

## Energy Systems Engineering Errata

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Notes:

We recommend that you check

<http://www.lightlink.com/francis/EnergySystemsEngineeringErrata.pdf>

to see if a more recent version of the errata is available.

To date there have been three pressings of the book, including a second pressing of the book in January 2009 and a third in summer 2009. Many of the errata below are corrected in the second and third pressings. (For readers unfamiliar with the term “pressing”, a pressing is different from an “edition”: all three pressings are of the first edition of the book, and there are no changes between pressings, other than correction of errata.)

Unfortunately, there does not appear to be any way to tell the different pressings apart, other than looking at your individual copy of the book to see which errors do or do not appear. We regret the inconvenience.

The errata are therefore arranged in order of 1) errata detected since the most recent pressing, which are therefore common to all of them, 2) errata common to the first and second pressing only, 3) errata appearing in the first pressing only.

### Errata in all pressings:

#### Chapter 2

p.51, Example 2-3: in the first paragraph in the “solution: section, the minimum cost should be \$150,000, not \$120,000 as printed.

p.54, eq.2-9: is missing a term “ $A_t$ ”, e.g.,

$$E_t = \left( \frac{E}{A} \right)_t A_t = \text{etc.}$$

#### Chapter 6

p.158, Example 6-11: should read “...the coal used is 100% carbon (i.e., ignoring non-carbon impurities)”

#### Chapter 9

p.233, Equation 9-7 should have everything within the square brackets removed -- because  $I_0$  already contains that information.

## Chapter 10

p.250, second paragraph: incorrect units, sentence should read “Costs fell from \$30/WATT in 1975 to approximately \$4/W... etc.”

## Chapter 12

p.368, homework exercise 12-2: the exercise states that the wind turbine has a swept area of 80 m diameter, however the turbine for which the output by bin data are presented, the Boeing Mod-2 2.5 MW, in fact has a swept area of 94 m diameter (see for example <http://www.stereovisionengineering.net/mod-2.htm>). The choice of diameter does not materially affect how the problem is solved, other than to slightly change the answers in parts a-c. Instructors and students could therefore solve with either 80 m or 94 m values, although 94 m would be more correct.

### Errata in the second pressing and earlier:

#### Chapter 1

p.21, Prob.1-3. Add the following data: “the adult literacy rate is 75%.” Also, the figure reference should refer to Figs. 1-2 and 1-3, not 1-4 and 1-5.

#### Chapter 4

p.86 2<sup>nd</sup> paragraph, replace diameter w radius, i.e., “The sun’s RADIUS is approximately  $7.0 \times 10^8$  m.”

p.103 Table 4-4: In rightmost two columns, values for Australia and USA are reversed. For the two countries, the correct 1990 and 2004 values for millions of tonnes of CO<sub>2</sub> should be: 263 and 386, and 5013 and 5912, respectively. (Note: by inspection it will be clear that the numbers as printed do not make sense, they are much too large for Australia and too small for the U.S.)

#### Chapter 6

p. 146-147. The following changes should be made to Example 6-9 due to reversed numbering of pumps 1 and 2:

"m<sub>9</sub>=0" should be changed to "m<sub>10</sub>=0"

"m<sub>11</sub> =m<sub>10</sub>" should be changed to "m<sub>11</sub>=m<sub>9</sub>"

"Pump work for pump 1 is ....." should be changed to "Pump work for pump 2 is ....." since there is no flow through pump 1.

In the next line WP<sub>1</sub> should be changed to WP<sub>2</sub>.

For Case 2 on p.147, the following changes should be made:

"m<sub>9</sub>=3" should be changes to "m<sub>10</sub>=3".

"m<sub>10</sub>=10.5+1.5=..." should be changed to "m<sub>9</sub>=10.5+1.5=..."

In the following line, the terms in the numerator of the second fraction in the equation for  $h_{11}$  are reversed, they should read “12(647.2) + 3(144.8)”

#### Chapter 7

p.165, units for CO<sub>2</sub> are in tonnes of carbon equivalent. Therefore the first sentence in Section 7-2 should read “In 1994, worldwide CO<sub>2</sub> emissions, measured in tonnes of carbon equivalent, surpassed...etc.”

Chapter 12

p.369. Exercise 12-5, part a), sub-part (iv), change “CP” to “C<sub>p</sub>”, i.e., power coefficient.

p.369. Exercise 12-6, should refer to Table 12-6, not Table 12-5.

Chapter 13

p.403, 4th full paragraph from the top, "ethanol production in temperature regions...", "temperature" should be replaced with the word "temperate".

Errata appearing in the first pressing only

Chapter 9

p.244, eq.9-27 should be corrected as follows:

$$\overline{R_b} = \frac{\cos(L - \beta) \cos(\delta) \sin(\omega'_s) + \omega'_s \sin(L - \beta) \sin(\delta)}{\cos(L) \cos(\delta) \sin(\omega_s) + \omega_s \sin(L) \sin(\delta)}$$

p.246. Prob.9-3. The problem refers to 9 AM solar time, i.e., the fifth sentence should read “On the summer solstice...on the device at 9 a.m. solar time?” Note the misspelling, should be “solar” not “solor”.

p.247, add the following sentence to the end of Exercise 9-8: “Assume both the local and standard longitudes are 90W.”

Chapter 11

p.293, eq.11-7, should be corrected to the following:

$$\eta = \beta_0 + \beta_1(t_i - t_a)/I + \beta_2(t_i - t_a)^2/I$$

p.302, Table 11-3, units in both rows in the table should be MJ m<sup>-2</sup> day<sup>-1</sup>

Chapter 12

p.347. Table 12-3. The column headed “Power [kW]” as given underreports the power value as a function of bin number. The corrected table, with changes to this column and the “Energy (1000 kWh)” column, is the following. As a result, the output value at the top of p.348 should refer to “the AEO value of 5.8 GWh”, and the capacity factor on the same page should be 44.4%, not 0.404. Below the capacity factor calculation, the parenthetical phrase should read “...than the 44% value above.)”

Bin	Min	max	Bin avge.	Frequency	Power	Energy
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	[m/s]	[m/s]	[m/s]	[hours]	[kW]	[1000 kWh]
1	0	3	n/a	780	0	0
2	3	4	3.5	537	14	8
3	4	5	4.5	672	60	40
4	5	6	5.5	807	155	125
5	6	7	6.5	836	269	225
6	7	8	7.5	833	420	350
7	8	9	8.5	831	625	519
8	9	10	9.5	685	900	616
9	10	11	10.5	579	1195	692
10	11	12	11.5	473	1395	659
11	12	13	12.5	366	1485	544
12	13	21	17	1359	1500	2039
13	21	and above	n/a	2	0	0
			Total	8760		5816

p.351, Eq.12-14 third line should read  $U_2 = U_1(1 - a)$ .

p.352, Eq.12-20: "+" should be changed to "-",  $C_p = 4a^3 - 8a^2 + 4a$ .

p.353, Eq.12-21: "4" should be changed to "2",  $T = 2\rho A_2 a U^2 (1 - a)$ .

p.358. 4<sup>th</sup> paragraph, 1<sup>st</sup> sentence, eliminate  $V_r$  from the sentence, i.e., "The magnitude of  $dT$  is then the force acting on an area..." etc.

p.360, Eq. 12-38: sign in denominator of equation should be "+", not "-". Thus the equation becomes:

$$C_L = 4 \sin \phi (\cos \phi - x \sin \phi) / [\sigma' (\sin \phi + x \cos \phi)] \quad (12-38)$$

p.360, Example 12-5, answer should be  $C_{P,max} = 0.3747$ . The sentence at the end of the Example should then read "The approximate value from eq.12-39 at  $\lambda = 5.75$  is somewhat lower than the maximum power coefficient seen in Fig.12-11 of 0.489 at 9.5 m/s, suggesting that the turbine in the figure may have a lower  $C_D/C_L$  ratio."

p.361, Example 12-6: similarly to eq.12-38 on p.360, change sign in denominator to "+". Once this correction is made, the calculation will give the correct value of  $C_L = 1.241$ .

p.369. Exercise 12-3, should refer to Fig.12-11, not 12-7.

## Chapter 13

p.403, 4th full paragraph from the top, "ethanol production in temperature regions...", "temperature" should be replaced with the word "temperate".

p.419, Prob. 13.1: rolling resistance should be  $C_o = 0.01$ , not  $C_o = 0.1$  as written.

p.420, prob. 13-5: reference voltage for fuel cell at 80 °C is  $E_0 = 1.18$  V.

## Chapter 15

p.475, Fig.15-3: the distance along the penstock pipe should be 1700 ft., not 17 ft.