

***BOOK PROPOSAL***

\*THIS WILL BE AN (SELECT ONE) AUTHORED \_X\_\_\_**/** EDITED \_\_\_\_ WORK.

\*WORKING TITLE OF YOUR BOOK: The metabolic economy

\*NAME OF SERIES (if applicable):

> SpringerBriefs in Energy: Energy Analysis

>

\*SUBTITLE:

> A model for material and energy flows

>

\*ESTIMATED NUMBER OF DOUBLE-SPACED (TEXT-ONLY) MANUSCRIPT PAGES:

> We are using the LaTeX template. We estimate 100-120 single-spaced pages in total with figures

\*ESTIMATED NUMBER OF FIGURES: Less than 30-35

How many of these figures do you estimate will be essential to reproduce in color? (This question refers to the printed book. All figures can be in color in the online e-book).

Probably most in color

>

\*TEXT CAPTURE (please check off the procedure you prefer):

\_ X You will deliver a \_\_ TEX or \_X\_ LATEX file according to the Springer macro packages (including a printout for reference) but we will make the page setup and the reproduction of figures.

\_ You will deliver something else: type written manuscript or manuscript written with a different textprocessor and separate figures for reproduction. We will typeset the manuscript or convert your data (if possible) and make a complete page setup.

\*WHEN DO YOU PLAN TO SUBMIT YOUR FINAL MANUSCRIPT (MONTH/YEAR)?

We are aiming at 1 February 2014

>

\*LANGUAGE

* X American English \_\_ British English

X\_\_ Excellent \_\_ Fair \_\_ Poor

\*TABLE OF CONTENTS (preliminary):

Note: please ignore page numbering

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\*MARKETING AUDIENCE:

- What disciplines - in order of importance - are addressed by your book?

1. Ecological Economics

2. Economics

3. Industrial Ecology

4. Net Energy Analysis

- Who will buy your book (please number in order of importance)?

Libraries in

1 \* universities

2 \* research institutes

4 \* government

5 \* industry

3 \* other

Individuals in

........1............\* scientific research

2 \* university teaching

7 \* industry

5 \* other applications

3 \* graduate students

4 \* undergraduate students

6 \* other

\*SUBJECT MATTER:

Please write a short description of your book of approx. 200-250 words, This paragraph, together with the main selling points below, should be carefully prepared to be suitable for back cover and/or promotional text for your book. In your paragraph, please incorporate answers to the following questions:

- What is the subject of your book?

- What methods, results, or topics will be of particular interest to readers, and why?

- What special features does your book contain (illustrations, tables, new form of presentation, didactic approach, etc.)?

- What main benefit will the reader derive from your book?

>

> Previous frameworks for both economic and energy input-output modeling have made the assumption that flows into and out of each economic sector balance, meaning there is no accumulation of economic factors—resources, labor, capital—or embodied energy within any of the sectors. This may be an adequate assumption for a sector of the economy operating at `steady-state'. However the assumption introduces errors in energy intensity estimates (e.g., kilojoules required per dollar of economic output) in analysis of sectors that are growing rapidly, or any sector that has a non-negligible proportion of input factors accumulated as capital within the sector.

Development of manufacturing facilities for new goods during a technological transition (e.g. rapid transition to electric vehicles) requires a high rate of capital investment and associated increase of materials and embodied energy within the manufacturing sector itself (as opposed to the products of the manufacturing sector). The previous I-O framework does not account for capital investment and associated embodied energy when estimating the energy and resource intensity of the production goods. Nor does the previous I-O framework account for the energy flow rates required during transitions. Thus, the previous I-O framework cannot correctly predict or evaluate the energy requirements of the production ramp-up.

An illustrative example that runs through the book is the US auto industry. The auto industry was selected for illustration purposes, because it appeared in the earlier work by Bullard and Herendeen, and it has significant capital stock in the form of buildings, factories, and capital equipment needed to produce automobiles. Furthermore, the auto industry will be important in any energy transitions, because transportation consumes a high proportion of liquid fuels in the world today. Transitions from liquid fossil fuels to renewable fuels will require significant capital investment in manufacturing facilities and technology. This book does not provide a detailed examination of the auto industry. Rather, the auto industry illustrates the methods developed in the book with quantitative data and points the way toward using existing data to estimate important parameters (e.g. energy intensity) in the models.

Traditional input-output methods also suffer from linearity, meaning that the millionth unit of production will have the same structural costs as the first. Such assumptions make it difficult to model regimes that are significantly different from those of today. Looking to the future, we realize that an energy transition is underway that will significantly alter the structure of the economy. The traditional I-O framework assumes no change in economic structure, i.e. no accumulation or depreciation of capital or technological change/advances. You cannot understand a transition that you assume will not happen.

This paper presents an extension to the traditional input-output framework in which accumulation is incorporated explicitly using a dynamic (transient) analysis method. Implications for input-output-based methods for net energy analysis are also considered. The new approach should assist in developing better explanatory models of the structure of economies and the physical factors, particularly energy and materials flows, that are required for economic growth. This improved understanding of "economic metabolism" should then promote superior prescriptive formulations as we enter a new regime of adjusting to a world of finite resources. Additionally, new insight is given into macro-economics, including an alternative metric for social development.

If your book is a new edition, how does it differ from the previous one(s)? Please be as detailed as possible.

N/A

If your book is a textbook, please list pedagogical features (e.g., worked-out examples, end-of- chapter summaries and problem sets, glossary of key terms, etc.) as well as specific course titles that would apply. Please estimate the number of students taking these courses annually in the US and worldwide.

>

> N/A

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\* MAIN SELLING POINTS:

In four to five bulleted entries not taken verbatim from the subject matter description above, please describe the key features of your book.

>

> 1. Proposes a new (improved) methodology for input-output modeling, which is the current basis of national accounting used by the U.S. Bureau of Economic Analysis (BEA).

> 2. Provides a concrete linkage between energy input-output modeling and BEA national accounting.

> 3. Develops an input-output methodology that is totally consistent with 1st and 2nd Laws of Thermodynamics.

> 4. Uses input-output flows of material and energy and capital accumulation within the US automobile industry to illustrate the new methodology.

>

\* COMPETITIVE LITERATURE:

What other works have been published on this subject (please give author,title, publisher, year of publication)

> Works on energy and material input-output method:

>

* Proposed SpringerBrief by Christian Kerschner

“There is very little overlap, if any at all, with my own work. What’s innovative about my work is the interpretation and application of already existing IO models (constrained, price and forward linkages) plus the inclusion of social network analysis (which has not been done before). So in my work it’s the application to different cases (not only the US) of known approaches, or to put it bluntly there is no new equation in our work - only a detailed review of the existing models within IO and then application of the ones we found most useful and telling plus an interpretation of the results. The goal of my work is to find out which economic sectors would be the hardest hit with peak oil / are most vulnerable to it. This is of paramount importance if you are forced into entering an adaptation process.” from Christian’s email July 22nd

* Bullard et al. (1978) Net energy analysis: method for combining process and input-output analysis, Resources and Energy

This analysis gives a static treatment (no accumulation or depreciation of capital, see comments above). Ours is dynamic.

* Hendrickson et al. (2006) Environmental life cycle assessment of goods and services: an input-output approach, RFF Press

This analysis gives a static treatment (no accumulation or depreciation of capital, see comments above). Ours is dynamic.

* Suh (eds.) (2009) Handbook of input-output analysis economics in industrial ecology

This analysis gives a static treatment (no accumulation or depreciation of capital, see comments above). Ours is dynamic.

How does your book differ or improve upon them?

>

As discussed previously, our book extends the I-O techniques found in the literature by We explicitly incorporate first-principles of Thermodynamics to derive I-O accounting equations that allow accumulation and depreciation of embodied energy in sectors of the economy.  This enhancement to the I-O methodology is necessary to address questions of economic development and energy transitions. To our knowledge, this is the first appearance in the literature of a systematic, detailed, and mathematically rigorous derivation of embodied energy accounting equations based upon the laws of thermodynamics.

>

\* KEYWORDS/TERMS FOR CATALOG INDEX AND GOOGLE SEARCH (min. 5)

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> industrial ecology, net energy analysis, material flow analysis, life cycle assessment

> ecological economics, biophysical economics, eco-thermodynamics, bio-economics

> input-output analysis, macro-economics, national accounting,

> economic growth,

\* OTHER COMMENTS OR SUGGESTIONS FOR PROMOTIONAL ACTIVITIES:

1. Congresses (place/date)

> International society for ecological economics conference (ISEE) 2014, TBD

> US society for ecological economics (USSEE) conference, 2015, TBD

> Others?

2. Journals for reviews

> Ecological economics, Industrial ecology, life cycle assessment

> Energy Economics

>

3. Professional societies

> ISEE, USSEE, International society for industrial ecology, American center for LCA

> Association for Advancement Sustainability in Higher Education (AASHE)

4. Comments

>

>

Date: Completed by:

> 10/08/2013 > Michael Dale, Matt Heun, Becky Haney