Self Test

Energy Lessons from the Past for the Future

Click on True or False to test your knowledge of the chapter.

1. **True** **False** Before the Big Bang, energy and matter were united in one big blob. The energy of the big bang caused them to separate. (Contributed by Carol Dahl.)

2. **True** **False** The core of our planet is mostly solid and has yet to be tapped as a useable energy source. (Contributed by Kevin DeGeorge. Proofed by Carol Dahl.)

3. **True** **False** Dinosaurs became extinct from over hunting by humans. (Contributed by Carol Dahl.)

4. **True** **False** Peat is organic material that can be transformed into coal given the right temperatures and pressures. (Contributed by Kevin DeGeorge and Tammy Foppe. Proofed by Carol Dahl and Pablo Guzman.)

5. **True** **False** During the Stone Age wood was used as fuel. However in today's power industry, wood is not used as a fuel source due to the abundance of alternate fuels such as coal and natural gas. (Contributed by Kevin DeGeorge. Proofed by Carol Dahl.)

6. **True** **False** During the initial feasibility stage of a highly capital intensive project, good scenario building is what often times separates the successful developers from the unsuccessful ones. (Contributed by Kevin DeGeorge. Proofed by Carol Dahl.)

7. **True** **False** Steam engines allowed flexibility in siting industrial/manufacturing facilities since they did not require running water. (Contributed by Kevin DeGeorge. Proofed by Carol Dahl.)

8. **True** **False** Thermal cracking results when steam boilers are fed excessive amounts of fuel causing exceedances in the thermal ability of the boiler walls. (Contributed by Kevin DeGeorge. Proofed by Carol Dahl.)

9. **True** **False** The stone age ended because we ran out of stones. (Contributed by Carol Dahl.)

10. **True** **False** A forecaster with many years of experience in a particular market who seems to operate well on "hunches" as well as hard data is better suited to using multi-variate and econometric models for their analysis. (Contributed by Kevin DeGeorge. Proofed by Carol Dahl.)

11. **True** **False** End-use models are used by utilities or state energy planners to help forecast future capacity requirements for different areas on an interconnected grid. (Contributed by Kevin DeGeorge. Proofed by Carol Dahl.)

12. **True** **False** Cohen et al would likely support the notion that price forecasts are more accurate in regulated energy markets. (Contributed by Kevin DeGeorge. Proofed by Carol Dahl.)

13. **True** **False** Suppose you have an economy with two composite goods, energy (*E*) and non-energy (*NE*). Both goods are used as intermediate inputs and as final goods for end-uses. Suppose it takes 0.1 unit of energy to produce a unit of *E* and 0.2 units of energy to produce a unit of *NE*. It takes 0.3 units of *NE* to produce a unit of *E* and 0.4 units of *NE* to produce a unit of *NE*. End-use demand is $D_E = 80$ and $D_{NE} = 1200$.

To find total demand for *E* and *NE*, the equations you will need to solve are:

$$E = 0.1E + 0.2NE + 80$$

$$NE = 0.3E + 0.4NE + 1200$$

The solutions are E=600 and NE = 2300.

14. **True** **False** In a two industry economy, industry X1 uses 15 cents of its own product and 45 cents of commodity 2 (X2) to produce a dollars worth of commodity 1. Industry 2 uses 10 cents of its own product and 30 cents of commodity 1 to produce a dollars worth of commodity 2. End use demand is d1 = $1000 of good 1 and d2 = $2011 of good 2. The total production of the two goods is X1 = 2386.01 and X2 = 3427.43. (Contributed by Carol Dahl.)

15. **True** **False** A firm owns a coal mine (X1) and an electricity generator (X2). $0.23 of coal is required per dollar of coal, and $0.25 of coal is required per dollar of electricity. $0.27 of electricity is required per dollar of electricity and $0.14 of electricity is required per dollar of coal. End-use demand for coal is $700 and end-use demand for electricity is $2500. The total production of X1 and X2 to satisfy the above end use demands is about X1 = 1633.5 and X2 =3984.1 (Contributed by Carol Dahl.)

16. **True** **False** Sufficient pressure and temperature are the only requirement to form oil and gas from decayed organism. (Contributed by Saad M. Al-Muaili. Proofed by Matt Alms.)

17. **True** **False** At the beginning of 'Iron Age', around 3000 years ago, iron ore was purified by heating it with coal and oxygen. (Contributed by Matt Alms. Proofed by Nick Bauer.)

18. **True** **False** Oil shale is an inexpensive, efficient source of oil. (Contributed by Nick Bauer. Proofed by Brett Berg.)

19. **True** **False** The Chinese were using oil as a source of energy as early as 3,000 BC, and when oil was not readily available on the surface, they drilled down, using bamboo pipes to bring oil to the surface. (Contributed by Brett Berg and Sarah Hunke. Proofed by Joseph Carsten and Jesse Jones.)

20. **True** **False** Multivariate Time Series and Econometric Models should be better at forecasting turning points and doing policy analysis than univariate time series. (Contributed by Taylor Wellman.)

21. **True** **False** Renewable energy, in the form of wind and water power, was used to drive industrial processes by the 11th century. (Contributed by Joseph Carsten. Proofed by Thomas Dooley.)

22. **True** **False** An "extrapolation model" shows interactions when a small number of players have a variety of options that affect the outcome of interest. (Contributed by Eric Valencia. Proofed by Gustavo Villagrana and Taylor Wellman.)

23. **True** **False** Pollution, a side effect of burning fossil fuels, was only recognized in the 20th century resulting in the first emission regulations to protect the environment. (Contributed by David Dwyer. Proofed by James Esteban.)

24. **True** **False** The Assyrians and Babylonians used asphalt to pave their roads over 5000 years ago. (Contributed by James Esteban. Proofed by Tammy Foppe.)

25.True False Schwartz argues that scenario planning should be based on historical data by an individual in charge of a company, such as a president or a CEO. (Contributed by Kevin Rowland. Proofed by David Shrewsbury.)

26. True False If you have the following time series model for world energy consumption $X_t = 1.05X_{t-1} - 0.02X_{t-2}$ with actual consumption for 2001 and 2002 of around 400 and 410 quadrillion BTUs, then your forecasts for 2003 and 2004 are 422.5 and 435.425, respectively.

(Contributed by Carol Dahl.)

27. True False On average, less than 30% of energy consumption in most countries goes for transportation. (Contributed by Jeff Zuech. Proofed by Robert Rodriquez.)

28. True False The largest oil field is 83 billion barrels and located in India. (Contributed by Jeremy Haberer. Proofed by Cammie Harding.)

29. True False Colonel Drake's discovery of oil in Pennsylvania spawned the first U.S. oil boomtown. (Contributed by Cammie Harding and Jesse Jones. Proofed by Luke Howard and James Estaban.)

30. True False Market forecasting is always a good judge of the market and offers a good chance for suppliers to judge production. (Contributed by Luke Howard. Proofed by Sarah Hunke.)

31. True False An increasing efficiency in the internal combustion engine should decrease energy use for all the cases. (contributed by Gerardo Franco)

32. True False After earth formed, water is thought to have formed when hydrogen and oxygen atoms bonded in chemical reactions driven by geothermal energy.

33. True False The use of petroleum and innovations like the combustion engine fueled and promoted the Industrial Revolution in the 18^{th} century. (Contributed by Tom Dooley. Proofed by Carol Dahl.)

34. True False One theory regarding the end of the universe and energy is the "expanding universe theory", which includes a "Degenerate Era" until 10^{36} years, and then a "black hole era" until 10^{99} years where the only things left are protons, electrons, neutrinos, and photons, leaving the universe a cold and dark place. (Contributed by Brent Zimmerman. Proofed by Jeff Zuech.)

35. True False According to Sheik Zaki Yamani, politics may govern oil prices in the short run, but economics governs oil prices in the long run. (Contributed by Jason Keenan and Robert Rodriguez. Proofed by Jesse Kuchinski.).

36. True False The forecasting technique which models the energy conversion process from an energy product to an energy service is called end-use modeling. (Contributed by Jesse Kuchinski. Proofed by Eric Marshall.)

37. True False Models are useful tools in simulation studies because assumptions can be changed to reflect a variety of scenarios or situations. (Contributed by Eric Marshall. Proofed by Bryan McCloskey.)

38. True False Judgment should never be incorporated into any forecasting models because different people exercise different judgment. (Contributed by Bryan McCloskey. Proofed by Bryan Mitisek.)

39. **True** **False** Forecast feedback may re-enforce or invalidate a forecast. (Contributed by Josh Rogers. Proofed by Kevin Rowland.)

40. **True** **False** Nakicenovic's model, showing what sources of energy have been and forecasting what will be used, predicted the use of nuclear power to be on the rise and nearly equal to the use of coal for 2002. These predictions are accurate and should make accurate forecasts. (Contributed by Chris Moulton. Proofed by Jennifer Phillips.)

41. **True** **False** Extrapolating historical trends, univariate time series, multivariate time series, econometric models are all models based explicitly on historical information. (Contributed by Jennifer Phillips. Proofed by Josh Rogers.)

42. **True** **False** It is feasible to have an input/output matrix with a value greater than 1 along the diagonal provided that $|I-A| > 0$

43. **True** **False** An Input/Output model can be written in the matrix form Ax=d where A is the input output matrix, x is the total production vector, and d is the final demand vector. (Contributed by Nick Paduano)

44. **True** **False** Suppose you have an economy with two goods- X_1 & X_2. Both goods are used as intermediate inputs and as final goods for end uses. Suppose it takes 0.25 units of X_1 to produce a unit of X_1 and 0.4 units of X_1 to produce a unit of X_2. Furthermore, it takes 0.1 units of X_2 to produce a unit of X_1 and 0.5 units of X_2 to produce a unit of X_2. We have obtained a forecast of end use demand for X_1 and X_2 of $D_{X1}=225$ and $D_{X2}=700$. The two equations to solve for X_1 and X_2 are:

$$X_1 = 0.25X_1 + 0.40X_2 + 225$$
$$X_2 = 0.10X_1 + 0.50X_2 + 700$$

45. **True** **False** Required total production in the example in question 44 is $X_1 = 1171.64$ and $X_2 = 1634.33$.

46. **True** **False**

$$E = a_{11}E + a_{12}NE + D_E$$
$$NE = a_{21}E + a_{22}NE + D_{NE}$$

The solutions to this system are:

$$E = \frac{(1-a_{22})D_E}{(1-a_{11}-a_{22}+a_{11}a_{22}-a_{12}a_{21})} + \frac{a_{12}D_{NE}}{(1-a_{11}-a_{22}+a_{11}a_{22}-a_{12}a_{21})}$$

$$NE = \frac{(1-a_{11})D_{NE}}{(1-a_{22}-a_{11}+a_{11}a_{22}-a_{12}a_{21})} - \frac{a_{21}D_E}{(1-a_{22}-a_{11}+a_{11}a_{22}-a_{12}a_{21})}$$

47. **True** **False** For question 46, our input-output model was:

$$E = a_{11}E + a_{12}NE + D_E$$

$$NE = a_{21}E + a_{22}NE + D_{NE}$$

The cradle to grave change in energy production from a one unit increase of either product is:

$$\frac{dE}{dD_E} = a_{11}$$

$$\frac{dE}{dD_{NE}} = a_{12}$$

48. **True** **False** In Einstein's famous equation $E=mc^2$, E=energy, m=momentum and c=the speed of light.

49. **True** **False** The first suggestion that CO_2 buildup could cause climate change was in 1861.

50. **True** **False** The model

$$X1 = 0.1X1 + 0.1X2 + 0.2X3 + 0.15X4 + 0.02Z + 12$$
$$X2 = 0.1X1 + 0.3X2 + 0.2X3 + 0.17X4 + 0.04Z + 15$$
$$X3 = 0.2X1 + 0.3X2 + 0.1X3 + 0.1X4 + 0.2Z + 150$$
$$X4 = 0.4X1 + 0.2X2 + 0.2X3 + 0.4X4 + 0.01Z + 10$$
$$Z = 0.9*0.05*X1$$

considers a pollution control industry with a law to sequester 90% of the carbon dioxide produced. This model restricts carbon dioxide production to 0.3 pounds.

51. **True** **False** Again take the economy in question 50, with four sectors producing goods – X1, X2, X3, X4 and the same technology: To produce 1 unit of X1, takes: 0.10 units of X1, 0.11 units of X2, 0.20 units of X3, and 0.40 of X4. To produce 1 unit of X2, takes: 0.12 units of X1, 0.30units of X2, 0.25 units of X3, and 0.21 of X4. To produce 1 unit of X3, takes: 0.15 units of X1, 0.17 units of X2, 0.13 units of X3, and 0.40 of X4. To produce 1 unit of X4, takes: 0.16 units of X1, 0.18 units of X2, 0.14 units of X3, and 0.22 of X4. The equations to solve for X1, X2, X3, and X4 that would product end-use demand d1=12, d2=15, d3=150, and d4= 10 are:

$$X1 = 0.10X1 + 0.12X2 + 0.15X3 + 0.16X4 + 12$$

$$X2 = 0.11X1 + 0.30X2 + 0.17X3 + 0.18X4 + 15$$

$$X3 = 0.20X1 + 0.25X2 + 0.13X3 + 0.14X4 + 150$$

$$X4 = 0.40X1 + 0.21X2 + 0.40X3 + 0.22X4 + 10$$

52. **True** **False** Again take the economy in questions 50-51, with four sectors producing goods – X1, X2, X3, X4 and the same technology: To produce 1 unit of X1, takes: 0.10 units of X1, 0.11 units of X2, 0.20 units of X3, and 0.40 of X4. To produce 1 unit of X2, takes: 0.12 units of X1, 0.30units of X2, 0.25 units of X3, and 0.21 of X4. To produce 1 unit of X3, takes: 0.15 units of X1, 0.17 units of X2, 0.13 units of X3, and 0.40 of X4. To produce 1 unit of X4, takes: 0.16 units of X1, 0.18 units of X2, 0.14 units of X3, and 0.22 of X4.

Now suppose, X1 produces a pollutant at the rate of 0.03 lbs/unit of X1. Z represents a pollution control industry. One unit of Z represents the removal of one pound of pollution. To remove 1 pound of pollution (Z =1), requires 0.02 units of X1, 0.04 units of X2, 0.2 units of X3, and 0.01

units of X4. If the law requires you to remove 90% of the pollution, the equations you would solve to determine how much X1, X2, X3, and X4 you would need to satisfy the above end-use demands (d1=12, d2=15, d3=150, d4= 10) are:

X1 = 0.10X1 + 0.12X2 + 0.15X3 + 0.16X4 + 0.02Z + 12

X2 = 0.11X1 + 0.30X2 + 0.17X3 + 0.18X4 + 0.04Z + 15

X3 = 0.20X1 + 0.25X2 + 0.13X3 + 0.14X4 + 0.20Z + 150

X4 = 0.40X1 + 0.21X2 + 0.40X3 + 0.22X4 + 0.01Z +10

Z = 0.9*0.03X1

53. **True** **False** Again take the economy in questions 52, but change the law to allow only 1 pound of pollution emitted. Since this law is probably the easiest law to monitor, it is probably a more likely way the law might be written. Now the equations to solve would the same first fours as above with a new last equation:

X1 = 0.10X1 + 0.12X2 + 0.15X3 + 0.16X4 + 0.02Z + 12

X2 = 0.11X1 + 0.30X2 + 0.17X3 + 0.18X4 + 0.04Z + 15

X3 = 0.20X1 + 0.25X2 + 0.13X3 + 0.14X4 + 0.20Z + 150

X4 = 0.40X1 + 0.21X2 + 0.40X3 + 0.22X4 + 0.01Z +10

Z = 0.03X1-1

54. **True** **False** Deep marine areas had abundant plant life, which led to the formation of oil and gas. (Contributed by Gustavo Villagrana. Proofed by Brent Zimmerman.)