

1.

	1	2	Y	X
1	450	200	350	1000
2	100	600	1500	2200
V	450	1400		
X	1000	2200		

- Describe in words what the highlighted values in the table represent.

450 and 200 belongs to  $Z_{ij}$  which are the input to economic sector  $j$  from sector  $i$

1000 and 2200 belongs to  $X_j$  which are the output values for sector 1 and 2, respectively

1500 is final demand for the sector 2

- Generate the direct requirements matrix

According to the equation:

$$A = \frac{Z_{ij}}{X_j} = \begin{bmatrix} 0.45 & 0.09 \\ 0.10 & 0.27 \end{bmatrix} \quad \text{and} \quad [I + A] = \begin{bmatrix} 1.45 & 0.09 \\ 0.10 & 1.27 \end{bmatrix}$$

- Generate the total requirements matrix

$$[I - A]^{-1} = \begin{bmatrix} 1.86 & 0.23 \\ 0.25 & 1.40 \end{bmatrix}$$

- For a final demand of \$ 50 million in sector 1, find the direct and total requirements.

Then the direct requirements matrix:

$$[I + A] \times Y = \begin{bmatrix} 1.45 & 0.09 \\ 0.10 & 1.27 \end{bmatrix} \times \begin{bmatrix} 50 & 0 \\ 0 & 50 \end{bmatrix} = \begin{bmatrix} 72.5 & 4.5 \\ 5 & 63.5 \end{bmatrix}$$

meaning that a \$50 million demand from sector 1 requires \$72.5 billion in purchases from sector 1 and \$ 5 million in purchases from sector 2.

In the same way, calculate the total requirements matrix:

$$[I - A]^{-1} \times Y = \begin{bmatrix} 1.86 & 0.23 \\ 0.25 & 1.40 \end{bmatrix} \times \begin{bmatrix} 50 & 0 \\ 0 & 50 \end{bmatrix} = \begin{bmatrix} 93.0 & 11.5 \\ 12.7 & 70.1 \end{bmatrix}$$

2.

Reconsider the washing machine homework question from Chapter 3 using the 2002 EIO-LCA purchaser price model. Assume a 10-year lifetime of each machine without discounting. Ignore potential impacts from a disposal phase.

(Recall Chapter 3 : A household is considering purchasing a washing machine and has narrowed the choice to two alternatives. Machine 1 is a standard top-loading unit with a purchase cost of \$500. This machine uses 40 gallons of water and 2 kilowatt-hours of electricity per load (assuming an electric water heater). The household would do roughly 8 loads of laundry per week with this machine. Machine 2 is a front-loading unit; it costs \$1,000, but it can wash double the amount of clothes per load, and each load uses half the water and electricity. Assume that electricity costs 8 cents/kWh and water is \$2 per 1,000 gals.)

Make assumptions

I assume each year has 54 weeks, then 540 weeks in 10 years.

Machine 1 :

$$E = 8 \frac{\text{load}}{\text{week}} \times 540 \text{ weeks} \times 2 \frac{\text{kWh}}{\text{load}} = 31.1 \text{ MJ}$$

$$W = 8 \frac{\text{load}}{\text{week}} \times 540 \text{ weeks} \times 40 \frac{\text{gallons}}{\text{load}} = 172.8 \text{ kGal}$$

For Machine 2 :

$$E = 4 \frac{\text{load}}{\text{week}} \times 540 \text{ weeks} \times 1 \frac{\text{kWh}}{\text{load}} = 7.78 \text{ MJ}$$

$$W = 4 \frac{\text{load}}{\text{week}} \times 540 \text{ weeks} \times 20 \frac{\text{gallons}}{\text{load}} = 43.2 \text{ kGal}$$

- Use the \$500 and \$1,000 purchaser prices as inputs into the EIO-LCA *Household laundry equipment manufacturing* sector to estimate the total energy consumption and fossil CO<sub>2</sub> emissions to manufacture the two machines. Compare direct and indirect effects. What do the results using these inputs suggest?

Inputs	Total energy MJ	Fossil CO <sub>2</sub> Kg
\$ 500	9.3	510
\$ 1000	18.6	1020

- Use the assumptions about water use to estimate the use-phase energy and fossil CO<sub>2</sub> emissions via input to the *Water, sewage, and other systems* sector.

Water use	Total energy MJ	Fossil CO <sub>2</sub> Kg
172.8 kGal	153.8	2009
43.2 kGal	38.4	502

\* 20.9 kGal / 18.6 MJ / 1020 kg CO<sub>2</sub> from the website

- Use the assumptions about water use to estimate the use-phase energy and fossil CO<sub>2</sub> emissions via input to the *Power generation and supply* sector.

Water use	Total energy MJ	Fossil CO <sub>2</sub> Kg
172.8 kGal	76.4	6113
43.2 kGal	19.1	1528

\* 251 kGal / 111 MJ / 8880 kg CO<sub>2</sub> from the website

- Create a table summarizing the results above and find total ene

- Energy and fossil CO<sub>2</sub> emissions for the two machines. Determine the percent of energy and fossil CO<sub>2</sub>

Purchase

	Inputs	Total energy MJ	Fossil CO <sub>2</sub> Kg
Machine 1	\$ 500	9.3	510
Machine 2	\$ 1000	18.6	1020

Use (water, sewage)

	Water use	Total energy MJ	Fossil CO <sub>2</sub> Kg
Machine 1	172.8 kGal	153.8	2009
Machine 2	43.2 kGal	38.4	502

Use(power supply)

	Water use	Total energy MJ	Fossil CO <sub>2</sub> Kg
Machine 1	172.8 kGal	76.4	6113
Machine 2	43.2 kGal	19.1	1528

Use for itself

	Total energy MJ
Machine 1	31.1
Machine 2	7.8

Total

Machine 1	270.6	8632
Machine 2	83.9	3050

$$\text{Percent of Energy} = \frac{\text{Machine 2}}{\text{Machine 1}} = \frac{83.9}{270.6} = 27.5 \%$$

$$\text{Percent of CO}_2 = \frac{\text{Machine 2}}{\text{Machine 1}} = \frac{3050}{8632} = 35.3 \%$$

3.

Use EIOLCA model available at [www.eiolca.net](http://www.eiolca.net) (select 2002 producer price model) to calculate the total energy consumption and water withdrawals for 1 million dollars of final demand from each of the following sectors.

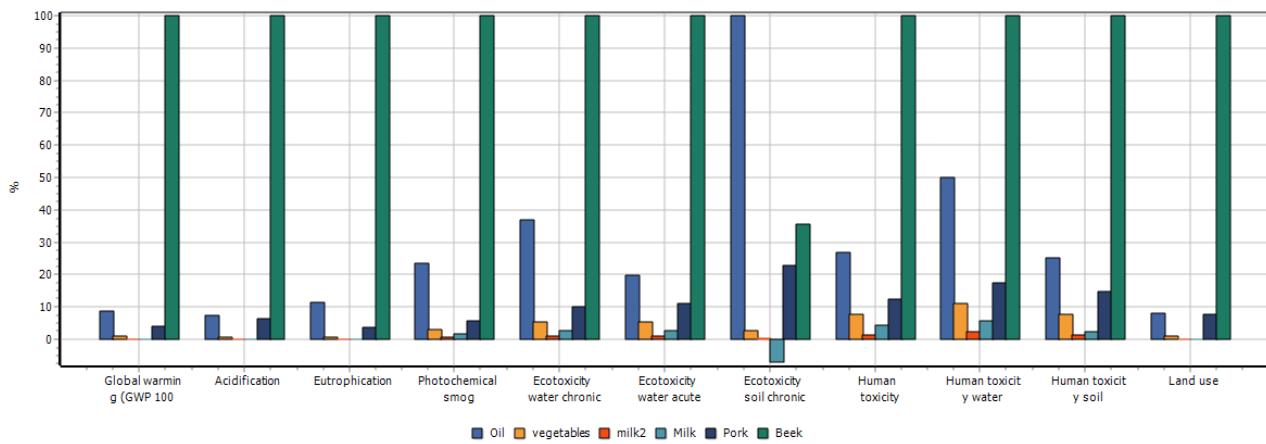
Sector	Total energy consumption TJ ( $10^{12} J$ )	Withdrawals kGal (3785 L)
Oilseed farming	16.1	75400
Cotton Farming	30.4	13900000
Petroleum Refineries	31.7	9410
Copper, Nickel, Lead, and Zinc	25.4	63600
Architectural and Engineering	2.7	2540
Management Consulting	1.96	2000
Insurance Carriers	1.07	1130
Nonresidential Manufacturing	6.23	3870
Breakfast Cereal Manufacturing	11.2	106000
Wineries	8.92	99600

resource: <http://www.eiolca.net/cgi-bin/dft/use.pl?searchTerms=oilseed&newmatrix=US430CIDOC2002>

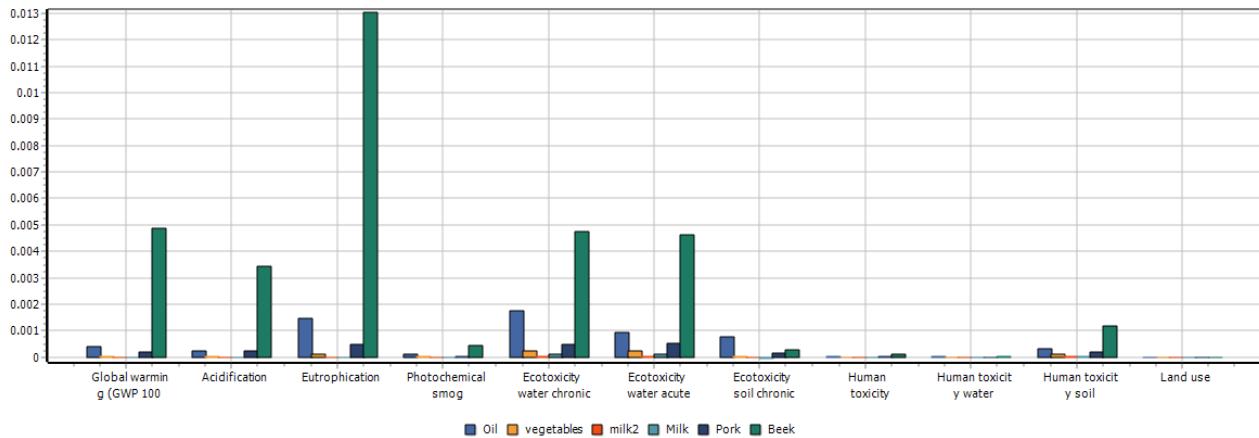
4.

Complete 1 Sima Pro Wizard. Show evidence that you completed it for example, one screen shots of final results.

Wizards Models Chosen: Food shopping for dinner



Characterization



Normalization

Food Recipe:

Beef Steak 1kg / week

Pork 0.5 kg / week

Milk 2 kg / week

Cheese 0.5 kg / week

Potatoes 1 kg / week

Oils 0.5 kg / week

