EIO/LCA METHOD TUTORIAL & STAKEHOLDER & POLICY ANALYSIS

Recitation 9

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ESD.00

LIFE CYCLE ASSESSMENT OF TRANSPORTATION SYSTEMS: GOAL & SCOPE

- Components considered in this analysis

	Rail	LCA Type	Aviation	LCA Type
Vehicle	Manufacturing Operation Maintenance ~~Insurance~~	Process Process Process & EIOLCA ~~EIOLCA~~	Manufacturing Operation Maintenance ~~Insurance~~	EIOLCA Process EIOLCA ~~EIOLCA~~
Infrastructure	Construction & Maintenance ~~Operation~~ ~~Insurance~~	Process & Hybrid ~~Process~~ ~~EIOLCA~~	Construction & Maintenance ~~Operation~~ ~~Insurance~~	EIOLCA & Hybrid ~~Process & EIOLCA~~ ~~EIOLCA~~
Fuel	Production	Process	Production	Process

Adapted from
Chester, "Life-cycle Environmental Inventory of Passenger Transportation Modes in the United States"

APPROACHES TO LCA: ECONOMIC I/O

- Economic Input-Output method.
  - Uses information about monetary transactions between sectors.
  - Most nations create economic input-output tables every so many years (e.g. U.S. models created every 5 years).
  - To combine LCA with EIO, traditional economic I/O models are appended with information on emissions.

Sample Input-Output Table

Industry Producing	Agriculture	Food & Beverages	Textiles	Apparel	Lumber & Wood	Furniture & Fixtures	Paper & Allied Products	Total Output
Agriculture	10.86	15.70	2.16	0.02	0.19		0.01	44.26
Food & beverages	2.38	5.75	0.06	0.01			0.03	40.30
Textiles	0.06		1.30	3.88		0.29	0.04	9.84
Apparel	0.04	0.20		1.96		0.01	0.02	13.32
Lumber & wood	0.15	0.10	0.02		1.00	0.39	0.27	6.00
Furniture & fixtures			0.01			0.01	0.01	2.89
Paper & allied products		0.52	0.08	0.02		0.02	2.60	7.90
Total Outlays	**44.26**	**40.30**	**9.84**	**13.32**	**6.00**	**2.89**	**7.90**	

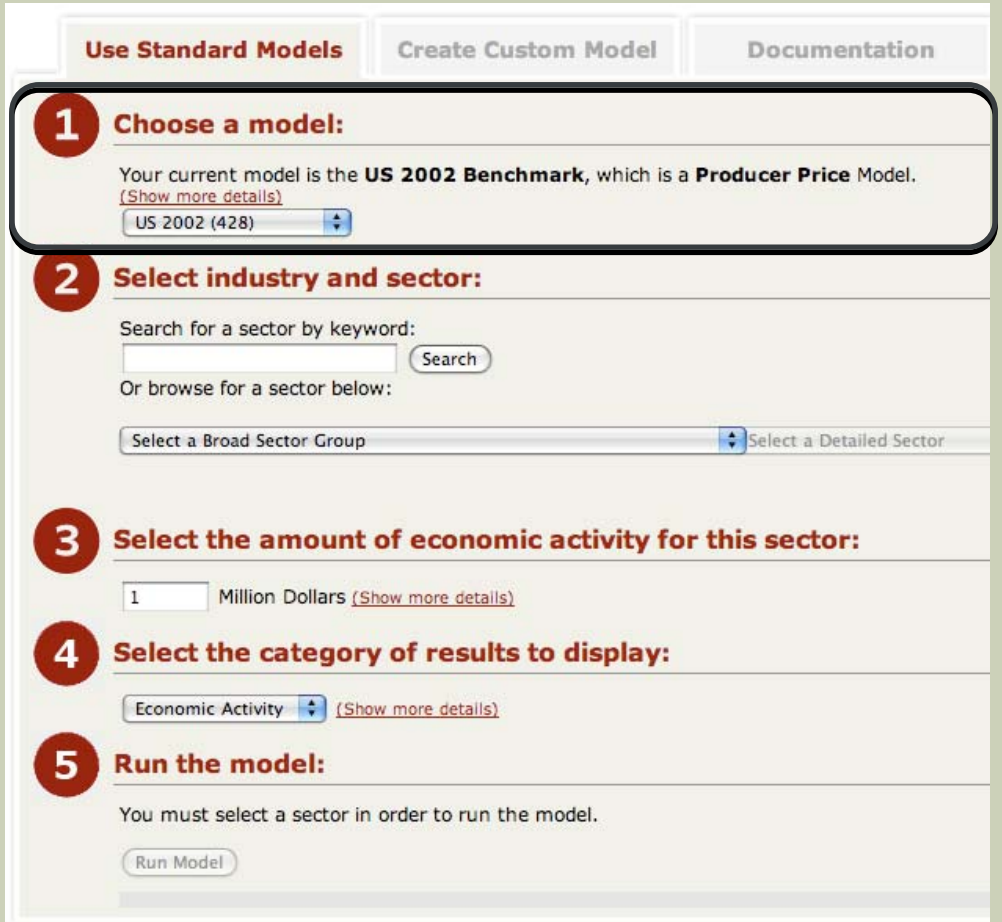
Figures in billions of U.S. dollars

Adapted from eiolca.net, Green Design Institute

EIOLCA: AIRCRAFT MANUFACTURING EXAMPLE

- Step 1:

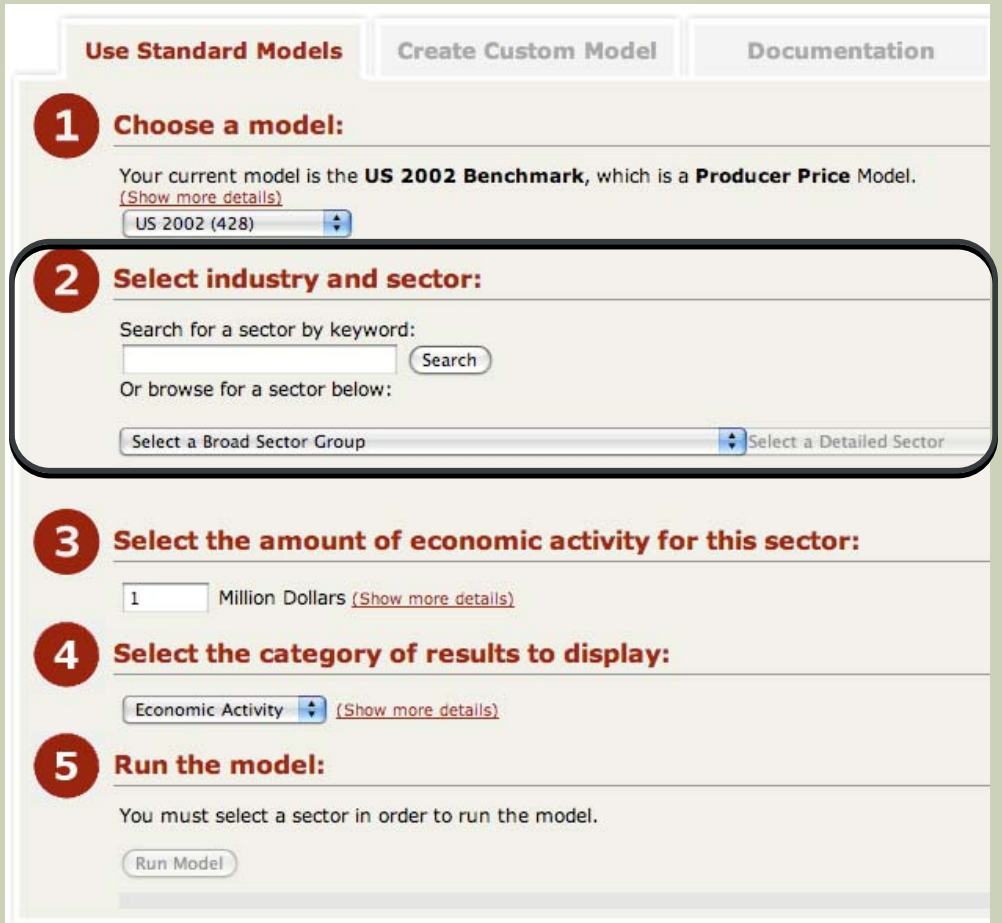
  Choose a Model
  - Models available for 1992, 1997, 2002.
  - 2002 is a Producer Price model ("cradle to gate") – does not include distribution costs to consumer.
  - Important to use the same model to compare HSR and aviation.
  - Suggested model: 2002.



Adapted from eiolca.net, Green Design Institute

EIOLCA: AIRCRAFT MANUFACTURING EXAMPLE

- Step 2: Select Industry & Sector
  - The model divides the economy into 428 divisions grouping businesses that produce similar goods or services, or that use similar processes.
  - Can either search for a sector by keyword.
  - In this case, select “Aircraft manufacturing” (note that this only includes the aircraft frame – we’ll look at engines separately).



Adapted from eiolca.net, Green Design Institute

EIOLCA: AIRCRAFT MANUFACTURING EXAMPLE

- Intermediate Step: Determine Costs
  - For Step 3, you must have an estimate of costs for the components or processes of interest.
  - The *commercial* price of an average Boeing 737-700 is $67.9 million.[1] (see link below for data on the full 737 family).
  - We will deduct the engine price, and assume a 10% markup.

Description	Amount
Boeing 737-700 (commercial price)	$67.9 M
CFMI CFM56-7 Engine (per engine)[2]	$6 M
Boeing 737-700 minus Twin Engines	$55.9 M
Boeing 737-700 minus 10% markup = ($55.9 M/1.1)	$50.8 M

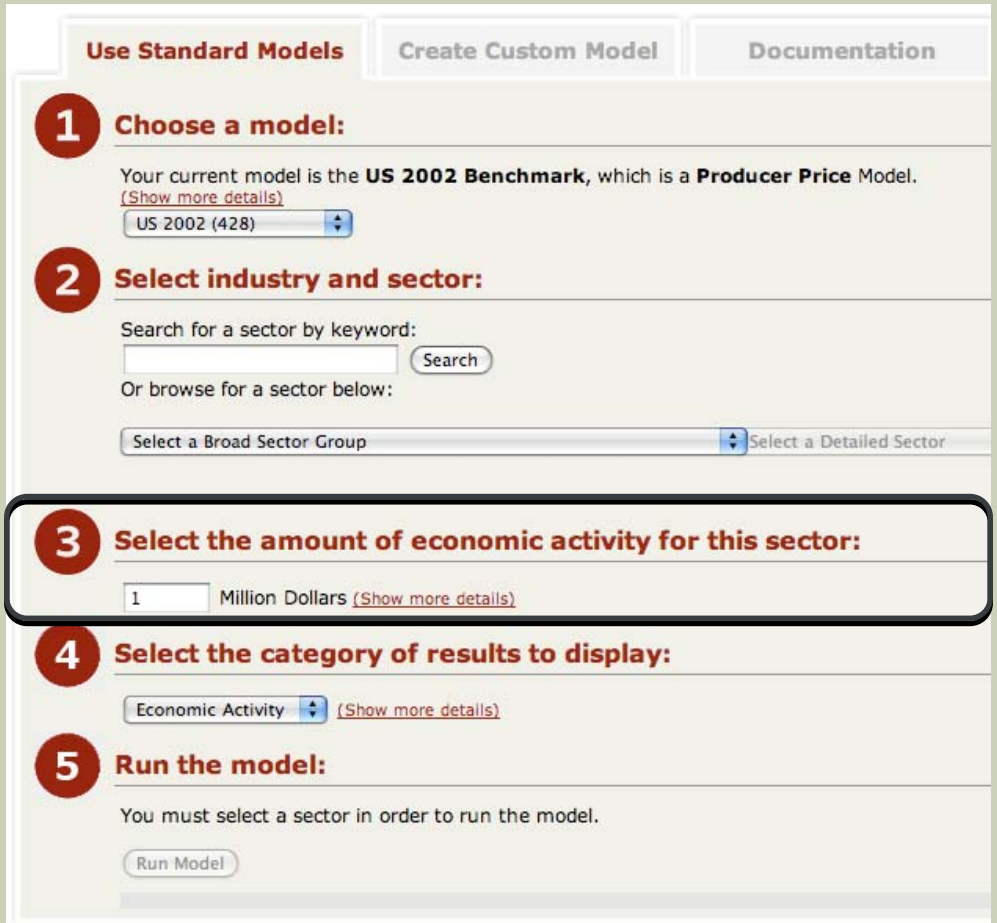
Adapted from eiolca.net, Green Design Institute

1: http://www.boeing.com/commercial/prices/

2: http://www.cfm56.com/press/news/cfm+logs+$600+million+cfm56-7b+engine+orders/129

EIOLCA: AIRCRAFT MANUFACTURING EXAMPLE

- Step 3: Enter the Amount of Economic Activity
  - We computed the level of economic activity associated with the production of one (1) aircraft frame on the previous slide.
  - Enter $50.8 M for this example.



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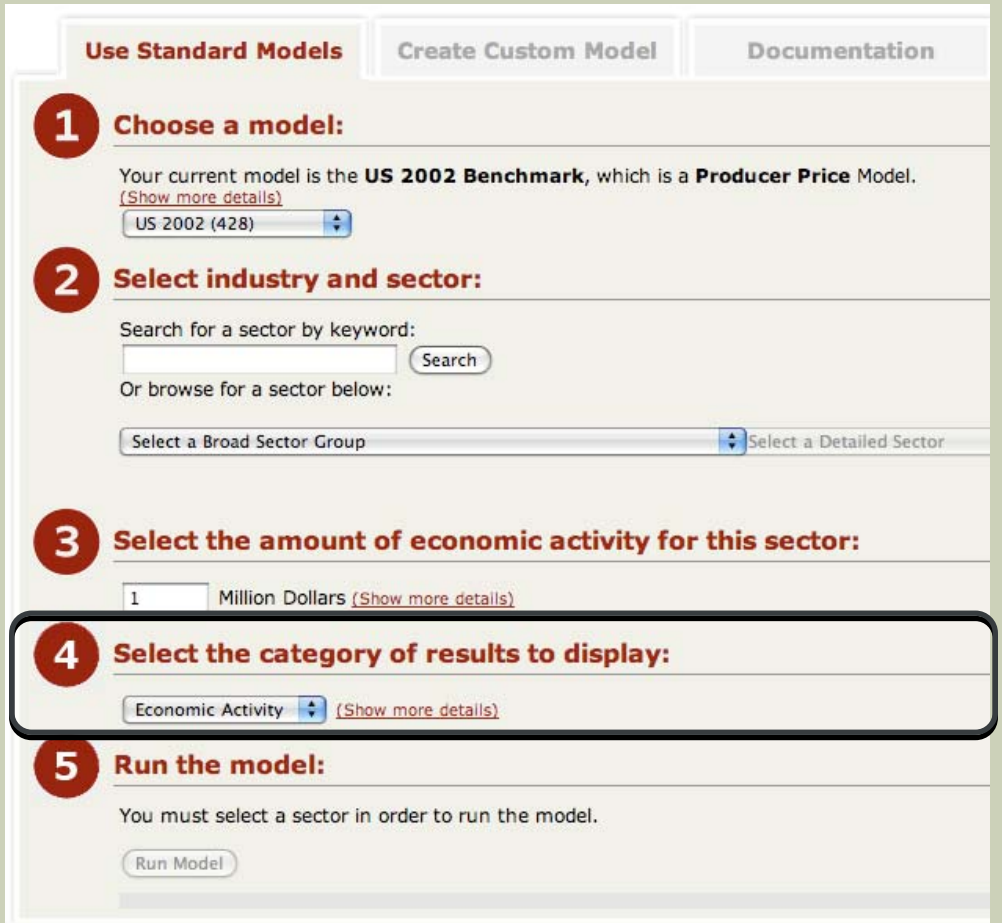
EIOLCA: AIRCRAFT MANUFACTURING EXAMPLE

- Step 4: Select Category of Results
  - Select the type of result to display (e.g. Greenhouse gas emissions, Energy).
  - Select "Energy" for this example.



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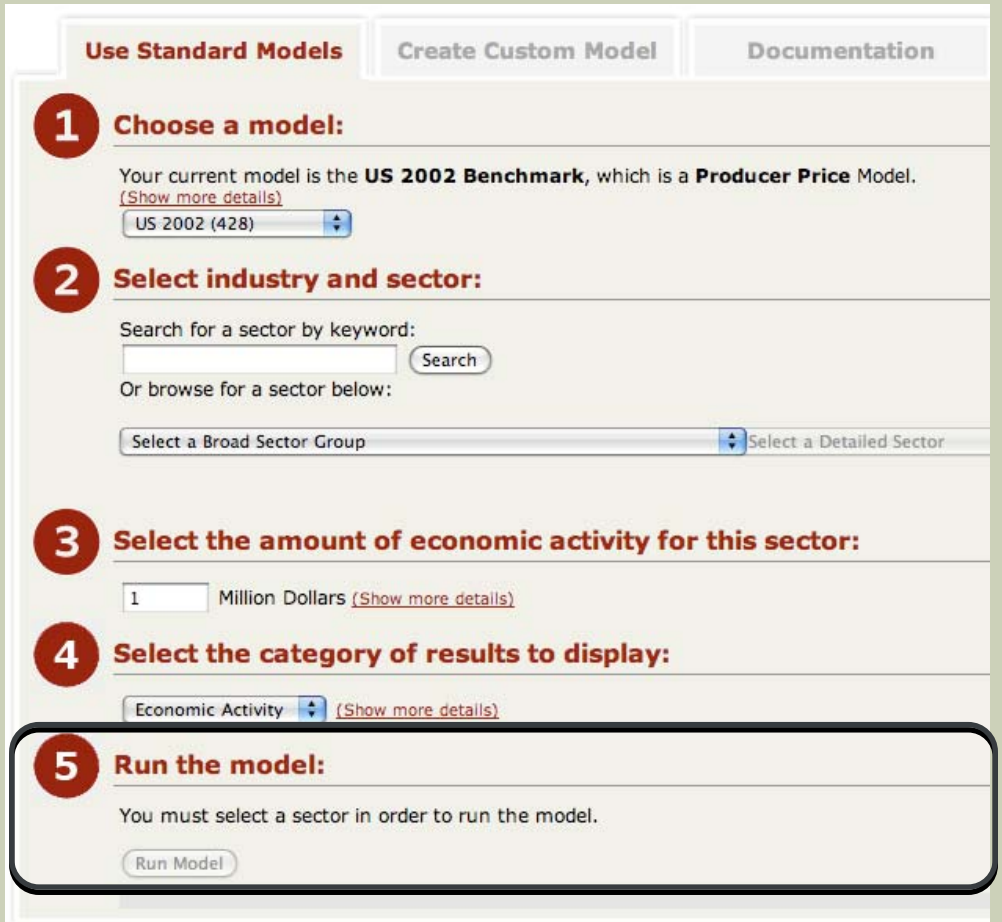
EIOLCA: AIRCRAFT MANUFACTURING EXAMPLE

- Step 5:

  Run the Model
  - Click “Run Model”.
  - Results should provide you with amount of energy (in terajoules) to manufacture one (1) aircraft.
  - You’ll then use this figure to determine the amount of energy required over the aircraft’s lifetime.



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STAKEHOLDERS

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- In the case of high-speed rail and aviation infrastructure investment, who are the stakeholders?
  - Citizens where high-speed rail and aviation services are being considered.
  - Citizens whose home/land may be affected by transportation expansion.
  - Environmental groups.
  - The airline and high-speed rail industries.

POLICY IMPLICATIONS

- Historical and current status of high-speed rail in the U.S.
  - Historically, limited support for passenger rail investment in the U.S.
  - A new president who strongly support HSR investment.
  - An issue that has become highly politicized.

- Potential policy implications of this analysis:
  - Help to make the environmental impacts of aviation and high-speed rail more *transparent* – to support decision-making.
  - If we find that high-speed rail is *not* as environmentally-friendly as compared with aviation, what are the implications?

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