


Designing Industrial Ecosystems Tool (DIET)

A project under development
for the
Environmental Protection Agency's
Office of Policy, Planning, and Evaluation
Urban and Economic Development Division



What is DIET?

- ◆ DIET is an interactive computer software program
- ◆ Designed to aid decision makers and planners
- ◆ Screens sets of facilities for co-location at a real or virtual eco-park
- ◆ Includes an optimization model
- ◆ Explores trade-offs between multiple planning objectives



Planning Scenarios

- ◆ Co-location of a number of facilities at a given site
- ◆ Co-location of a number of facilities at several non-contiguous sites
- ◆ Existing facilities outside the park with new facilities within the park
- ◆ Virtual park linking facilities throughout a city or region

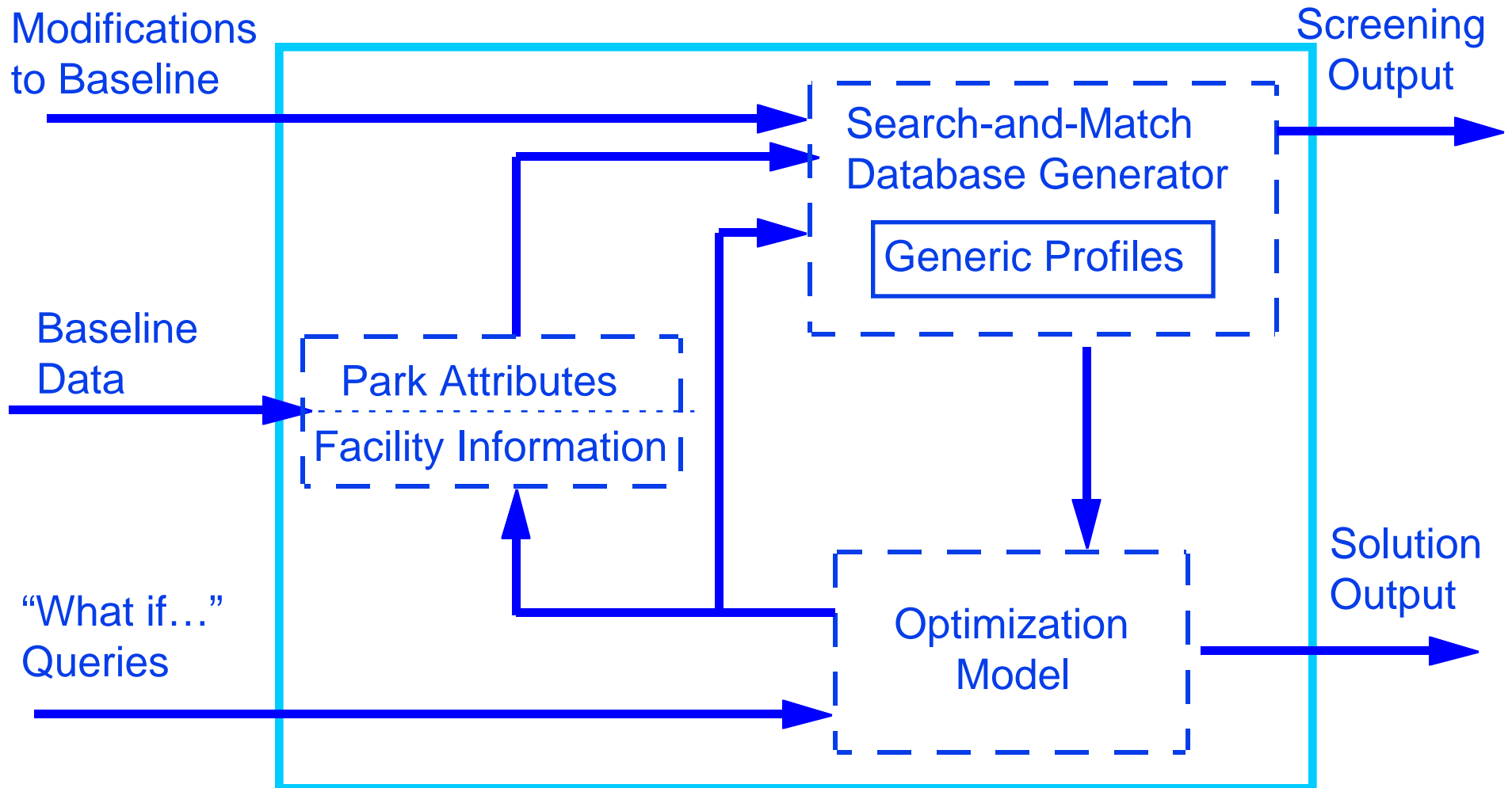


System Components of DIET

- ◆ **User Front-End for Data Input**
 - Collects initial set of input data and information
- ◆ **Search-and-Match Database Generator**
 - Identifies subset of industries that may work effectively at eco-park site
- ◆ **Linkage Program**
 - Translates search-and-match information into optimization model file format
- ◆ **Optimization Model**
 - Identifies optimal mix of facilities and activity levels based on planning objectives
 - Facilitates “What if...” analysis



Flow Diagram of DIET



Generic Profiles

◆ Current set of industrial profiles:

- paint manufacturer
- tire manufacturer
- metal finisher
- batch chemical plant
- cement industry
- electroplating industry
- paper manufacturer
- steel industry
- food processor
(ice cream)

◆ Data included:

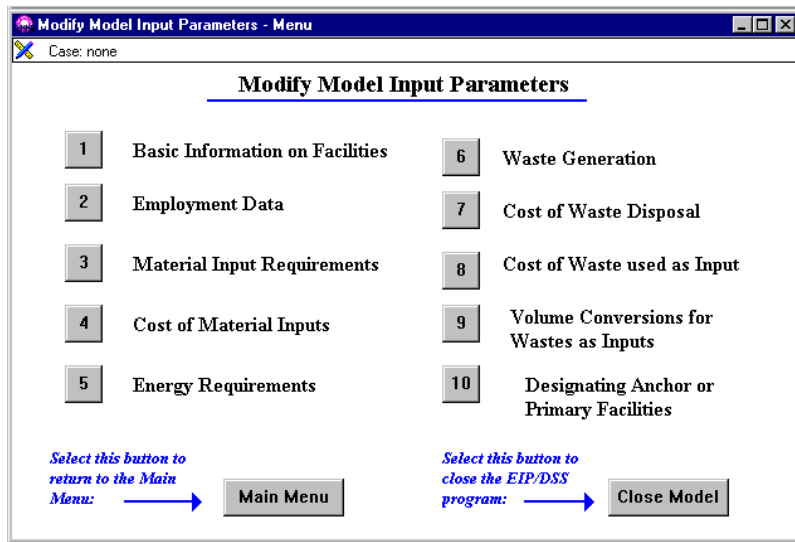
- material inputs
- revenue and production
- byproducts (wastes / releases)
- resources demands
- size of facility
- employment levels

◆ Profiles under development:

- municipal recycling facility
- waste water treatment facility



Input Data



- ◆ Attributes of the site(s)
- ◆ Facility information
 - employment levels
 - product/ revenue data
 - material input requirements
 - resource requirements
 - waste generation
- ◆ Anchor and specified primary facilities



Multiple Planning Objectives

◆ Environmental objectives include:

- maximizing waste re-used in waste exchanges
- minimizing waste generated
- minimizing net waste generated

◆ Economic objectives include:

- maximizing total revenue
- minimizing total costs
- maximizing net revenue

◆ Employment objectives include:

- maximizing number of jobs created
- targeting the mix of labor types

Modify Objective Function Weights

Case: none

Environment

wzMAXWSTUSE	1.00
wzMINWSTGEN	
wzMINNETGEN	

1 Overall weight on objective function M

Economy

wzREVENUE	
wzCOST	
wzNETREVENUE	1.00

0 Overall weight on objective function MAX

Employment

wzEMPLOYMENT	1.00
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1 Overall weight on objective function I

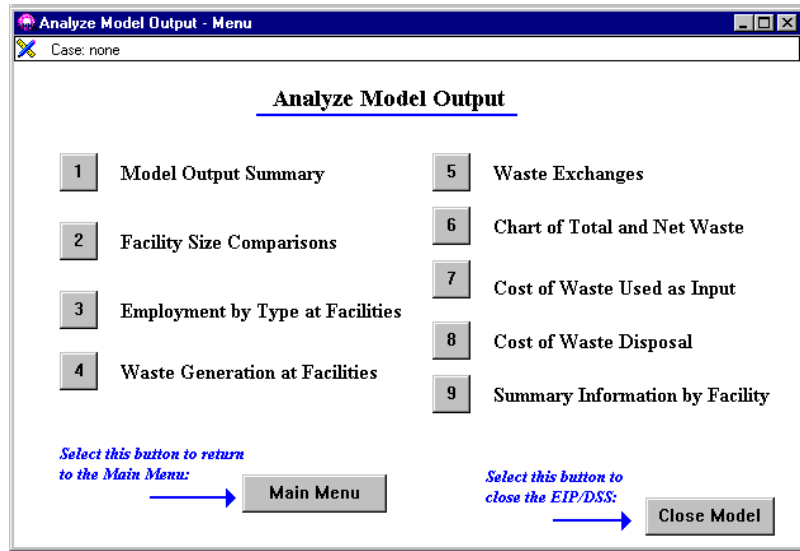
To set weights by waste type, select this button: ↓
Waste Type

To set weights by employment type, select this button: ↓
Employment Type

Select this button to return to the Output Menu: → Main Menu

Select this button to EXECUTE the model: → Execute Model

Solution Output

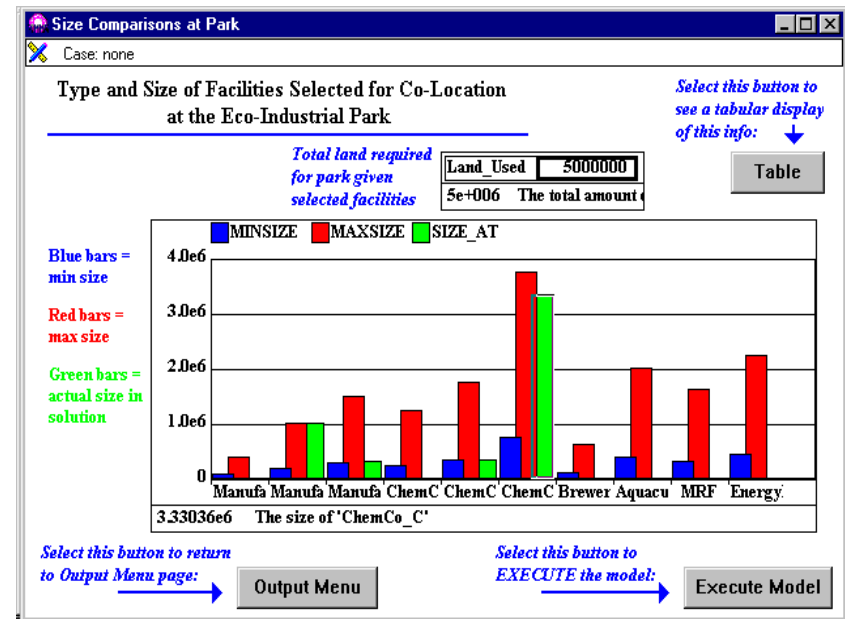


- ◆ Sets of facilities for co-location
- ◆ Activity levels of selected facilities
- ◆ Economic performance
- ◆ Employment levels
- ◆ Total and net waste generation
- ◆ Waste exchanges



Solution Output: Sets of Facilities / Activity Levels

- ◆ Which facilities for co- location
- ◆ Viable activity levels for facilities selected
- ◆ Footprint requirement for facilities selected



Solution Output: Economic Performance / Employment Levels

- ◆ Activity levels
- ◆ Facility size
- ◆ Expected revenue
- ◆ Employment levels
- ◆ Cost of using virgin materials as inputs
- ◆ Cost of reusing byproducts (wastes) as material inputs

The screenshot shows a software window titled "Individual Facility Summary Information" with a sub-header "Case: none". The main section is "Summary Information". It features two index boxes, both set to "Manufac_B". A "Waste Flows" button is on the right. Below the index boxes is a table with columns: ACTGEN, SIZE_AT, EMP_AT_FACILITY (Managerial, Skilled, Unskilled), and REV. The table shows data for "Manufac_B" with a revenue of 4.56e6. Below this is a "Waste Flows" table with columns: ACTREC, CST_IMPORT_FAC, CST_WST_FAC, IMPORT, and WASTEUSE. The table shows data for "Manufac_B" and three waste streams (ChemWste_1, ChemWste_2, ChemWste_3). At the bottom, there are "Output Menu" and "Execute Model" buttons.

Case: none

Summary Information

Select this button to investigate the flows of re-usable waste into and out of each facility: **Waste Flows**

Index box #1:

Click on the arrows in the index button to select the facility that you would like to display. Index box #1 controls the first display table. Index box #2 controls the bottom display table.

	ACTGEN	SIZE_AT	EMP_AT_FACILITY			REV
			Managerial	Skilled	Unskilled	
Manufac_B	25000	1000000	3	25	25	4.560000

4.56e6 The revenue at 'Manufac_B'

	ACTREC	CST_IMPORT_FAC	CST_WST_FAC	Manufac_B	
				IMPORT	WASTEUSE
Manufac_B	25000	39589	309810		
ChemWste_1				43988	125000
ChemWste_2					156012
ChemWste_3					175000

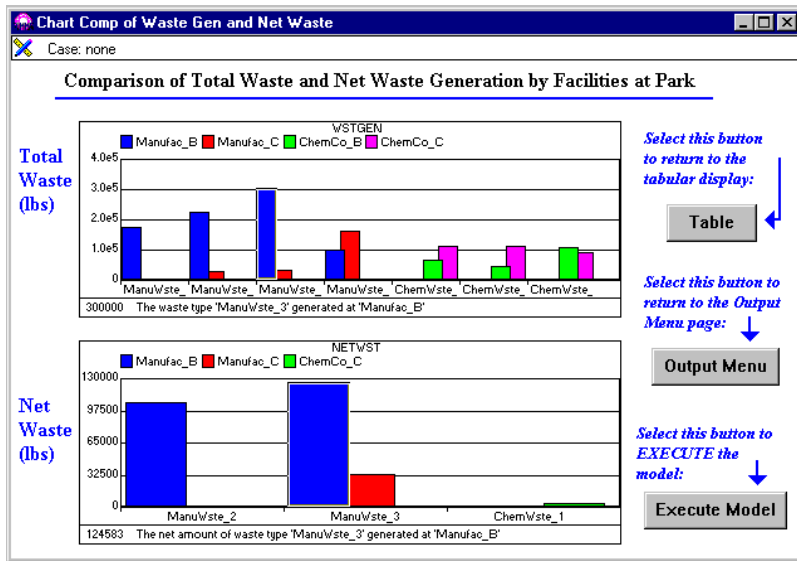
39589.3 The cost of all material inputs imported to 'Manufac_B'

Select this button to return to the Output Menu: **Output Menu**

Select this button to EXECUTE the model: **Execute Model**

Solution Output: Total and Net Waste Generation

Bar Charts...



Waste Generation Activity at Each Facility

	Manufac A		Manufac B		Manufac C		ChemCo A	
	WSTGEN	NETWST	WSTGEN	NETWST	WSTGEN	NETWST	WSTGEN	NETWST
ManuWste_1			175000					
ManuWste_2			225000	105625	26637	31964		
ManuWste_3			300000	124583				
ManuWste_4			100000		159821			
ChemWste_1								
ChemWste_2								
ChemWste_3								
Org_Waste								
MRF_1								
WasteHeat								

Tables...

Solution Output: Waste Exchanges

Individual Facilities...

Facility Waste Exchange Information
Case: none

Waste Exchange Information for Each Facility *Select this button to return to the Summary page:*

The first table shows output flows of re-usable waste at each facility.

Select this button to change the facility being displayed:

	WSTIN			
	ManuWste_1	ManuWste_2	ManuWste_3	ManuWste_4
Manufac_B				
ChemCo_B		9e3	2e4	6e4
ChemCo_C	2e5	1e5	2e5	4e4

8363.1 The amount of waste type 'ManuWste_2' from 'Manufac_B' used at 'ChemCo_C'

The second table shows input flows of re-usable waste at each facility.

Select this button to change the facility being displayed:

	WSTIN		
	ChemWste_1	ChemWste_2	ChemWste_3
Manufac_B			
ChemCo_B	7e4	5e4	1e5
ChemCo_C	6e4	1e5	7e4

6500 The amount of waste type 'ChemWste_1' from 'ChemCo_B' used at 'Manufac_B'

Waste Exchange at Park
Case: none

Waste Exchanges at the Eco-Industrial Park

	WSTIN					
	ManuWste_1	ManuWste_2	ManuWste_3	ManuWste_4	ChemWste_1	ChemWste_2
Manufac_B						
Manufac_C						
ChemCo_B		8363	20000		60000	
ChemCo_C	175000	111012	155417		40000	
Manufac_C						
Manufac_B		26637				
Manufac_C						
ChemCo_B					159821	
ChemCo_C						
Manufac_B	111012					

111012 The amount of waste type 'ManuWste_2' from 'Manufac_B' used at 'ChemCo_C'

Select this button to return to the Output Menu: **Output Menu** *Select this button to EXECUTE the model:* **Execute Model**

Entire Park....

Scenario Analysis

Exploring a wide range of scenarios, such as . . .

- ◆ What happens if one of the facilities you have identified for recruitment decides not to be involved in the eco-park?
- ◆ How does it change the make up of the park when your priorities or planning objectives shift?
- ◆ Which of the facilities are most crucial to the economic health of the eco-park?



Summary: Features of DIET

- ◆ Selects viable sets of facilities for co-location based on the underlying planning objectives
- ◆ Determines activity levels for the facilities selected
- ◆ Identifies potential waste exchanges among facilities
- ◆ Assesses environmental, economic, and employment benefits of locating at the park
- ◆ Facilitates “What if...” Analysis

