ECO-INDUSTRIAL DEVELOPMENT EXERCISE: NEW HAVEN Harbor

In this group exercise, you will be tasked with re-developing the New Haven, Connecticut Harbor region using the principles of industrial ecology and following the eco-industrial park model. We will take a field trip to the area, driving in vans through the neighborhoods surrounding New Haven Harbor, where you will view representative industrial sites in the community. You will be provided selected materials — flow information, which will allow you to begin to develop potential materials exchanges between a network of companies and municipal facilities, including the large power station, small auto shops, small metal fabrication facilities, the sewage treatment plant, local parks, and residential housing. You will also be able to suggest additional companies or facilities that would be well suited to locate in an eco-industrial development in the New Haven Harbor region.

NEW HAVEN HARBOR HISTORY

Around four hundred years ago, the area that is now New Haven was the home of a small tribe of Native Americans, the Quinnipiack, who built their villages around the harbor. On April 24, 1638, a company of five hundred English Puritans led by the Reverend John Davenport and Theophilus Eaton, a wealthy London merchant, sailed into the harbor. Pequot and Mohawk raiders from the surrounding areas were harassing the Quinnipiacks and other local tribes. The Quinnipiacks agreed to sell the tribe’s land to the Puritans in return for protection and the use of the lands on the east shore of the harbor (where today’s tour will end). New Haven’s founders not only hoped to create a Christian utopia, they also saw New Haven’s spacious harbor as an opportunity to establish a commercial empire that would control Long Island Sound and much of the New England coast. Over the next few years, however, the flow of newcomers to New Haven dwindled and trade with the outside world shifted more and more to Boston. In an attempt to establish direct trade with England, the settlers managed to assemble enough produce to fill a vessel that would become known as the “Great Shippe.” However, after setting sail in January 1646, the ship and its crew were never heard from again. This disaster ended the dream of creating an economic empire, as New Haven was rapidly overshadowed by New Amsterdam (New York City) and Boston.
By the time the Revolutionary War began, New Haven had evolved from a colonial village into a growing town of about 3,500 that would contribute men, financial support and arms to the revolutionary cause. Industry grew around the harbor and along the rivers that flowed into the harbor. Eli Whitney (a Yale graduate and inventor of interchangeable parts and the cotton gin) established the Whitney Arms Company along the Hamden border, which was eventually bought by the Winchester Arms Company. Winchester Arms Company became one of New Haven’s largest employers and helped establish New Haven as one of the major American arms manufacturing locations. Up until the 1950s, New Haven industries (many located in the harbor region) produced a wide range of products, including clocks, carriages, rubber goods, door locks, beer, pianos, plows, wagons, guns, and clothing. However, after the 1950s, new roads and the increasing availability of the automobile opened the floodgates on the middle class exodus to the suburbs. As suburban communities gave birth to industrial parks and shopping centers, New Haven’s economic condition became progressively worse, and industrial activity in the Harbor area steadily declined. As you will see during the tour, many of New Haven’s large industrial facilities have been replaced by a dispersed assortment of smaller manufacturing and service operations.

**SCHEDULE OF EVENTS**

12:15 - 12:45 PM: Travel and van tour from Bowers Hall to Wisvest New Haven Harbor Power Station (follow guide below for highlights of van tour).

12:45 - 1:15 PM: Lunch at Wisvest New Haven Harbor Power Station.

1:15 - 1:30 PM: Welcome and briefing on group exercise.

1:30 - 2:30 PM: Group meetings to devise an eco-industrial development plan for the New Haven Harbor industrial ecosystem. Roof access at Wisvest New Haven Harbor Power Station may be possible for a “bird’s eye view” of the local area, weather dependent.

2:30 - 3:00 PM: Report group findings and discuss answers to eco-industrial development questions.

3:00 - 3:15 PM: Board vans and return to hotel.

**SUMMARY OF ECO-INDUSTRIAL DEVELOPMENT EXERCISE**

There are three main steps to this afternoon’s eco-industrial development exercise. First, on the way to lunch from Yale, you will be given a driving tour of the New Haven Harbor region. Please try to go in the same van as the rest of your pre-assigned group. Second (after lunch), you will work with your group to devise an eco-industrial development plan for the New Haven Harbor region based on industrial ecology, industrial symbiosis, and eco-industrial park concepts. Third, your group will present and discuss your answers to the three central questions with the other groups.
STEP 1:
VAN AND AERIAL TOUR OF NEW HAVEN HARBOR AREA

All participants will take part in a field trip to the industrial, residential, and parkland portions of the New Haven Harbor region. Refer to the following “points of interest” description and the map as your guide to the van and aerial tour. Feel free to ask your van driver to point out interesting sites. The tour will end at the Wisvest New Haven Harbor Power Station, which will serve as a home base for the exercise.

Points of interest

- Tour begins on Chapel Street, heading towards the Harbor area. Use the map in Figure 2 as a reference.
- Just before the Mill River Bridge, look to the right-hand side to see the Suzio Cement Mixing Company, easily recognized by the tall green and white cement tower.
- While going over the Mill River Bridge, look up river to the left to see the Quinnipiac Oyster Company and their heaps of oyster shells along the shore. Look down river to the right to see one of the many metal scrap yards that are located on this section of the Harbor.
- Traveling along Chapel Street, be sure to notice the pipe, plumbing, and metal working shops along the way. Pay particular attention to the large ladder and scaffolding factory on the right.
- The tour takes a right onto Ferry Street to go over the Ferry Street Bridge and the Quinnipiac River. Observe the large boat and barge repair docks on the left at the end of the Ferry Street Bridge.
- The tour will wind its way down through a mixed industrial and residential zone of auto repair shops, plumbing shops, small metal fabricators, and some now-abandoned buildings of the New Haven Terminal. To follow on the map, the vans will loop through Fairmont Avenue, Fulton Street, Forbes Avenue, Wheeler Street, Goodwin Street, and back to Forbes Avenue. Try to find the plumbing supply shop on Forbes Avenue that is located in what appears to have been a church.
- The tour will turn onto Waterfront Street, traveling past the petroleum tank farms of Gulf, Sunoco, and Global Petroleum. The tour then winds along Alabama Street, back to Fulton Street down towards the New Haven municipal wastewater treatment plant. At the end of the road (the circular turn-around) you can see the parking lots and basketball courts of East Shore Park.
- The driving tour ends at the Wisvest New Haven Harbor Power Station. Upon entering the power station, observe the high voltage transformers, the supplemental natural gas pipeline, the fuel oil unloading dock, fuel storage tanks, and the large smokestack.
Weather permitting, the view from the roof of the Power Station shows the petroleum tank farms, cement plants, highways, and miscellaneous industrial facilities to the North; the municipal sewage treatment plant and East Shore Park to the South; the residential housing districts to the East; and New Haven Harbor to the West.

STEP 2:
DEVISE AN ECO-INDUSTRIAL DEVELOPMENT PLAN FOR THE NEW HAVEN HARBOR REGION

Each group will create an eco-industrial development plan for the Harbor area of New Haven by incorporating the basic ideas of industrial ecology, industrial symbiosis, and eco-industrial parks. Each group can use the following information describing the material flows of potential participants in the New Haven Harbor eco-industrial development plan. In addition, be sure to draw upon the personal knowledge and experience of your group in devising additional industrial symbiosis linkages. Each group should try to quantify linkages of industrial systems whenever possible. Each group should develop a network flow diagram and should explore the economic and social aspects of the symbiotic relationships.
Location Key
1 Electric Power Station
2 Municipal Sewage Plant
3 Petroleum Tank Farms
4 Concrete Mixing
5 Metal Scrap Recycling
6 Barge and Boat Repair
7 Residential Housing
8 Quinnipiac Oyster Co.
9 Automotive Repair Shops
10 Metal Fabrication
INDUSTRIAL FACILITY MATERIAL FLOW PROFILES

1. Electric Power Station

![Diagram of Electric Power Station]

- **Energy Requirements**: N/A (Energy producer)
- **Water Requirements**: 5.7 x 10^9 L/year seawater (cooling)
- **Material Inputs**: 3 x 10^9 L/year of #6 fuel oil
- **Products**: 450 MW peak capacity
- **Non-Product Outputs/Wastes**: CO₂ 1.9 million ton/year
- **Footprint/Physical Size**: ~70 acres

2. Municipal Sewage Plant

![Diagram of Municipal Sewage Plant]

- **Energy Requirements**: 20,000 LKwh per year
- **Water Requirements**: Process water from municipal water service
- **Material Inputs**: 1 x 10^9 L/year of sewage
- **Products**: 1 x 10^8 L/year of clean water
- **Non-Product Outputs/Wastes**: Dried biological material
- **Footprint/Physical Size**: ~10 acres
3. Petroleum Tank Farms

4. Concrete Mixing
5. Metal Scrap Recycling

ENERGY REQUIREMENTS
Electricity for facility operation
(Lighting, machinery)

WATER REQUIREMENTS
Limited facility water

MATERIAL INPUTS
Scrap steel
Scrap aluminum
Scrap copper
Solvents (cleaning)

Metal Scrap Recycling (Hypothetical)
Industrial Activity: Metal scrap storage and sorting
Footprint/Physical Size: ~1-10 acres

PRODUCTS
Sorted and certified scrap for reuse

NON-PRODUCT OUTPUTS/WASTES
Unrecoverable mixed metal scrap
Waste oil
Waste solvents

6. Barge and Boat Repair

ENERGY REQUIREMENTS
Electricity for facility operation
(Lighting, machinery)

WATER REQUIREMENTS
Municipal freshwater

MATERIAL INPUTS
Damaged barges and boats
Steel
Wood
Nonferrous metals
Paint & corrosion protection
Waterproofing chemicals
Solvents (cleaning)

Barge and Boat Repair (Hypothetical)
Industrial Activity: Repair of metal & wood vessels
Footprint/Physical Size: ~1.5 acres

PRODUCTS
Seaworthy barges and boats

NON-PRODUCT OUTPUTS/WASTES
Metal scrap
Waste oil
Waste solvents and paint
7. Residential Housing

![Diagram of Residential Housing]

- **Energy Requirements**: Electricity, Heat (boiler, furnace, etc.)
- **Water Requirements**: Municipal freshwater
- **Material Inputs**: Construction materials, Fuel, Durable goods and appliances, Solvents, paints, and household cleaning chemicals
- **Products**: Functioning households
- **Non-Product Outputs/Wastes**: Municipal sewage, Municipal solid waste, Waste oil, Waste solvents and paint

8. Quinnipiac Oyster Company

![Diagram of Quinnipiac Oyster Company]

- **Energy Requirements**: Electricity for facility operation (lighting, machinery), Fuel for boat operation
- **Water Requirements**: Nutrient rich, temperature and salinity sensitive saltwater, Municipal freshwater
- **Material Inputs**: Baby oyster “seedstock”, Old shell as oyster bed foundation
- **Products**: Full grown oysters
- **Non-Product Outputs/Wastes**: Waste oyster shells, Scrap nets (plastic or rope fiber), Waste oil, Waste solvents
9. Automotive Repair Shops

**Energy Requirements**
- Electricity for facility operation (lighting, machinery)

**Water Requirements**
- Municipal freshwater for facility operation

**Material Inputs**
- Damaged automobiles and trucks
- New and used parts
- Tires
- Oil, lubricants, solvents and paints

**Automotive Repair Shop (Hypothetical)**
- Industrial Activity: Auto and truck repairs
- Footprint/Physical Size: ~25,000 square feet

**Products**
- Repaired automobiles and trucks

**Non-Product Outputs/Wastes**
- Scrap ferrous metal (steel)
- Scrap non-ferrous metals (copper, aluminum)
- Scrap plastics
- Waste oil
- Waste solvents
- Old tires
- CFCs from air conditioning systems

10. Metal Fabrication - Ladder and Scaffold Example

**Energy Requirements**
- Electricity for facility operation (lighting, machinery)

**Water Requirements**
- Municipal freshwater for facility operation

**Material Inputs**
- Aluminum, steel, brass and copper
- Wood
- Plastic
- Oil, lubricants, solvents and paints

**Ladder and Scaffolding Shop (Hypothetical)**
- Industrial Activity: Metal and wood fabrication for ladders and scaffolds
- Footprint/Physical Size: ~1.5 acres

**Products**
- New aluminum, steel and wood ladders and scaffolds

**Non-Product Outputs/Wastes**
- Scrap ferrous metal (steel)
- Scrap non-ferrous metals (copper, brass, aluminum)
- Scrap plastics
- Scrap wood
- Waste oil, solvents and paints
STEP 3: EXPLORE, DISCUSS, AND PRESENT GROUP FINDINGS ON THE CENTRAL QUESTIONS
Each team will explore the central questions below and will compare their findings with the other groups. Choose a group spokesperson to present your ideas to the other groups.

Central Questions for Eco-industrial Development Groups

1. What is your group’s proposed near-term (5-10 year) eco-industrial development plan for the area? Specifically, what industrial symbiosis linkages are possible for the New Haven Harbor Industrial Zone? (A network flow diagram may be useful to clarify potential linkages).

2. What might you do differently in a long-term (20+ years) eco-industrial development plan for the area? (Feel free to think about extreme changes to the urban-industrial landscape).

3. What are potential companies that you would target to invite to the area to participate in the New Haven Harbor eco-industrial development in the near-term? In the long-term?