Comments on Beyond GDP proof of 19 March 2015

Heun, Dale, Haney

General comments:

1. Please do not capitalize the first letter of an itemized list if the list occurs mid-sentence. See p. 32 and other locations throughout the manuscript.
2. In several places (e.g. Fig 4.6 and Table 4.1) the Fig or Table is placed before the section in which it is referenced. Please place figures and tables only after they have been referenced in the text.

Lecture Notes in Energy Information Page:

1. Should "**Indexed in Scopus and EI Compendex**" have double asterisks around it?

Lewis Carroll quote:

1. "You may rest a little now. → "You may rest a little now."
   Needs a closing quotation mark
2. " Alice looked round → Alice looked round
   Should NOT have a closing quotation mark at the start.

Preface:

1. p. vii: that we wish for human society….
   This should be an ellipses (...) followed by a period (.). But, it looks like a four-dot ellipses. Can you make a little space between the third and fourth dot, like this: "... ."?

Acknowledgements:

1. No changes here.

Prologue:

1. p. xiii: *[1, p. 23]* → [1, p. 23]
   Eliminate italics
2. p. xiii: *---William Nordhaus* → ---William Nordhaus
   Eliminate italics
3. p. xiii: Philippines served as a pilot study → Philippines was the subject of a pilot study
   Word changes to clarify meaning
4. p. xiv: phase I → Phase I
   Capitalize Phase
5. p. xiv: $ 400,000 → $400,000
   Close the space
6. p. xiv: phase II → Phase II
   Capitalize Phase

Table of Contents:

1. Page numbers in the Table of Contents are incorrect. Given the pagination of the proof sent on 19 March 2015, the table of contents should look as below. If there are any pagination changes because of the edits we're providing, PLEASE RE-DO THE TABLE OF CONTENTS TO REFLECT THE ACTUAL PAGE NUMBERS. Also, please use the following short titles for the sections.

List of Figures:

1. Page numbers in the List of Figures are incorrect. PLEASE RE-DO THE LIST OF FIGURES TO REFLECT THE ACTUAL PAGE NUMBERS. Also, please use the following short titles for the figures.
   List of figures names should look like this (ignoring page numbers):

List of Tables:

1. Page numbers in the List of Tables are incorrect. Given the pagination of the proof sent on 19 March 2015, the list of tables should look as below. If there are any pagination changes

because of the edits we're providing, PLEASE RE-DO THE LIST OF TABLES TO REFLECT THE ACTUAL PAGE NUMBERS. Also, please use the following short titles for the tables. List of tables names should look like this:

List of Symbols:

1. p. xxvii: $\boldsymbol{B}$_W_dot column vector of waste flows [MJ/year] $\rightarrow$ **B**_W_dot column vector of waste flows [MJ/year]
   Eliminate italics on the boldface **B**. See Eqn. 7.24.
2. p. xxviii: product mass flow rate [kg] $\rightarrow$ product mass flow rate [kg/year]
   Edd "/year". It is a rate.
3. p. xxviii: Put q_0 before Q
4. p. xxix, subscripts list: Insert "add   addition"
5. p. xxix, subscripts list: Delete "gen   generation"

Chapter 1:

1. p. 1: The world is entering in a new economic $\rightarrow$ The world is entering a new economic
   Eliminate "in"
2. p. 5: Delete this sentence near the bottom. "It counts all forms of productive capital (natural, human, and manufactured)."
3. p. 6: We must go *beyond GDP*! $\rightarrow$ We must go *Beyond GDP*!
   Capitalize "B" in "Beyond." This is a play on the title of the book.
4. p. 7: can cause economic slowdown and, conversely, drive $\rightarrow$ can cause economic slowdown or, conversely, drive
   Change "and" to "or"
5. p. 7: The first sentence in section 1.3.1 needs to have "are" inserted in it between the words "services" and "provided": "All manufactured goods are made and services provided from raw materials that have been manipulated, processed, transported, or otherwise transformed using energy." $\rightarrow$ "All manufactured goods are made and services are provided from raw materials that have been manipulated, processed, transported, or otherwise transformed using energy."

6. p. 7: oil crisis. (See Fig. 1.3). → oil crisis (see Fig. 1.3).
   This change provides consistency with other figure references at ends of sentences.
7. p. 9, Fig 1.4 caption: Oil prices (*left* axis, data .2points) → Oil prices (*left* axis, data points)
   Remove ".2"
8. p. 13: Data from [29, Fig. A.2, p. 274]. © Gail Tverberg, http://www.ourfiniteworld.com. Used by permission → Data from [29, Fig. A.2, p. 274].
   Remove the copyright information. We are no longer using the Tverberg graph. This graph is our own.
9. p. 14: equal to or higher than the original → equal to or larger than the original
   Change "higher" to "larger"
10. p. 15: (e.g., copper, soil and timber) → (e.g., copper, soil, and timber)
    Add the Oxford comma to maintain consistency with rest of book.
11. p. 18, top of Section 1.5: economic decision making → economic decision-making
    Insert hyphen

Chapter 2:

1. p. 24: entering the age of resource depletion. [4] → entering the age of resource depletion.[4]
   Remove space between "." and footnote mark "4".
2. p. 24: demand[6]. → demand.[6]
   Move footnote mark "6" outside of period to maintain consistency with the rest of the book.
3. p. 24, footnote 6: Add period at the end of the footnote. It is missing.
4. p. 29: footnote 16: efforts → effort
5. p. 36, Fig. 2.4 caption: by permission. → by permission
   Remove period to be consistent with other figure captions.
6. p. 37: theoretical scaling due to either mass → theoretical scaling by either mass
7. p. 37: delete ", both in an absolute sense and on a per capita basis,"
8. p. 39: [44, p. 1] "1" is orphaned from "p.". Keep them together.
9. p. 39: (GDP vs. as a function of fuel consumption) → (GDP vs. fuel consumption)
   Delete "as a function of"
10. p. 40: Unbold the list. Instead, perhaps put a gray box behind it.

Chapter 3:

1. p. 47: energy flows *and accumulations* not just at the → energy flows *and accumulations*, not just at the
   Add a comma after "*accumulations*,"
2. p. 47: metabolizes food, water and air → metabolizes food, water, and air
   Add Oxford comma to be consistent with the style of the book
3. p. 48: to around 35 Gt/yr in the period 1945–1980 → to around 35 Gt/yr over the period 1945–1980
   Change 'in' to 'over'
4. p.49: water flowing out the plughole → water flowing out down the plughole
   Add 'down'

5. p.49: all of the trappings of modern life; buildings, vehicles, and computers. → all of the trappings of modern life; office buildings, vehicles, and computers.
   Add 'office'
6. p. 50: the interplay between money and energy → the interplay among money, materials, and energy
   Insert "materials", change "between" to "among", and add commas
7. p. 50: and economic value (Chap. 6) throughout this book. → and economic value (Chap. 6).
   Delete "throughout this book"
8. p. 50: What gets counted is what passes through the boundary. → What gets counted is what passes across the boundary.
   Change 'through' to 'across'
9. p. 50: After accounting for the stock of apples in a week → After accounting for the change in the stock of apples over a week
   Add 'change in the', change 'in' to 'over'
10. p.50: "at what rate does the stock of apples change?" → "at what rate does our stock of apples change?"
    Change 'the' to 'our'
11. p. 51: They flow through the consumption process unaffected → They flow through the apple consumption process unaffected
    Add 'apple'
12. p. 51: chemical elements) is unaffected, → chemical elements) are unaffected,
    Change "is" to "are" for agreement with the subject, "mass flows"
13. p. 53: energy resources, such as the solvents → energy resources, the solvents
    Delete "such as" because solvents are not energy resources.
14. p. 53: within automobile production and process water → within automobile production, and process water
    Add the Oxford comma
15. because the operation of the sector is dependent upon the accumulation of these materials within the sector → because the operation of the sector is dependent upon the *accumulation* of these materials within the sector.
    Emphasize 'accumulation'
16. p. 53 make up Georgescu-Roegen's "flow" elements[4] [9] → make up Georgescu-Roegen's "flow elements" [9]
    Change quote marks to be around whole phrase "flow elements" and remove footnote 4.
17. p. 53. Examples of these capital flows would be the factory and office buildings or manufacturing equipment within the automobile industry. → Examples of these capital flows would be the factory and office buildings or manufacturing equipment within the automobile industry. Capital goods (K) are equivalent to Georgescu-Roegen's "fund" elements [REF 9] or Daly's "efficient causes" [REF 10].
    Add second sentence at end of paragraph with appropriate references.
18. p. 54: leave to the right of the sector. → leave from the right of the sector.
    Replace "to" with "from"

19. p. 54: We also set up another → We also define another
    Change "set up" to "define" to be less colloquial

The punctuation for equations in Chapter 3 is, in many cases, different from other chapters in the book. I would like there to be consistency. I think changing Chapter 3 will be less work than changing the other chapters. So, many of the following comments try to bring consistency among the chapters on equation punctuation.

20. p. 56, above equation 3.7: Reference to Fig. 3.2 is hyperlinked. This is inconsistent with how other figure references are handled. Either remove this hyperlink or add hyperlinks to all figure references in the main text that refer to figures within the same chapter.
21. p. 56, above Equation 3.7: accounting equations, such that: → accounting equations.
    Delete ", such that:" and end the sentence.
22. p. 56: Remove period at end of Eqn. 3.7
23. p. 56: Add "and" in line between Eqn. 3.7 and 3.8. This should not be indented, same as that between Eqn. 3.10 and 3.11
24. p. 56: Remove period at end of Eqn. 3.8
25. p. 56, above Equation 3.9: we find that: → we find that
    Remove colon
26. p. 56: above Eqn. 3.12: we may say that: → we may say that
    Remove colon
27. p. 56: above Eqn 3.13: sectors, so we may state: → sectors.
    Delete ", so we may state:" and add a period.
28. p. 56: Eqn. 3.13: Remove period at the end.
29. p. 56: Eqn. 3.14: Remove period at the end.
30. p. 56 Footnote 6 contains a cross reference to Footnote 8 which is hyper-linked and in blue. This is inconsistent with how other footnote references are handled. Either remove this hyperlink or add hyperlinks to all footnote references in the main text that refer to footnotes within the same chapter.
31. p. 57, above Eqn. 3.15: we may say that: → we may say that
    Remove colon
32. p. 57 Looking deeper at flows of resources and short-lived goods, → Looking more deeply at flows of resources and short-lived goods,
    Change 'deeper' to 'more deeply'
33. p. 58, above Eqn 3.16: we may state that: → we may state that
    Remove colon
34. p. 58: above Eqn. 3.18: variable as: → variable as
    Remove colon
35. p. 58, above Eqn. 3.20: we obtain: → we obtain
    Remove colon
36. p. 58: An intact brick is of higher material quality—and is of more use—than the brick dust that has been eroded by weather and scattered on the wind. → An lump of iron ore is of higher material quality—and is of more use—than the cast iron dust that has been eroded by weather and scattered on the wind.
    Change 'brick' to 'iron ore', change 'brick' to 'cast iron'

37. p. 58: from naturally occurring , → from naturally occurring,
   Close space between occurring and the comma
38. p. 58: (including overburden ---what must be → (including overburden---what must be
   Close space between overburden and long dash
39. p. 59: process less concentrated resources → process less-concentrated resources
   Add hyphen for multi-word adjective
40. p. 59, above Eqn. 3.21: we obtain: → we obtain
   Remove colon
41. p. 59: As such, we can deduce that the economy must always be a subsidiary of the biosphere → As such, we can deduce that the economy must always be a (wholly-owned!) subsidiary of the biosphere
42. p. 60, above Eqns. 3.22, 3.23, and 3.24: Remove colon (be sure to fix all THREE equations)
43. p. 60, footnote 11: lifetime → lifespan
44. p. 60 i.e., The depreciation per unit of capital stock, → i.e., the depreciation per unit of capital stock,
   Do not capitalize 'the'
45. p. 61, above Eqn. 3.26: Remove colon
46. p. 61, above Eqn 3.27: natural resources: → natural resources.
   Replace colon with period
47. p. 61: Remove period after Eqn. 3.27
48. p. 61: Build up societal capital stock → build up societal capital stock
   Do not capitalize 'build'
49. p.61: Provide short-lived goods and energy to run society → provide short-lived goods and energy to run society
   Do not capitalize 'provide'
50. p. 61: Overcome depreciation → overcome depreciation
   Do not capitalize 'overcome'
51. p. 61: In our second example B, → In Example B,
52. p. 61: resembles very closely to the basic → resembles very closely the basic
   Delete "to"
53. p. 61: produced by Sector (2) → produced by Production (2)
   Change "Sector" to "Production" to maintain consistency with rest of the book
54. p. 61: short-lived goods (S_dot_11) and → short-lived goods (S_dot_11), and
   Add Oxford comma to maintain consistency with rest of the book
55. p. 63 above Eqns. 3.28, 3.31 and 3.32: Remove colon (be sure to fix all THREE equations)
56. p. 63 Footnote 13: In actuality, both R_{11} and S_{11} are zero → In actuality, both R_{11} and K_{11} are zero
   Change "S" to "K"
57. p. 64 above Eqns. 3.36 and 3.38: Remove colon
58. p. 65 above Eqns. 3.48, 3.53, and 3.55: Remove colon
59. p. 66 above Eqns. 3.57, 3.59, and 3.62: Remove colon
60. p. 66 Building up capital stock → building up capital stock
   Do not capitalize 'building'

61. p. 66 Providing goods for → providing goods for
    Do not capitalize 'providing'
62. p. 66 Providing short-lived goods → providing short-lived goods
    Do not capitalize 'providing'
63. p. 66 Overcoming depreciation → overcoming depreciation
    Do not capitalize 'overcoming'
64. p. 66: Build up capital stock → build up capital stock
    Do not capitalize 'build'
65. p.66: Provide short-lived goods → provide short-lived goods
    Do not capitalize 'provide'
66. p. 66: Overcome depreciation → overcome depreciation
    Do not capitalize 'overcome'
67. p. 68: sector (2) produces energy and sector (3) → Sector (2) produces energy and Sector (3)
    Capitalize Sector
68. p. 68 above Eqns. 3.63, 3.64, and 3.67: Remove colon
69. p. 69 above Eqns. 3.70, 3.73, and 3.76: Remove colon
70. p. 70, above Eqn. 3.90: Remove colon
71. p. 71 above Eqns. 3.93, 3.96, and 3.87: Remove colon
72. p. 72 above Eqns. 3.100, 3.103, and 3.105: Remove colon
73. p.72 Increasing human-made capital stocks → increasing human-made capital stocks
    Do not capitalize 'increasing'
74. p. 72 Providing short-lived goods → providing short-lived goods
    Do not capitalize 'providing'
75. p.73: Overcoming depreciation → overcoming depreciation
    Do not capitalize 'overcoming'
76. p. 73: some of which are listed below in Table 3.1 → some of which are listed in Table 3.1
    Delete "below," because the table is actually on the next page.
77. p. 73 Currently available → currently available
    Do not capitalize 'currently'
78. p. 73 Where it is old → where it is old
    Do not capitalize 'where'
79. p. 73 Where it has never been available → where it has never been available
    Do not capitalize 'where'
80. p. 73 Furthermore, the industry still remains a large portion → Furthermore, the industry still constitutes a large portion
    Change 'remains' for 'constitutes'
81. p. 74: Table 3.1:
    a. remove all horizontal lines
    b. cast iron (engine block); … petroleum (paints, lubricants) : remove horizontal lines between these entries (within 'Resources from other sectors' category) and remove semi-colons from all
    c. energy (oil, natural gas, electricity) … paper (towels, packaging): remove horizontal lines between these entries (within 'Short-lived from other sectors' category)

d. steel (buildings, equipment) … petroleum (paints, lubricants) : remove horizontal lines between these entries (within 'Capital from other sectors' category)

e. air emissions (GHG, NOx , SOx)...emissions to water : remove horizontal lines between these entries (within 'Short-lived to biosphere' category)

f. depreciated equipment … depreciated buildings : remove horizontal lines between these entries (within 'Capital to biosphere' category)

82. p. 75 a short-coming of this book serves to address. → a shortcoming that this book serves to address.
Delete hyphen in 'short-coming' and change 'of' to 'that'

83. p. 76: where is our system boundary (control volume) located → where our system boundary (control volume) is located
Move "is" so the sentence is clearer

84. p. 76: We defined four different types of materials: *Resources*, *short-lived goods*, and *capital* which are used to make *products* and specified that only capital may accumulate within economic sectors. → We defined three different types of materials (*resources*, *short-lived goods*, and *capital*) all of which are need to make *products*. We specified that only capital may accumulate within economic sectors.

Chapter 4:

1. p. 79: economies processes raw resources for the benefit of producers and consumers → economies process raw resources for the benefit of producers and consumers
Change 'processes' for 'process'

2. p. 79: In the absence of high rates of energy → In the absence of large flows of energy
Change 'high rates' to 'large flows'

3. p. 79: The analogy for this chapter is this: energy is to thermodynamics → The analogy for this chapter is that energy is to thermodynamics
Change 'is this:' to 'is that'

4. p. 79: Or, energy is the currency of thermodynamics. → Or alternatively, energy is the currency of thermodynamics.
Add 'alternatively'

5. p. 80: and the thermal energy of CO_2 automobile → and the thermal energy of automobile
Delete "CO_2", because exhaust is comprised of much more than CO_2.

6. p. 80: (coal, steam, and CO_2) → (coal, steam, and exhaust)

7. p. 81: will be zero → will be zero,
Add comma

8. p. 81: and outgoing waste heat will balance incoming direct energy. → and outgoing waste heat will balance net inflow of direct energy.
Change 'incoming' to 'net inflow of'

9. p. 81: are typically orders of magnitude larger than any other material flows due to large chemical potential energy content. → are typically orders of magnitude larger than that for other material flows (iron, copper, etc.) due to fossil fuels' large chemical potential energy content.

Change 'than any' to 'than that for' and add '(iron, copper, etc.)' and add 'fossil fuels'' [NB. 'fossil fuels' needs an apostrophe]

10. p.82: The direct energy consumption of extraction and refining firms → The direct energy use by extraction and refining firms
    Change 'consumption' to 'use', change 'of' to 'by'

11. p.84: we are not stock-piling oil and coal at any meaningful rate → we are not stock-piling oil, natural gas, and coal at any meaningful rate
    Add 'natural gas,'

12. p. 84: The first law of thermodynamics requires that both direct energy and waste heat be conserved around each entity → The first law of thermodynamics requires that both direct energy and waste heat be conserved around each sector
    Change 'entity' for 'sector'

13. p. 86, two lines above Eqn. 4.11: E_dot_2 – E_dot_12 + E_dot_22 → E_dot_2 – (E_dot_12 + E_dot_22)
    Add parentheses as indicated to this equation

14. p. 86: where GER stands for gross energy ratio an equivalent → where GER is gross energy ratio, an equivalent
    Change "stands for" to "is" and add comma between "ratio" and "an"

15. p.86 As EROI (and thus energy quality) declines, more energy is needed to extract and deliver energy from the environment, both directly, for example, the energy to pump oil from deeper underground, and indirectly, to build the extra oil rigs necessary to maintain production levels. → As energy quality declines, more energy is needed to extract and deliver energy from the environment (resulting in a lower EROI). This energy is used both directly, for example, the energy to pump oil from deeper underground, and indirectly, to build the extra oil rigs necessary to maintain production levels.

16. p. 86: delete footnote 5.

17. p. 89: Table 1: remove vertical lines from Table. Remove horizontal lines between lines for 'Electricity' and 'Other'

Chapter 5:

1. p. 91: economy. (See Sect. 1.3.2.) → economy (see Sect. 1.3.2).
   Move parenthetical inside the sentence to remain consistent with the rest of the book

2. p. 91: consumed in the manufacture of its products, → consumed in production,
   Change "manufacture of its product" to "production" to clarify the sentence

3. p. 92: This is true even for food production, → This is especially true of food production,
   Change 'true even for' to 'especially true of'

4. p. 93: Replace Fig. 5.1 with attached file named "Fig 5-1 NEW.pdf"

5. p. 93 Conversely, the material produced by a nonenergy sector of the economy → Conversely, the material produced by a non-energy sector of the economy
   Hyphenate 'non-energy'

6. p.94 because direct energy (E) produced by a nonenergy sector is negligible in this framework → because direct energy (E) produced by a non-energy sector is negligible in this framework.

Hyphenate 'non-energy'
7. p. 94: Bulleted list:
    a. Change bullets to capitalized alphabetical list (A:, B:, C:,...)
    b. second bullet: economic sectors, → economic sectors, and
       Add "and"
8. p. 99, first line of section 5.2.3: Society and (1) are orphaned from each other. Please do not break the sentence between 'Society' and '(1)'.
9. p. 99: Each of these material flows will have associated embodied energy such that → Each of these material flows have associated embodied energy such that
   Delete 'will'
10. p. 100: less embodied energy the leaves the sector → less embodied energy that leaves the sector
    Change first "the" to "that"
11. p. 100: delete footnote 9. It doesn't make any sense here.
12. p. 102 above Eqn. 5.27: the following equations. → the following equations:
    Change period to colon
13. p. 102: Similar to Example A, we observe that the accumulation rate of embodied energy in the economic sectors (1 and 2) → Similar to Example A, we observe that the accumulation rate of embodied energy in an economic sector (e.g., 2)
    Change 'the' to 'an', change 'sectors' to 'sector' and change '(1 and 2)' to '(e.g., 2)
14. p. 102: Eqn (5.39): $dB_{K,j} \rightarrow dB_{K_j}$
    Change subscript 'K, j' to K_j
15. p. 103, after Eqn. 5.41: change period to comma
16. p. 105, after Eqn. 5.47: which are same as → which are the same as
    Insert "the"
17. p. 105: because (a) energy" products → because (a) energy products
    Delete closing quotation mark (")
18. p. 106: leads to significantly increased lifecycle emissions. → all lead to significant lifecycle emissions.

Chapter 6:

1. p. 111: In this chapter, we develop a framework for accounting value flows (X) through economies. → In this chapter, we develop a framework for accounting stocks and flows of economic value (X) through economies.
2. p. 112: resource depletion. (See Sect. 1.5). → resource depletion (see Sect. 1.5).
   To be consistent with the rest of the book
3. p. 112: the classicals) and noneconomists alike → the classicals) and non-economists alike
   Hyphenate "non-economists"
4. p. 112: Adam Smith, Karl Marx, David Ricardo, and neo-Ricardian Piero Sraffa, for example, have all proposed alternative determinants of value → Adam Smith, Thomas Malthus, David Ricardo, Karl Marx, and neo-Ricardian Piero Sraffa, for example, have all proposed alternative determinants of value

Add 'Thomas Malthus', move 'David Ricardo' before 'Karl Marx'

5. p.112: such as *labor* (Marx) or *land* (Malthus), → such as *land* (Malthus) or *labor* (Ricardo and Marx),
   Change order to reflect order in previous list. Add 'Ricardo' to second parenthesis

6. p. 113, Fig 6.1 caption: Aggregated flows → Flows
   Delete "Aggregated"

7. p. 114: section (See, e.g., Fig. 6.2). → (see, e.g., Fig. 6.2).
   Lower-case "see" to be consistent with the rest of the manuscript.

8. p. 114: The dashed lines represent the equal and opposite flows of currency used to pay for the material and energy. → The dashed lines represent the equal and opposite flows of money used to pay for the material and energy.
   Change 'currency' to 'money'

9. p. 114: We denote creation and destruction of value → We denote addition and destruction of value
   Change "creation" to "addition"

10. p. 115: change Fig 6.3 to attached file "Fig 6-3 NEW.pdf"

11. p. 115: value-source are denoted $\dot{X}_{gen}$ → value-source are denoted $\dot{X}_{add}$
    Change subscript "gen" to "add"

12. p. 115: destroyed by economic processes or natural disasters → destroyed by depreciation or natural disasters
    Change "economic processes" to "depreciation"

13. p. 115: Although we do not define the value creation and destruction processes any further (mathematically), we discuss what is meant by the underlying processes in Sect. 6.3.2. → We discuss what is meant by the underlying processes in Sect. 6.3.2 and 6.3.3.
    Delete "Although we do not define the value creation and destruction processes any further (mathematically)," and add "6.3.3" at the end of the sentence.

14. p. 117–122, Equations 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.10: subscript gen → subscript add
    This is a significant and important change to all equations. Please take care to make all of these changes.

15. p. 117: Buyers (who receive things of value, $\dot{X}_{11}$, in exchange for currency) and → Buyers (who receive things of value, $\dot{X}_{11}$, in exchange for money)
    Change 'currency' to 'money'

16. p. 117: Sellers (who give up things of value, $\dot{X}_1$, in exchange for currency). → Sellers (who give up things of value, $\dot{X}_1$, in exchange for money).
    Change 'currency' to 'money'

17. p. 117: As a consequence, the seller's stock of currency grows, → As a consequence, the seller's stock of money grows,
    Change 'currency' to 'money'

18. p. 117: due to value generation → due to value addition
    Change "generation" to "addition".

19. p. 117, below Eqn. 6.2: $(\dot{X}_{gen,1})$ → $(\dot{X}_{add,1})$
    Change subscript "gen" to "add"

20. p. 117: 6.3.2 Value Generation ($\dot{X}$ gen) → 6.3.2 Value Added ($\dot{X}$ add)

Change "Generation" to "Added". Change subscript "gen" to "add"

21. p. 117: Delete "In Eq. 6.1, the value generation term ($\dot{X}$ gen) is akin to growing apples."

22. p. 117: The term $\dot{X}$ gen is accounted → The term $\dot{X}$ add is accounted

Change subscript "gen" to "add"

23. p. 117, Section 6.3.2, end of first paragraph: by workers and manufactured capital. → by workers and manufactured capital. In terms of our framework, value added for sector j is

defined as $\dot{X}_{add,j} \equiv \dot{X}_{\dot{P}_j} - \sum_{i} \dot{X}_{\dot{R}_{ij}} - \sum_{i} \dot{X}_{\dot{S}_{ij}}$.

Add the sentence that begins "In the terms of…" to the end of the paragraph. The LaTeX for the inline equation at the end of the sentence is:

$\dot{X}_{add,j} \equiv \dot{X}_{\dot{P}_j} - \sum_{i} \dot{X}_{\dot{R}_{ij}} - \sum_{i} \dot{X}_{\dot{S}_{ij}}$.

24. p. 118: The subjective theory of value indicates that there is no economic value associated with these "transactions," because no currency is exchanged. → The subjective theory of value indicates that there is no economic value associated with these "transactions," because no money is exchanged.

Change 'currency' to 'money'

25. p. 118: The above factors indicate that the process of value generation → The above factors indicate that the process of value addition

Change "generation" to "addition"

26. p. 118: In Eq. 6.1, the value destruction term ($\dot{X}$dest) is akin to consuming apples: value is destroyed by a process that consumes, or otherwise renders unusable, previously- valuable things in the economy → In Eq. 6.1, the value destruction term ($\dot{X}$dest) indicates that value is destroyed by any process that consumes, or otherwise renders unusable, previously-valuable things in the economy

Eliminate comparison to eating apples. Reword as indicated to make everything read smoother.

27. p. 118: If Society (1) in Fig. 6.4 represents → If the sector in Fig. 6.3 represents

Change "Society (1) in Fig. 6.4" to "the sector in Fig. 6.3"

28. p. 118, section 6.3.4: country, $\dot{X}$ 1 is its GDP → country, $\dot{X}$ add is its GDP

Change subscript "1" to "add"

29. p. 122: ($\dot{X}$ gen,j) → ($\dot{X}$ add,j)

change subscript "gen" to "add"

30. p. 122: auto industry (X_dot_P_dot_gross). And subtracting → auto industry (X_dot_P_dot_gross), and subtracting

Combine the two sentences

31. p. 122: The first number is the value → The first number in Fig. 6.7 is the value

Insert "in Fig. 6.7"; otherwise the sentence doesn't make sense.

32. p. 124: (line17) → (line 17)

Insert a space between "line" and "17"

33. p. 125: ($\dot{X}$ gen and → ($\dot{X}$ add and

change subscript "gen" to "add"

Chapter 7:

1. p. 127, footnote 1: in *products* for example, "The → in *products*. For example, "The
   Split the sentence.
2. p. 128: Caption, Fig 7.1: **d** the framework developed and presented herein accounts also for accumulation in capital stock (K) of embodied energy within materials in economic sectors → **d** the framework developed and presented herein accounts also for accumulation in capital stock (K) within economic sectors
   Replace "of embodied energy within materials in" by "within"
3. p. 129: the EI–O method relies upon physical units (especially energy units of joules) to represent some of the flows among economic sectors. → the EI–O method relies upon physical units (especially energy units of joules) to measure some of the flows from the biosphere into the economy, thereafter using monetary flows as a proxy to represent total energy flows (see Section 5.1.1) among economic sectors.
4. p. 129: When applying the EI–O method, it is important to clearly define → When applying the EI–O method, it is important to define clearly
   Change 'to clearly define' to 'to define clearly'. Don't split the infinite.
5. p. 129: The motivation for this particular book is primarily the effects of declining energy natural resource quality → The motivation for this particular book is primarily the effects of declining natural resource quality
   Delete 'energy'
6. p. 131: However, evidence of the durability of goods and the accumulation of materials surrounds us. Furthermore, energy was required to both fabricate and emplace the durable goods and infrastructure of modern economies.[10] As Georgescu-Roegen notes,"in the everyday world one cannot possibly cross a river only on the flow of maintenance materials of a non-existent bridge" [20]. → However, evidence of the durability of goods and the accumulation of materials surrounds us. Indeed, most of the demand for physical flows captured within the I-O snapshot exists in order to support the existence of both human and manufactured capital stocks. As Georgescu-Roegen notes, "in the everyday world one cannot possibly cross a river only on the flow of maintenance materials of a non-existent bridge" [20]. Furthermore, energy was required to both fabricate and emplace the durable goods and infrastructure of modern economies.[10]
   Add new sentence and rearrange sentence order.
7. p. 132: We define the input–output ratio (a_{ij}) that represents the input of good i required to produce a unit of output from sector j → We define the input–output ratio (a_{ij}) that represents the value of input good i required to produce output value from sector j .
8. p. 135: The three-sector economy of Example C affords the opportunity to develop a matrix version of ~~the~~ total energy accounting
   Delete 'the'
9. p. 137: we can rewrite Eq. 7.17
   "we can rewrite E. 7.17" is indented. Make it flush with the left margin. It is not a new paragraph.

10. p. 140–141: numbered list at the bottom of p. 140 and top of p. 141.
    Eliminate "First", "Second", and "Third". These words are redundant with the list numbers.
11. p. 141: input–output methods (EI–O) to estimate → input–output (EI–O) methods to estimate
    Move "(EI–O)" forward one word
12. p.142: Table 7.1:
    a. Entry for 1963 should be '1.07×10^5'
13. p. 142: Table 7.2:
    a. Remove vertical line
    b. Remove horizontal lines between 'Coal mining' and 'Auto repair'
    c. Entry for 'Air transport (73)' should be '1.77×10^5'
    d. Entry for 'Motor vehicles and equipment (63)' should be '9.51×10^4'
14. p. 142: Table 7.3:
    a. Remove vertical line
    b. Remove horizontal lines between '1992' and '2002'
15. p. 142: Hendrickson Lave and Matthews → Hendrickson, Lave, and Matthews
    Add commas
16. p. 142: we find that $1M of output → we find that $ 1M of output
    Insert space between "$" and "1" to maintain consistency with the rest of the manuscript?
17. p. 143: power generation and → power generation, and
    Add Oxford comma to maintain consistency with rest of the manuscript
18. p. 143: The range of energy intensities for the auto sector is 0.83×10^4 kJ/$ to 11.6×10^4 kJ/$ →
    The range of energy intensities for the auto sector is 0.83×10^4 kJ/$ to 10.7×10^4 kJ/$
    Change '11.6×10^4 kJ/$' to '$10.7\times10^4$ kJ/$'

Chapter 8:

1. p.147. Bulleted list:
   a. Remove capitalization from each bullet item
2. p. 153, second bullet: is assigned to products → is not assigned to products
   Insert "not"
3. p. 153, fourth bullet: is assigned to products → is not assigned to products
   Insert "not"
4. p. 155, last sentence of section 8.2.3: energy in put from society. → energy input from society.
   Delete space between "in" and "put"
5. p. 157: Eqn. (8.20): should be:
   $$GDP = \sum_j \dot{X}_{add,j}$$
   a.
   b. LaTeX: GDP = \sum_{j}\dot{X}_{add,j}
6. p. 157, footnote 5: tracking the well-being → tracking well-being
   Delete "the"
7. p. 159, Eqn. 7.32: Add a period at the end of this equation to end the sentence.
8. p. 159: Berry and Fels found that recycling of the material in automobiles would result in energy reduction of 12,640 kW-hr per vehicle → Berry and Fels found that recycling of the

material in automobiles would result in an energy reduction of 12,640 kW-hr (roughly a third) per vehicle,
Add '(roughly a third)'

9. p. 159: Reduced material and energy input (E_0) can be accompanied by no change in the growth of the economy → Reduced material and energy input (E_0) can be accompanied by no change in the physical growth of the economy
Add 'physical'

10. p. 160: the human economy is a subset of the biosphere, a finite, nongrowing system. → the human economy is a subset of the biosphere; a finite, non-growing system.
Change comma after 'biosphere' to semi-colon, hyphenate 'nongrowing'.

11. p. 161: This definition is consistent with zero rate of accumulation of capital stock within the economy and society. → This definition is consistent with both a zero rate of accumulation of capital stock within the economy and society and a constant flow of materials into from the biosphere into the economy.
Add 'both a' and 'and a constant flow of materials into from the biosphere into the economy'

12. p. 161, eqn. 3.105: Change period to a comma, because the sentence continues after the equation

13. p. 161: had better be at some rate lower than the biosphere can replenish those stocks → needs to be at a rate lower than the biosphere can replenish those stocks
Replace 'had better be at some' with 'needs to be at a'

14. p. 162: capital stock increases thereby increasing → capital stock increases, thereby increasing
Add comma

15. p. 162: how large is the (currently growing) human economy in relation to the finite, nongrowing biosphere of which it is a sub-system? → how large is the (currently growing) human economy in relation to the finite, non-growing biosphere of which it is a sub-system?
Hyphenate "non-growing"

16. p. 163, before Eqn. 8.24: we could write: → we could write
Delete colon

17. p. 163, below Eqn. 8.26: capital stock (K) or the flow rate → capital stock (K) or the magnitude of the flow rate
Insert "the magnitude of" to clarify the sentence

18. p. 163: Eqn 8.27: should be:

$$\frac{\mathrm{d}}{\mathrm{d}t}(GDP) = \sum_{j} \frac{\mathrm{d}}{\mathrm{d}t}\left(\dot{X}_{add,j}\right) = 0$$

   a.

   b. LaTeX: \frac{\textrm{d}}{\textrm{d}t}\left(GDP\right) = \sum_{j}\frac{\textrm{d}}{\textrm{d}t}\left(\dot{X}_{add,j}\right) = 0

19. p.164: Bullet list:
   a. Second bullet: Second, that increased GDP increases relative income inequality, which decreases welfare for both rich and poor alike → Second, that growth in GDP may exacerbate relative income inequality, which can decrease welfare for both rich and poor alike

Chapter 9:

1. p. 168, item 1: IEESA (see the Prologue.) → IEESA (see the Prologue).
   Move period outside of the closing parentheses to maintain consistency with the rest of the manuscript
2. p. 168, item 1: outside of the market. (See Sects. 1.3.1 and 1.5.) → outside of the market (see Sects. 1.3.1 and 1.5).
   Change capitalization and punctuation to maintain consistency with the rest of the manuscript
3. p. 168, item 2: quality of life. (See the Prologue and Sect. 1.1.) → quality of life (see the Prologue and Sect. 1.1).
   Change capitalization and punctuation to maintain consistency with the rest of the manuscript
4. p. 168, item 5: within economies. (See Sects. 2.2.3 and 8.4.) → within economies (see Sects. 2.2.3 and 8.4).
   Change capitalization and punctuation to maintain consistency with the rest of the manuscript
5. p. 170: Wendell Berry quotation should be on a recto page, i.e., a right facing, odd-numbered page. Also, center the quotation vertically on the page.

Appendix A:

1. no changes from BH.
2. no changes from MKH.

Appendix B:

1. p. 175: If we consider the Biosphere (0) to be producing a valuable product, namely energy, we can say → If we consider the Biosphere (0) to be the source of resources for a valuable product, namely energy, we can say

Appendix C:

1. p. 177: Subtracting and multiplying matrices gives → Subtracting and multiplying matrices, respectively, gives
   Add ', respectively,'

Appendix D:

1. p. 179, before Eqn. 7.31: Appendix C → Appendix C,
   Add comma
2. p. 179, Eqn. 7.31: Remove semicolon after the equation
3. p. 179, Equation D.1: Add period at the end of the equation to complete the sentence

Appendix E

1. p. 181: In this manuscript, we choose to define energy intensity (ε) and energy input (E_0 and T_1) as a column vectors → In this manuscript, we choose to define energy intensity (ε) and energy input (E_0 and T_1) as column vectors
   Delete 'a'

2. p. 182, left side of Eqn. E.5: delete dot between the a*X_dot matrix and the epsilon vector. They are multiplied together, but the dot is not needed.

Glossary:

1. p. 183: EROI → ERO(E)I
2. p. 183: Add "FY   Fiscal Year" above GDP
3. p. 183: Life Cycle Assessment → Life Cycle Assessment or Life Cycle Analysis
   Add 'or Life Cycle Analysis'
4. p. 183: LINear Exponential → LINear EXponential
   Capitalize the "X" in EXponential because it is part of the term LINEX.

Bibliography:

1. Remove numbering. The numbers do not correlate with anything else in the book. In fact, they will be confusing to the reader, because they do not correlation to reference numbers in any chapter.

Index:

1. Please add index item for 'Economics' with subitems: 'biophysical', 'classical', 'ecological', 'environmental', and 'mainstream'
2. Please add index item for 'Economic growth'
3. IEESA -- there are some references to it in the Prologue. Please include page number ("xiv") in the index.
4. 'Theory of value' listing should be under 'T', not 'S'