Heun Review of old Chapter 2 now 3

P. 22 In Chapter 1, we put forward the idea that economies are like organisms, using energy derived from outside the system to construct, maintain and grow the system itself. This chapter…

Changed text to “we put forward the idea that economies are like organisms, using energy and material resources derived from the natural environment for their construction, maintenance and growth.”

Building, as we introduced in chapter one and use in other chapters, from a one-sector economy up to examples of both two- and three-sector economies.

Example in Chapter 2 is actually a two-sector model (production and consumption). Text has not been altered, though I’m open to other suggestions.

??add at end of first para in 2.1 “..throughout this book.” On a more philosophical front, a biophysical theory is desirable because it starts from an energetics basis and unites economics with the natural sciences.

This is a good sentiment, though I’m not sure it belongs here, where we are discussing a specific methodology. I believe it would be more appropriate in the Introduction. Will discuss with other authors. Discussed – added to introduction, where we discuss biophysical economics (Section 1.2)

2.11

and the time derivative d/dt , or the dot over a)

This is not accurate. The time derivative (da/dt) and the dot notation () refer to different concepts. The dot notation () represents a flow of material (in this case apples). The time derivative (da/dt) represents the change in the value of the stock of apples.

as waste (in the apple core or garbage)

I’m not sure why this is an either or. I have changed to “as waste (in the apple core in the garbage)”

where are green lines in figure 2.1 OR ITS LEGEND??? Maybe black lines??? No that is capital goods.

Maybe you need to say that energy is not represented but accompanies all flows or something??

Good point. The legend is universal for all diagrams, but that may be somewhat confusing. Have added the following to the caption. “Energy flows are associated with all flows of materials, but are not drawn explicitly in this diagram. Flows of energy will be depicted in diagrams in later chapters.”

After discussion – change legend to only flows shown in diagram

What us stored in birdcage symbol? Explain in legend OK iguess in next paragraph. Green ine is confusing in legend)

Figure caption describes storage of capital within storage tank, “Only capital stock (K ̇ ) may accumulate within the sector, depicted by the storage tank.” We have also added ‘K’ to the ‘birdcage’.

P 26 the resource inflow (crude oil) is literally embodied<< no,except for processing energy, it is contained in the chemical bonds …. within the out-flowing

Likewise as coal – it is indeed embodied in electricity but not contained --embodied means used in past to build, as Marx’s embodied labor in a chair

I think this is a semantic argument. I would argue that ‘literally embodied’ means that the physical stuff that makes up one thing is contained within another. I would argue that the ‘embodiment’ that Marx speaks of is metaphorical. I would also argue this about the use of ‘embodied energy’. The energy is not *literally embodied* within the product.

That said, we may be fighting an uphill battle here, so could switch a different, less loaded term.

P 27 the resource inflow (crude oil) is literally embodied CONTAINED within the out-flowing IT IS EMBODIED

Changed as stated

since the coal is not physically contained [NO >> embodied] in the electricity and leaves the economy (in the form of carbon dioxide

Text changed to “Similarly, the coal or natural gas flowing into a power plant is accounted as an flow, because the incoming chemical elements (carbon and hydrogen) *do not* depart the plant contained within the product, but leave the economy in the form of carbon dioxide.”

and ash) as part of flow S˙ 10. Some of the coal is destined for metallurgical processes

because the carbon in the coal ends up physically [NO ….Yes>>] embodied within the steel in flow ˙P1

Changed ‘embodied’ to ‘contained’

\*\*\*\*\*\*\*\*2.26 I Like this kind of explanation of final equations as you do here: GOOD!!!! Do more of???

Thanks

“ Equation 2.26 tells us that depletion of natural resources

\_

􀀀

dR0

dt

\_

are used within society in order to:

\_ build up societal capital stock

\_ dK1

dt

\_

,

\_ provide short-lived goods and energy to run society (S˙ 11), and

\_ overcome depreciation (K1K1). “

p. 32 I assume you got all your math/subscripts right

I hope so. We’ll double-check all of the math when we do the re-write.

Fig 2.4 As I have said before I like the energy symbol to the left most, but probably too late for that…;

\*\*\*\*

This was done (goods and services on left) because an earlier draft had the two sector model with just energy sector split out of rest of society and then three sector model added in goods and services. To change would take a significant amount of time, as it would require updating all of the arrow notations for all chapters.

Is there a compelling reason why energy is better on the left?

\*\*\*\*

2.5 Materials in the US auto industry

“ Throughout the book, we shall be applying the methodology that has been outlined

through the examples to the real-world case of the US auto industry.” AGAIN PLEASE MAKE THE CASE, (IF TRUE THAT YOU ARE USING THE AUTO INDUSTRY FOR AN EXAMPLE BECAUSE YOU HAVE THE (approximate) DATA FOR IT. DO YOU? DO YOU HAVE I-O DATA WHY DO YOU HAVE THE DATA FOR THAT INDUSTRY? IF NOT WHY DO YOU USE THIS INDUSTRY?

I GUES S YOU TRY TO ANSWER THAT QUESTION IN THE NEXT FEW PARAGRAPHS BUT IT SEEMS TO ME THAT YOU DANCE AROUND IT – CAN YOU/DID YOU DERIVE THEM ATERIAL FLOWS FROM MONETARY FLOWS OR NOT? WHAT DID YOU DO WITH THE EUROPEAN DATA? Or ARE YOU TALKING BOUT WHAT MIGHT BE DONE. VERY FRUSTRATING.

\*\*\*\*

We don’t have special data for the US auto industry. In fact, in terms of materials (i.e. Chapter 3), the data does not exist. It would be a serious data collection effort to obtain it. The data for energy (Chapter 4) exists via EIA survey of manufacturing. The embodied energy data (Chapter 5) exist via old EI-O studies and EIOLCA, though obviously these are based on financial flow proxies.

In theory, you could build up a model of the materials usage by the auto industry from bottom-up LCA of individual cars (with appropriate error bounds!!)

Will discuss with other authors to generate better reasoning for this choice.

New text added to section:

“Although our choice for using the auto industry is somewhat arbitrary, there are a number of compelling reasons for choosing to study it. Automobile manufacture has been used previously in the literature in both process-based [11–17] and Input- Output [18–20] analysis methods. The automobile boom was clearly central to the development of most Western countries during the 20th Century. Furthermore, the industry remains a large portion of many industrialized economies. The automobile industry is a large consumer of material resources, some of which are listed below in Table 3.1. The automobile has obvious links with the energy industry, both in the direct demand for energy used in automobile manufacture, and also indirectly for the oil needed to operate vehicles. This dependence aptly demonstrates demand ‘lock-in’, discussed in Section 1.5. The industry also shows evidence of post-industrial decline (shrinking profit margins, etc.) and thus represents a sector-level analogy of the maturation and decline in growth of economies.”

Charlie, if this is not acceptable, we may need to discuss this in person.

\*\*\*\*

“We categorized the types of materials used to produce

automobiles, but found that industry-level data are difficult to obtain.” So did you in chapters three and four? Can you say that despite these difficulties we made a first approximation in chapters three and four? Or what? This would help to tie the book together very much. We need less ass covering and more directional charge.

\*\*\*\*

In chapters 4 (direct energy) and 6 (value) the data exist (as discussed above). The data is old for embodied energy (chapter 5) and energy intensity (chapter 7) and does not include accumulation of embodied energy in capital goods. Data for materials (chapter 3) has never existed.

The purpose of the book is not meant to make an analysis. The point is to demonstrate the necessary requirements of the model. If the analysis would make the book more compelling, then it could be done in a limited fashion BUT, this would take time.

\*\*\*\*

p.n48 We begin by noting that direct energy travels with material through an economy (and opposite to money flow).

This is a good point and generally true (though not always, as in the case of waste treatment), but probably more appropriate when we discuss flows of economic value.

Fig. 3.1 Energy content (˙E ) of material flows (˙R, ˙ S , and ˙K) from Figure 2.1.

(Energy flow symbols from Howard Odum).

This is a good point. This reference has been added to Fig 2.1 when we first introduce the energy circuit diagrams.

49 the direct energy associated WITH flows of steel

Good spot. Text changed as stated

EQU. 3.4 WHERE IS FLOW01 ON DIAGAM?

LIKEWISE e1 FROM BIOSPERE???

Thanks, Fig. is labeled wrongly. Flow E02 should be labeled E01.

Note that ˙E 1 is the gross direct energy production rate of society. For example,

firms extract crude oil (a component of ˙E01) and refine it into petroleum products (a

component of ˙E1) that are consumed by society. The direct energy consumption of

extraction and refining firms is a component of ˙E11 ??All this needs to be made clearer relativeto diagram

New text:

“Note that E ̇1 is the gross direct energy production rate of society. For example, firms extract crude oil from the biosphere (a component of E ̇01) and refine it into petroleum products (which in Figure 4.3, leave as part of flow E ̇1) that are then consumed by society. The direct energy consumption of extraction and refining firms is a component of E ̇11, that is some of the energy that circulates back into society in flow E ̇11 is used within the extraction and refining processes to generate flow E ̇01 from the biosphere.”

Eq 3.11 ref 3 EROI should not be attributed to Ayers but Hall (e.g.1986)

Refs 2 and 3 are for the ‘muscle work’ within the economy and are correctly attributed to Ayres and Warr. Citation for EROI has been added.

Fig 3.5 Energy module should be moved to LEFT of goods and services as it must come first

(OK chicken and egg, but conceptually)

\*\*\*\*

Again, re-arranging the figures could be done. If it would make the book more compelling, then it could be done BUT, this would take time.

\*\*\*\*

The First Law of Thermodynamics around APPLIED TO ? the biosphere (0)

Changed as suggested

The First Law around APPLIED TO the goods and services sector (3) i

Changed as suggested

Table 3.1 Can you add in KJ for each component??? As a separate column?

Energy content in kJ added to table

Chpt 4

In Chapter 3, the First Law of Thermodynamics accounted direct energy (˙E ) flowing

among sectors of an economy. In this chapter, we will adapt the First Law to account

FOR THE embodied energy in the material flows of an economy.1

Changed as stated

p. 58 Total energy (T) is defined as the sum of direct energy (E, see Chapter 3) and embodied

energy (B).DEFINE EMBODIED ENERGY

Text changed to, “Total energy (T) is defined as the sum of direct energy (E, see Chapter 3) and embodied energy (B), which we will not define at present. This analysis will lead us to a mathematical definition of embodied energy. “

59 bottom: waste heat is ignored when accounting for total energy ????? It is in equations

The embodied energy accounts for all of the waste heat. As discussed for Equations 5.6-5.8

60

The final term ( ˙Qout) is a proxy for all direct energy (˙E) consumed (i.e. turned into heat)

within the sector.

Fig. 4.2 Total energy flows (T˙ ) in a one-sector economy.(see fig 3.3 ).

Don’t see a comment for Fig 3.3. Labels on flows are wrong (should be T01=E01, not T02=E02). Have changed to be correct.

dBK;1

dt = ˙B11 􀀀 ˙B1 􀀀 ˙B10 + ˙Q10: (4.21)

>>>>>Add In words this say that the change in the embodied energy etc etcc I think o be perf3ectly clear you should give the final equation in words each time !!!!!!!!!!!!!!

THIS IS A GOOD PRACTICE. WE WILL CHANGE THE DISCUSSION ACCORDINGLY

p. 64 The term ˙B10 in Equation 4.21 represents the disposal rate of embodied energy from

Society (1) to the Biosphere (0). (i.e. dumps etc). …depreciated physical <<<<assets.

Text changed to add term ‘depreciated physical assets’.

Fig 4.4 see comment fig 3.5

\*\*\*\*

Again, re-arranging the figures could be done. If it would make the book more compelling, then it could be done BUT, this would take time.

\*\*\*\*

Chpt 5

The monetary flow is an easy and logical (if hardly perfect ) l proxy for the value of the material

and energy flows. At least most ordinary humans accept that.

Text changed to “The monetary flow is an easy and logical (though imperfect) l proxy for the value of the material and energy flows”

Fig. 5.1 Flows of value (˙X ) for a single sector. The value flows are associated with each of the

dfferent material and energy flows outlined in previous chapters. ----------I do not see a green flow

Agreed, figures will be updated so the legend only shows flows depicted in the diagram.

Why are the/re not dashed lines indicating money (value) ??? How are we connecting to title of chapter???

We could use dashed lines to represent the money flow. The flows of money represent ‘value’ as stated in first paragraph of methodology section:

“We begin by explicitly stating what we mean by value. We follow the mainstream approach of using the market price at the time of an exchange to determine the value of the flows of products (goods, services and capital). As materials and energy flow in one direction between sectors, currency flows in the opposite direction.”

MAYBE WE NEED TO BE MORE EXPLICIT ABOUT THIS

Fig. 5.1 Flows of value (˙X ) for a single sector. The value flows are associated with each of the

di\_erent material and energy flows outlined in previous chapters. ??? is value flowing in opposite direction??

No. Value flows with the material and energy flows. Currency flows in the opposite direction.

The contrast between THE BIOPHYSICAL REAL) FLOWS OF Figures 2.2 and 3.3, on the one hand, and THE USUAL ECONOMIST’S DEPICTION OF Figure 5.3, on the other, is striking <<<<<<<NOTE HOW I AM TRYING TO HIT THE READER OVER THE HEAD …

Good comment. Text has been changed to,

“The contrast between the biophysical picture (as represented in Figures 3.2 and 4.3) on the one hand, and the conventional viewpoint of economics (as rep- resented in Figure 6.3) on the other, is striking.”

Fig. 5.3 Flows of value (˙X) for a one-sector economy. <<<NOW IS ThIS THE ECONOMISTS VIEW?? (yes) Or what? Link with what comes before

Yes, this is the economics viewpoint. As stated in the text,

“Figure 6.3 shows flows of value in the single-sector economy. Following typical assumptions in economic modeling, the economy is completely isolated from the biosphere in terms of both material inputs and wastes.”

The next 2? sections are representing the economists’ view of value. Be explicit when you are representing economists when your biophysical perspective

Good point. Text amended to emphasize biophysical vs. traditional economic viewpoint.

5.2.2 Value generation INCLUDING BIOPHYSICAL INPUTS (˙Xgen) <<TELL THE READER YOU ARE SHIFTING PERSPECTIVES…

We are not shifting perspectives here. WILL DISCUSS WITH AUTHORS HOW TO IMPROVE TEXT

Fig. 5.4 Flows of ??BIOPHYSICAL?? value (˙X) within a two-sector economy. AGAIN I AM CONFUSED. THE RROWS ARE SHOWING THE FLOW OF BIOPHYSICAL VALUE (UPGRADED STUFF) BUT THE FLOW OF M0NEY IS OPPOSITE. (DOTTED LINES). YET YOU SAID YOU WERE VALUING VALUE IN MONEY, WHICH YOU ASRE NOT SHOWING FLOWING. MAYBE IT’S THE FLOW OF BIOPHYSICAL VALUE….ALSO FIG 5.5

Agreed, we need to be more specific. The value is measured in a traditional way (i.e. using monetary flows) but is associated with the flow of goods and services (i.e. flows in the opposite direction to the money). WILL DISCUSS WITH OTHER AUTHORS

5.5 Value in the US auto industry

To estimate value flows through the automobile industry (ONE OF THE FEW SECTORS OF THE US ECONOMY WITH N ADEQUATE DATA BASE) , we use publicly..

We could have picked any NAICS defined industry and found comparable data from the BEA. The auto industry is not special in that sense.

Define KLEMS and PERKS

KLEMS is defined in footnote 5 – capital (K), labor (L), energy (E), materials (M) and services (S).

PERKS has not been defined. WILL DISCUSS WITH OTHER AUTHORS.

From fig 5.6 I see you are using dollars to represent the biophysical flows…. You are measuring the value of the biophysical flow in dollars

Yes, exactly right

Chapter 6

such that for sector j, (such as tires??)

Example added,

“Energy intensity (ε) is the ratio of total energy (T˙ ) and value (X) outflow rates from an economic sector (e.g., the auto industry), such that for sector j,”

Define R, S and K after eq. 6.4 as some readers will have forgotten

Good point. Text added:

“where R represents resources, S represents short-lived materials, and K represents capital, as discussed in Chapter 3.”

T jk = "jajk˙Xk: (6.5) : likewise, please define terms first time used in chapter

I guess you Can find each .. I stlill like lots of definitions….

Description of equation added:

“That is, the flow of total energy from sector j into sector k (T˙ jk ), is given by the energy intensity of sector k (ε j ) multiplied by the amount of input good j is required to produce a unit of output from sector k (a jk ) multiplied by the output flow of value from sector k (X˙ k ).

WE ASSUME all goods produced by a sector are produced at the

average energy intensity of that sector.

T jk = "jajk˙Xk: (6.5)

Now give as words

Likewise give eq, 6.11 and 6. 12 in words … I don’t know if you agree but I much prefer to give final equations in words as well as symbols …then you know you are conveying correct info to everyone

Good point. WILL DISCUSS WITH OTHER AUTHORS HOW BEST TO ACHIEVE THIS

Equations 6.15 and 6.16 can be rewritten in vector notation as

8>>><>>>: <<<<Explain why we want to do this and what it means …

Good point. WILL DISCUSS WITH OTHER AUTHORS HOW BEST TO ACHIEVE THIS

Is B embodied anery as before? I assume so . We (you) really need a glossary at beginning of book

Agreed. Glossary of terms is included in the book

with the “Kronecker delta” …explain

Text amended to “with the “Kronecker delta” (δi j ), being a function of two integer variables (i and j) that has value of 1 if i and j are equal and zero otherwise;”

YOU ARE WRITING FOR ENGINEERS, NOT MORTALS!!!!!!!!!!! I ASSUME ALL YOUR MATH/NOTATION IS CORRECT !

Yes, the writing is very technical. Unfortunately, this is the only way to explicitly present the methodology. We will double-check the math.

extension of the algebraic form of the energy intensity equation.

Equation 6.37 provides a means to estimate energy intensity (") of the sectors of

the economy, under the assumption that final consumption (Sector 1) is exogenous

to the economy (Sectors 2: : :n).

BUT WE DO NOT HAVE THE DATA SINCE 1977……….????????? Are you saying tht yu have th I-O data for the uto industry???

Not sure what you mean here.

I-O data (financial flows) is calculated by the BEA and is updated every 5 years. The energy intensity calculations are available from EIOLCA for 1992, 1997 and 2002, for the US, 1995 for Germany, and 2002 for Canada and Spain (financial only).

Chapter7

I think you need more of an introduction:

Something like “ In economics the Leontief Input-Output (I-O) method is an approach that allows for the investigation of the economic interdependency o the economy, that is how much economic activity in each main sector of the economy is used to generate a “final demand” product. Energy analysts have extended the method for energy analysis to estimate the energy intensity of economic products,including the energy required “upstream” in the whole economy for their manufacture . “

I think you need to explain why these two different approaches exist: not just how you deal with them .

Let me try:

Two different approaches exist for calculating the energy intensity of ?intermediate and final demand? Economic products: “product based” and “physical accounting”. The first was developed by xxxx Hannon??? in order to yyyy and the second later by ……… frameworks, whether capital stock is included in the

accounting framework, and whether energy input from society to the economy is

included. (See Figure 7.1.)We will end with our suggestion for how best to estimate

" within a materials, energy, and value accounting system.

99

I think then it will all seem less arbitrary

P 101 “because

product-focused accounting systems assign energy embodied in wastes to products ” ???IN fact the diference in method makes relatively little difference in he energy inensity of products. “ ???

p. 102 Bullard and Herendeen [4], following Kirkpatrick [3], added flows of capital

as inputs to each sector [4, Figure 5], and, in so doing, changed Equation 7.5 to

Equation 7.6:103 They assumed INSTEAD that half of the incoming capital went toward replacement

103 -106 I am impressed at how sophisticated the math is compared to the available data! Will we ever get there?

Hence:

redefinition of A and " to include embodied energy on inflows of material, and

\_ use of Equation 7.20 instead of Equations 7.5 or 7.6 for estimating energy intensity

(") of economic sectors within an economy. ADD>>>of course the inclusion or exclusion of any of these flows into our analysis is much less important than the implementation of any such method, which requires an understanding of the importance of undertaking such analyses for good future economic and energy analysis. [Since we are undertaking no such analyses now, at least in US, seems like you need to make a case for doing it…..]

p. 108

Viewing these dimensions through the lens of our framework illustrates

some important points about measures of economic growth and well-being. Which are 1) 2)

7.3 Implications for recycling, reuse, and dematerialization

All of this seems good to try to show the importance of the analyses, should we ever be able to really implement them!

Good to touch on population growth, distribution.

Conclusions seem to be sort of obvious at least based on others who have come to the same conclusions (e.g. Brian Czeck) from a far less sophisticated analysis. You might at least point out that your very sophisticated analysis is consistent with other such analyses.

We found that there are many potential definitions of a

steady-state economy, none of which are fully satisfying when compared against the

ideal of sustainability. -----🡪 so? Can your approach resolve this? You leave us hanging.

Chapter 8

Unfinished Business: Practical, Methodological,

and Theoretical Issues -- This title seems like such a hodge podge to me: Can we find a title that ties it together: “From the base model to encompass additional considerations”? hmmm, probably not.

>>>>>>>: I added these five paragraphs after I finished chapter 8

This chapter confused me, probably because I thought it was a final discussion. Instead it s a hodge podge that I had a hard time fitting in with rest of book or itself.

There is a lot of methods that seem to me to belong in an earlier methods chapter. If Not it need its own methods “ section

You unmoor me because you just gave 6-7 chapters of detailed methods, “this is how you do it” and then you add ” this is how you do it, when I thought I knew because you had laid it out.

I suggest you say ” I have showed you how to do it, now IF you want to include some bells and whistles not usually included (environmental, consumption) here is how you do that. If you do not do that then I am left with the idea that what you told me before was not correct.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

OK from first pass:

“This chapter discusses several practical, methodological,

and theoretical issues that should be addressed in the future. On a practical

level, additional data are needed to fully utilize the framework developed herein. In

terms of methodological issues, we encourage economists of all types to embrace

material, energy, embodied energy, and economic value counting as a valid method

of inquiry for modern economics. Additionally, there are issues of co-products and

the choice of the energy input vector that need to be addressed. Finally, several theoretical

issues, including a return to the theme of metaphors and models, theories

of value, the need for data, material and energy quality, boundaries, and the Sun are

addressed. We begin with metaphors and models.”

To me this is failing to see the forest for the trees. Here you are talking about the various things that you cannot do when in fact you have just written an entire book with great conceptual and mathematical detail about how to do all these things when in fact you did not and can not do ANY of them – even for the auto industry let alone the economy more generally. So it seems to me that you want to start this list with a cry for Federal collection of data (as was once done ) on the energy intensity of the various parts of the economy -- and then the reconstruction of I-O analyses, first in $ and then in energy a la Bullard. ONLY then should you think about these other things. You say “needed to fully utilize” but its to utilize at all.

Data discussion has been moved to final chapter, now called “Next Steps.”

Maybe move section 8.3 up here and make it more important ….

“In fact, much of mathematical economic modeling today relies upon

mechanistic conceptual foundations whose roots are in Newtonian physics and The

Enlightenment. ADD >>In fact it is only a poor reflection of Newtonian physics, since the mathematical form was used but without the thermodynamic and dynamic underpinning that adds reality and rigor to the physical analogy.

such equations often assume a machine that operates independently from the biosphere (and often reality).

And, we encourage continual assessment OF our models and metaphors.

8.2 We use market prices (subjective theory of value) for pragmatic, rather than

philosophical, reasons because more people accept this and other, probably better indices re very difficult to implement.

e.g., oil extracted from the Texas panhandle ) are used up and more di\_cult locations must be tapped (e.g., Alaskan north slope or deep Gulf of Mexico )

This drawdown of capital is mis-measured in GDP as AN INCREASE IN income.

8.3 “For example, the latest version of the ecoinvent database (v3) contains

detailed analysis of over 10,000 processes.[8] This is a fantastic report, but more

needs to be done to bring this crucial information into the public arena. ” <<<Maybe discuss this more..is it I-O? Energy? US ? how does it relate to old Hannon work? How might it?

The BEA developed the Integrated Environmental and Economic Satellite Accounts to complement the

<<<What is the impetus for this? Any laws???

Several alternative valuation methods were used to provide a range of estimates. It was a great firat approach. <<OK???

8.4 Hybrids of I-O and process-based methods 🡪>>??? 8.4 I-O vs. process-based methods????

8.4 whole section seems like methods, in a methods book. It seems more methods than discussion…

Seems like fig 8.3 could come earlier

Likewise 8.51 -8.53 seems like it should come earlier, in an earlier chapter, maybe its own short chapter 3??? Why is it way back here, where you should be discussing , not giving (good) basics?

However, the EI-O method has been extended in the literature to include co-products for each economic sector.[27, 28], where energy costs are apportioned to different sectors in proportion to the quzntity of the outputs. ……. To do so, both make and use data are employed.

meaning that the embodied energy of food may actually be several times larger than the actual energy content of the food itself. Here is a reference for embodied energy, about three times chemical energy. Also about 3 times even that for distributing , cooking and so on. (Pimentel personal communication).

. Hamilton A , Balogh SB, Maxwell A, Hall CAS. 2013. Efficiency of edible agriculture in

Canada and the U.S. over the past 3 and 4 decades. Energies 6:1764-1793.

The transitions from 8.3 to 8. 4 to 8.5 to 8.6 seem almost non existent

“Within our framework, we do not account for either the material or energetic

quality of resources that pass through the economy nor the irreversibility of economic

processes “ who is OUR? NCE? Heun yet l.? I thought that is what you did do???

In industrialized societies, it may be negligible, It IS negligible

How about energy cost of education etc> The quality per Joule is high, but the energy cot is high.

8.8 Sun In industrialized societies, it may be negligible, H0ward Odum and Mark Brown have developed and assessment called emergy analysis whiich includes an assessment of the embodied solr energy in all resources. <<add, maybe a few paragraphs later OK yy have it, Good.

8.9 What is endogenous? << now this is discussion

But …. It seems that starting at “The key energy intensity equation in this book (Equation 6.37) was derived under the assumption that “final consumption” is exogenous to energy intensity calcula…”

You are trying to make a complete synthesis.. It seems like you need to make a final section

“Putting it all together” or something like that … at this point you need to have made a basic plan/methodology, and then in the discussion: (optionally) expanding the boundaries of analysis and then discuss things like adding in environment final consumption etc. . Then some of these sections would make more sense to me….

8.10

I and II sounds like double counting to me ….

We believe that the DIRECT approach is correct and that the DEC method is unwarranted. BECAUSE???? make it really clear.

Again this sounds like METHODS in the discussion.

Chapter 9.

First paragraph very good…

We found that the waste heat from each sector is additive to the embodied energy..

You found it? Hmmm you decided to approach it that way

Bot p 137 n lives. Our use of the metabolic metaphor is anathema to many mainstream economists but embraced by many ecological  ***AND BIOPHYSICAL*** economists.

I did not review appendices….

OK you have a good book here but it needs some organization Chpt 8 seems especially fractured…