to the business owner. As one local businessman put it, itemizing materials flows and seeking out exchanges is “far too inefficient a process. There’s no way I’d waste my time looking for a needle in a haystack.”⁸⁴

Lack of data. The materials flow of Roxbury is still a black box. Data can be difficult to get - from small businesses that don’t keep track themselves, to polluters who don’t want *anyone* to keep track. We can make estimates based on experience with businesses of a similar type, as I did with JERK, but it won’t be as accurate or useful as empirical data from the source.

However, there are a also number of trends and assets that address the problems above:

Regulatory climate in flux. The laws regarding waste in Massachusetts are changing, and the DEP has long term plans to drastically reduce the waste flow, using outright bans on some materials where deemed appropriate. This will provide a powerful incentive to implement source-reduction and waste diversion practices.

State government’s written commitment to EI and EJ principles. The state constitution, the EOEPA, and the DEP are all explicit in their commitment to ecologically sound principles, and a clean sustainable environment for everyone. Of course, such statements are easy to make but difficult to implement. Nonetheless, it represents a starting point from which the government institutions and local groups can collaborate.

⁸³ Interview with Jesse Jeter at Jet-A-Way, 3/09/02

⁸⁴ Phone interview with Marlowe Sigal, Solutek, 5/9/02

Lessons are being learned; data are being collected. IE is a nascent field and new EIP's are springing up globally. As IE becomes more generally accepted, studies are being done in more and more places. As the data comes in on the most effective ways of fostering such activity, it will help the ongoing efforts in communities like Roxbury. There is a growing body of knowledge and expertise to draw on. The DSNI project, while getting off to a rocky start, is nonetheless in the process of acquiring data and setting the foundation for a database of the area's businesses.

High potential for community social capital. As discussed in, the Roxbury area has built up social capital through its shared history of EJ battles and founding of a number of community organizations. Now that these community groups are beginning to address IE, possibilities for positive changes loom large.

Establishing Priorities and moving forward

In Part 5, I discussed a few ways that IE has taken shape in Roxbury and its surroundings, and they span the range of wastes and diversion strategies - C&D vs. food waste; business clustering vs. materials exchange and re-use. However, community resources are limited, and groups must decide where to concentrate their efforts - which routes for IE practice hold the most immediate promise. This is a complex question, where we must weigh a few competing interests:

1. Which is the best approach for a community just embarking on implementing these ideas?
2. Which approach to address the worst ecological problems - in other words, which focus would be the biggest boon to the environment?
3. What is most feasible and logical considering the impending regulatory changes?
4. Which wastes can be confronted with community education, and which need more involved efforts (materials analysis, etc)?

There are essentially two types of solid waste - municipal (MSW) and non-MSW. Non-MSW is primarily C&D waste, with some sludge and dredged solids as well. Because C&D waste is usually produced by contractors who are used to moving and

sorting large amounts of material, and the waste is generally more bulky and easier to sort, this is one of the logistically simpler areas to focus on change. Unsurprisingly, this is the area in which we are already seeing marked reductions in non-diverted waste output (note the changes at Jet-A-Way and the upcoming ban on C&D).

MSW, on the other hand, is a much more difficult and intractable problem. It is produced by businesses, residences, and consumers walking down the street; there is no single source (like construction sites) to focus on. Once collected into mixed waste containers, MSW is virtually impossible to sort effectively. Hence, it must be interrupted at the source by changing people's habits and practices, and this can only happen through massive community education and organization towards source reduction.

I would argue that this is where community groups are most effective, and where they should place their initial efforts. By doing so, they can address the above 4 issues:

1. Education about the problems and solutions is the first step in any process of mass community change, and is the forte of community groups.
2. Changes in non-MSW handling are already well underway as seen in Part 3. The biggest looming waste issue - and one begging to be addressed by community organizations (almost literally, in the case of the DEP) - is production of MSW.
3. The variety of explicit governmental commitments to helping facilitate such changes is an open invitation to community groups, and should be taken advantage of.
4. Community groups by themselves are capable of education campaigns to address resident waste issues. In collaboration with business groups, they can address business-born MSW as well.

Developing and implementing a materials exchange program among local businesses (the original and ongoing intent of the DSNI/NEI project), within a backdrop of broader community IE education is within the capacity of these community groups. It offers the opportunity to build a variety of new alliances and gather data about the area and its materials flows; out of these collaborations, any number of positive developments can arise. Here are some suggested steps to begin the process.

STEP 1: Contact the Newmarket Business Association and get on their agenda.

DSNI and NEI, the progenitors of the Roxbury IE study, should first contact ACE, CCRED, NCDC, and other local environmentally concerned groups to gain partners in their plans for a local study. Even if the support is mostly in name, being able to cite a fellowship of respected community groups who have signed on to the IE educational and information-gathering campaign could greatly help its credibility. Once a few committed partners have been assembled, they should move on to contact Newmarket.

Networks of business relationships - like those facilitated by the NBA - are the foundation upon which the successful EIP examples were built. Contacting the NBA and tapping into their network is perhaps the most effective and highest priority action a local community group can take. The NBA has monthly meetings where they discuss various issues, and getting on the agenda would be a valuable first step.

O'Rourke, Connelly, and Koshland, in a critical review of IE literature, found that one thing direly needed was a mechanism "for discussion and debate regarding the transformation of industrial activity that includes a broad range of actors and interested parties."⁸⁵ Potentially, the NBA - if it invests itself in the idea of being a center for IE networking - could be such a nexus of business-related IE information and discussion. An institution where businesses not only find exchange linkages but also avail themselves of the tacit knowledge their colleagues gain in their own attempts to be more "green." New businesses in the area - once joining with the NBA - could be exposed to a variety of opportunities to form social and economic connections to their neighbors.

Jet-A-Way is a member of Newmarket, and believes that this is a positive first step. "I think [community groups] could do a better job of having a relationship with the Newmarket Business Association," says Jeter. "That should be where the relationship should take off next. So it's not directly with the Jet-A-Ways but it's directly with the business organization, or chamber, so to speak ... DSNI with Newmarket - now that would be a dynamite relationship."⁸⁶

⁸⁵ O'Rourke, Connelly, Koshland, "Industrial Ecology: A Critical Review," *International Journal of Environment and Pollution*, Vol. 6, Nos. 2/3, 1996, p.108

STEP 2: Solicit federal/state/city partnerships and support.

Grants and loans, technical assistance, and other support can be vital and is always a major priority for community groups, whose budgets are already strained around the formidable problems their neighborhoods face. In addition, “if the government can contribute by lending its support through letters or having their name affiliated with such projects, it provides legitimacy and credibility to materials exchange and the efforts of those working to promote its use.”⁸⁷ Such benefits are available through productive relationships with local, state, and federal institutions.

As the DEP puts it, “Our vision of maximum waste reduction calls for significant changes in the behavior of the public and private sectors and even changes in how goods are produced. The social and economic changes needed for achieving this vision are not easy to make, and will require strong partnerships between the public and private sectors.”⁸⁸ Community groups willing to take this task of educating local residents and businesses about IE will no doubt find support - financial and otherwise - from the EPA, DEP, and other government or municipal institutions.⁸⁹

For example, the EPA funds a grant program called the National Industrial Competitiveness through Energy, Environment, and Economics (NICE3). According to the EPA website, NICE3 “funds up to 40% of total project cost for up to three years in support of technology development that can improve industrial cost competitiveness, prevent pollution, conserve energy, and reduce industrial wastes. Since 1991, NICE3 has sponsored 58 projects, totaling \$17.9 million of DOE funding.”⁹⁰

For a determined community, a number of routes exist to obtain financial support for implementing IE initiatives. For instance, the Springfield EI Baseline study was funded in part by the U of Massachusetts CCRED, the EOEA, and the Clean Environment Fund.⁹¹ In fact, the sheer number of sources and bureaucratic pathways to sift through can be daunting for small businesses, but “technical assistance is available

⁸⁶ Phone interview with Jesse Jeter, 5/9/02

⁸⁷ du Moulin, Radicci, Teter, Wozniak, “Waste materials exchange at the community level: Building readiness and awareness,” Tufts University Dept. of UEP, May 2002

⁸⁸ DEP Solid Waste Master Plan, p.16

⁸⁹ See appendix for list of government assistance sources

⁹⁰ <http://www.sustainable.doe.gov/business/fedassi.shtml>

⁹¹ Springfield EI Study Executive Summary

for organizations that need it through the emergence of organizations that help small institutions figure out what their options are. On the local level many CDC's [community development corporations] help do this, such as Nuestra Comunidad. On the state level, Massachusetts Small Business Commercial Center and the Massachusetts office of Business Development can help."⁹²

The city of Boston can play a role as well. Though the city's Roxbury Strategic Master Plan has no specific mention of environmental initiatives such as the ones discussed here, it does give support to the Roxbury community's *2020 Vision*. In this document, the city pledges to work "to ensure that Roxbury is a vibrant, safe, affordable, culturally diverse, accessible, clean, sustainable and historic community — a place in which residents of all income levels can take pride in calling home."⁹³ Again, as we saw at the state level, there is an explicit commitment to sustainability. Getting the city on board could be an extremely valuable - if not critical - piece of the overall move towards ecoindustry. Local community groups, businesses, and residents concerned about Roxbury's future (and the IE potential there) should be very involved in this process of local planning. The plan itself suggests that "to become involved or gather information about the Roxbury Strategic Master Plan process, please contact Jessica Pineo, Deputy Director of Strategic Planning, Boston Redevelopment Authority, [617] 918-4226 or e-mail Jessica.Pineo.BRA@ci.boston.ma.us."⁹⁴

This is only the beginning of what could be more extensive partnerships in crafting future environmental or development policy. Making recommendations for what such policy shifts can and should be are difficult without the input of stakeholders - it should, as the DEP as maintained, be done in a collaborative fashion. Nonetheless, forming these IE partnerships only lays the groundwork for this kind of collaboration in the future.

STEP 3: Develop a community education and materials auditing program

⁹² 2nd Annual Regional Sustainable Development Forum, "The Greening of Community Development," at MIT, September 17, 2001. Notes from proceedings, available on NEI website : <http://www.newecology.org> Workshop notes

⁹³ Roxbury Strategic Master Plan

⁹⁴ *ibid.*, p.13

Without more knowledge of (and different attitudes towards) IE on the part of Roxbury inhabitants, none of these ideas will go anywhere. Education is thus a major priority. The IE guidebook produced by the Tufts students is a good start, but a much more extensive campaign is required to fully engage businesses and residents. A model for consideration in Roxbury is the PRIME project in the Philippines. PRIME is an environmental project under the United Nations Development Program and is run by the Philippines' Department of Trade and Industry's Board of Investments, which has convened IE workshops and seminars with local industry.

Another example is a project undertaken by the National Center for Eco-Industrial Development. The group's mission is to "facilitate job creation and sustainable industrial expansion in distressed communities around the nation by applying principles of industrial ecology, establishing eco-industrial parks, and expanding use of environmentally benign manufacturing processes and techniques."⁹⁵ They plan to hold community workshops to bring together "state and local economic practitioners, the community-based organizations, and stakeholders within the distressed community."⁹⁶

Many businesses, even those interested in IE, are hesitant to dedicate the time and labor necessary to itemize their materials onto a survey. Survey response rates are in general already notoriously low; one that requires intensive materials cataloging is likely (as we have seen) to be ignored completely, even after extensive community IE education. The level of information required is much more suited to an on-site audit program like the one conducted by the Industrial Assessment Center than an impersonal survey.

This program, funded through the U.S. Department of Energy's Office of Industrial Technologies, sponsors free energy audits for small to medium manufacturers. They are conducted by teams of engineering faculty and students from a number of universities throughout the U.S. serving as Industrial Assessment Centers. "At the end of 1994, the Industrial Assessment Centers had conducted more than 5,000 assessments and participating manufacturers had cumulatively saved \$517 million and 94 trillion BTUs of

⁹⁵ NCEID website: <http://www.usc.edu/schools/sppd/research/NCEID/index.html>

⁹⁶ NCEID website: <http://www.usc.edu/schools/sppd/research/NCEID/Projects.html>

energy.”⁹⁷ If a materials audit could be tied to a program such as this, it could efficiently provide a valuable service to companies while obtaining their participation in the larger exchange project.

Two possible methods of developing such a program are:

1. Continue to refine the survey developed for the DSNI study, with further advice from other communities with experience on the subject. Train community group members to perform the materials audits using the survey as a guide, and designate a database (such as the IMD/JERK) to store the data and find the matches. Apply for grants to help fund the process and future software development.
2. A common complaint among the more socially active planning students is that there is not enough linkage between universities, with all of their resources, and struggling local communities. DSNI, ACE, or another group could develop a joint program with students from local universities, who for class credit can perform audits among local businesses, and write case study reports on ways to improve efficiency or make IE links.

Both of these possibilities offer benefits. Using community members to perform the audits keeps the project tied to and “owned” by the community, and strengthens ties between the community groups and the local businesses. Also, community members may be able to obtain cooperation and information where graduate students with no connection to the community may not. However, using students helps develop the links between the universities and the community, and adds a level of professorial and academic oversight that can strengthen the technical aspects of the audits. Ideally, teams comprised of students and community members could perform the audits together, and the best of both worlds can be obtained. Once the capacity to perform such audits is assured, the idea should be brought to local business leaders through the NBA contacts that were established in step 1, and cultivated in step 2. From there, a database on local material flows can be built and steadily refined.

STEP 4: Begin building materials flow database; make contents web accessible

⁹⁷ *ibid.*

As was seen in Part 7, IE software can make a significant contribution in identifying exchange possibilities. While such possibilities can also be identified informally, through relationships between business owners, on a large scale (such as the regional one just mentioned), this becomes more complex. Having a database that can perform matching functions and be fed into Geographic Information System software can become a powerful tool for identifying relationships and assessing their feasibility. Springfield, Taunton, and other local communities have similarly found software to be an integral part of their endeavors.

The IMD could be modified to allow exchange searches. It's a good database for storing materials flows, is more user-friendly than the EPA software, and can be modified by anyone with moderate MS Access skills to suit the needs of a particular project. If the EPA ever gets money restored to update its software, simplify its interface, and render it more transparent, its software could also be a useful tool for communities doing this type of planning, or more intensive EIP planning. Of course, until then, there's always JERK.

It should be noted that the larger the number of businesses in the database, the more possibility for matches. This is why regional coalitions of businesses can be so valuable, as they increase the size and variety of the materials pool. An alternative (or perhaps complement) to such an institutional infrastructure is one already established and easily accessible: the Internet. The contents of the database could easily be published to the websites of the community groups involved, or perhaps fed into a more widely known site such as materialsexchange.com.

It is clear that the problems born from our industrial short-sightedness threaten the health of our environment and society. It is also the case that poor communities of color - such as Roxbury - often face a disproportionate burden from these problems. Nonetheless, signs of change are everywhere - from shifts in the state regulatory approach, to improvements in businesses' environmental practices, to an interest in IE by local community groups. Hopefully, by focusing on collaborative projects and utilizing the various benefits and tools available, communities like Roxbury will be able to lead the way in reforming our practices and moving us towards an ecologically sustainable future.

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Appendix

List of Acronyms

ACE	Alternatives for Community and Environment
C&D	Construction and Demolition
CCRED	Chelsea Center for Recycling and Economic Development
CDC	Community Development Corporation
DEP	(Massachusetts) Department of Environmental Protection
DSNI	Dudley Street Neighborhood Initiative
EIP	Eco-Industrial Park
EJ	Environmental Justice
EOEA	(Massachusetts) Executive Office of Environmental Affairs
EPA	Environmental Protection Agency
FaST	Facility Synergy Tool
IE	Industrial Ecology
IMD	Industrial Materials Database
JERK	Jesse's Ecoindustrial Resource Kiosk
MSW	Municipal Solid Waste
NBA	Newmarket Business Association
NCDC	Nuestra Comunidad Development Corporation
NEI	New Ecology, Inc.
RCRA	Resource Conservation and Recovery Act
SWMP	(DEP's) Solid Waste Master Plan
VEP	Virtual Eco-Park

Material flows for JERK exchange model

company name	outputs	inputs
<i>Blue Hill Industries</i>	acid, hydro acid, nitric oil, lube	oil, lube packing materials acid, hydro acid, nitric
<i>Boston Globe</i>	acid, acetic cardboard metals, silver pallets	cardboard oil, motor pallets acid, acetic metals, silver ink solvents
<i>Brewer's Ledge Inc.</i>	boxes cloth	boxes oil, lube
<i>Condor Press, Inc.</i>	ink rubber solvents	metals, aluminum metals, silver oil, motor pallets paper solvents wood
<i>Cutter, DJ, and Co.</i>	acid, hydro metal drums metals, aluminum metals, steel pallets	acid, hydro metal drums metals, aluminum metals, steel NaOH oil, lube pallets
<i>Dancing Deer Baking Company</i>	acid, acetic alcohol, ethyl buckets food waste metal drums oil, lube pallets	acid, acetic alcohol, ethyl buckets oil, lube pallets

<i>Dutchmaid Bakery</i>	alcohol, ethyl metal drums oil, lube	alcohol, ethyl oil, lube
<i>HIQ Computers</i>	boxes pallets paper	boxes paper pallets
<i>Labora Health Care</i>		
<i>Pollak Actuator Division</i>	pallets	pallets
	boxes acid, hydro acid, sulfuric NaOH oil, lube metal drums pallets	acid, hydro metal drums oil, lube metals, steel metals, aluminum packing materials acid, sulfuric pallets ink boxes NaOH
<i>Pure Golden Co.</i>	alcohol, ethyl buckets metal drums oil, lube	alcohol, ethyl buckets oil, lube
<i>Royal Label Company Inc.</i>	ink pallets rubber blankets	ink metals, aluminum oil, lube pallets paper paper, corrugated
<i>Servolift Eastern Corp.</i>		
	metals, steel	metals, steel
<i>Teradyne</i>	oil, motor packing materials pallets	oil, motor packing materials pallets
<i>Swiftly Auto Mall</i>	metals, steel oil, lube oil, motor rubber	absorbents oil, lube oil, motor solvents

JERK Company Input Screen

Jesse's Ecoindustrial Resource Kiosk

company

Condor Press, Inc.

SIC

sic code	
▶	2752
	2789

Record: [Left Arrow] [Right Arrow] 1

Inputs

material description
metals, aluminum
metals, silver
oil, motor
pallets
paper
solvents
wood
▶

Record: [Left Arrow] [Right Arrow] 8 [Next Arrow] [End Arrow]

Outputs

material type
▶ ink
rubber
solvents
*

Record: [Left Arrow] [Right Arrow] 1 [Next Arrow] [End Arrow]

JERK Matching Screen

Jesse's Ecoindustrial Resource Kiosk

Material

metal drums

Needs as input

	company name
▶	Cutter, DJ, and Co.
	Pollak Actuator Division
*	
[Large shaded area]	
Record:	◀◀ 1 ▶▶▶

Produces as byproduct

	company name
▶	Cutter, DJ, and Co.
	Dancing Deer Baking Compar
	Dutchmaid Bakery
	Pollak Actuator Division
	Pure Golden Co.
*	
[Large shaded area]	
Record:	◀◀ 1 ▶▶▶*

Survey Cover Letter

February 20, 2002

To Whom It May Concern:

Would you like to find ways to improve Roxbury and Dorchester's environment, strengthen local business relationships, and save money?

To examine potential cost and resource-saving partnerships that can be formed between local businesses, Dudley Street Neighborhood Initiative, along with New Ecology, Inc. and help from Tufts/MIT graduate students, is performing an "eco-industrial baseline" study of Roxbury. "Eco-industrial" development involves finding ways to make one industry's waste products another's raw materials, thereby diverting the waste from the landfill, saving virgin resources, and cutting costs for those involved.

This is done by conducting a survey of the material flows (inputs and outputs) of businesses in the area, followed by more detailed interviews. By forming a database of this information, we intend to begin identifying existing and possible future "materials exchange" links between businesses. Such a database will also allow other cost-saving possibilities - such as service exchanges or cooperative purchasing - to be examined as well.

Please complete the enclosed survey, filling out only what you feel comfortable about answering. Keep in mind that all data will be kept confidential unless you give explicit permission to share it with others. If you have any questions or comments at all, feel free to contact Trish Settles or Nicole Flynt at DSNI at 442-9670 or urbanvillage@dsni.org

Thanks so much for your time and assistance in helping improve the environment, economy, and neighborhoods of Roxbury and Dorchester!

Sincerely,

Dudley Street Neighborhood Initiative
in partnership with New Ecology, Incorporated

Section A – COMPANY INFORMATION

Name of Company:
(please also write on following pages) _____
Name of person
completing this survey: _____
Title: _____
Company Address: _____

Tel: _____ extension: _____
Fax: _____ E-mail: _____
Employees: _____ Website: _____
**4-digit NAICS Code(s): _____

Please provide a brief description of your company's primary business activity.

**** The NAICS number assigned to your company typically appears on tax documents, or can be found at <http://www.census.gov/epcd/www/naics.html>**

1. Would you be interested in participating in a materials exchange program?

yes no

2. Would you be interested in having a water and/or energy usage audit?

yes no

3. Do you consider waste disposal (excluding hazardous wastes) a major cost?

yes no

4. Where are your major customers located?

5. Where are your major suppliers located?

Section B –TRASH GENERATION

1. How much **trash** does your facility generate, on average, each month?
 Your response should **ONLY** address trash, not material destined for a recycling facility.
 (Either volume **or** weight generated is fine.)

_____ Volume (cubic yards/month) _____ Weight (tons/month)

2. Is the trash compacted before collection? _____ yes _____ no

3. What company provides your **trash** hauling service?

Name _____
 Phone: _____
 Address: _____

4. Please list what kinds of materials you dispose of:

Example:

Material	Amount Generated	Units	Comments
<i>Metal paint buckets</i>	<i>1100</i>	<i>buckets</i>	<i>Contain dried paint so we don't recycle</i>
<i>Plastic dropcloths</i>	<i>50%</i>	<i>%</i>	<i>Fill ~50% of 10 yd. dumpster once/month</i>
Material	Amount Generated	Units	Comments

Company Name: _____

Section C – RECYCLING

Please list any materials that you recycle:

Example:

Material	Amount Generated	Units	Comments
<i>Office Paper</i>	<i>50</i>	<i>%</i>	<i>estimate half of trash dumpster once/week</i>
<i>Cardboard</i>	<i>4.5</i>	<i>tons</i>	<i>20 cu. Yd. compactor approx. 2 X/mo.</i>
<i>Pallets</i>	<i>5</i>	<i>units</i>	<i>reused internally, then trashed (~ 5/mo.)</i>
Material	Amount Generated	Units	Comments

Please provide information for the hauler(s) providing the recycling service:

Name _____
Phone: _____
Address: _____
Material(s) Handled: _____

Name _____
Phone: _____
Address: _____
Material(s) Handled: _____

Section D - RESOURCE INPUTS

1. *What kinds of goods and services do you purchase?*

2. *What kinds of companies would be beneficial for yours if they located in your area?*

Please provide some detail on the materials that your business receives:

Example:

Material	Amount Generated	Units	Comments
<i>Paint</i>	<i>1100</i>	<i>gallons</i>	<i>One purchase/month. ~50% white paint</i>
<i>Lumber</i>	<i>4.5</i>	<i>tons</i>	<i>Particle board and 2x4's, used for construction</i>
<i>Pallets</i>	<i>15</i>	<i>units</i>	<i>Re-used internally until they wear down, then trashed and replaced (~ 15/mo.)</i>
Material	Amount Generated	Units	Comments

Thank you so much for completing this survey!