1. It takes Earth _____ days to revolve around the Sun.
   A) 24
   B) 202
   C) 365.25
   D) 278

2. It takes Earth _____ hours to complete one rotation on its axis.
   A) 24
   B) 202
   C) 365.25
   D) 278

3. The path that Earth and the other plants follow as they orbit the Sun is called the _____.
   A) subsolar point
   B) plane of ecliptic
   C) axial tilt
   D) circle of illumination

4. The farthest position of Earth's orbit around the Sun is called _____.
   A) aphelion
   B) perihelion
   C) plane of ecliptic
   D) an astronomical unit

5. The average distance between Earth and the Sun is _____ million kilometers.
   A) 149.6
   B) 167
   C) 180
   D) 274.3

6. Earth's North Pole points to _____.
   A) the subsolar point
   B) the plane of the ecliptic
   C) Polaris
   D) the Sun

7. How fast would you have to travel to stay beneath the subsolar point as it moved along the equator?
   A) 656 kilometers per hour
   B) 909 kilometers per hour
   C) 1,035 kilometers per hour
   D) 1,670 kilometers per hour

8. The _____ is the division between night and day.
   A) circle of illumination
   B) solar declination
   C) perihelion
   D) solar altitude

9. The _____ refers to the height of the Sun above the horizon at noon.
   A) circle of illumination
   B) solar declination
   C) perihelion
   D) solar altitude

10. Over a six-month period, the subsolar point migrates across _____ degrees of latitude.
    A) 0
    B) 23.5
    C) 47
    D) 90

11. If Earth's axial tilt were zero, the subsolar point would migrate across _____ degrees of latitude each six months.
    A) 0
    B) 23.5
    C) 46
    D) 90

12. If Earth's axial tilt were 90 degrees, the subsolar point would migrate across _____ degrees of latitude each six months.
    A) 0
    B) 23.5
    C) 46
    D) 90

13. Which statement is not true about the December solstice?
    A) The subsolar point is over 23.5 degrees south latitude.
    B) It is the longest day in the Southern Hemisphere.
    C) Daylight hours get longer as one travels northward.
    D) The subsolar point is over the Tropic of Capricorn.

14. Which statement is not true about the March equinox?
    A) All locations on Earth (except the poles) receive 12 hours of daylight and night.
    B) It is the first day of spring in the Northern Hemisphere.
    C) It is the first day of fall in the Southern Hemisphere.
    D) The subsolar point is over the Tropic of Capricorn.

15. Which statement is not true about the June solstice?
    A) The subsolar point is over the Tropic of Cancer.
    B) It is the shortest day of the year in the Northern Hemisphere.
    C) Daylight hours get shorter as one travels southward.
    D) It is the first day of winter in the Northern Hemisphere.

16. Which statement is not true about the September equinox?
    A) All locations on Earth (except the poles) receive 12 hours of daylight and night.
    B) Winter has ended in the Southern Hemisphere.
    C) It is the first day of spring in the Northern Hemisphere.
    D) The solar declination is 0 degrees latitude.

17. On June 21, the latitude 41 degrees north receives _____ hours of daylight.
    A) 0
    B) 9
    C) 12
    D) 15

18. On the March equinox, the latitude 41 degrees north receives _____ hours of daylight.
    A) 0
    B) 9
    C) 12
    D) 15

19. On December 21, the latitude 80 degrees north receives _____ hours of daylight.
    A) 0
    B) 9
    C) 12
    D) 15

20. The Arctic Circle is located at _____ latitude.
    A) 66.5 degrees north
    B) 23.5 degrees north
    C) 23.5 degrees south
    D) 66.5 degrees south

21. The Tropic of Capricorn is located at _____ latitude.
    A) 66.5 degrees north
    B) 23.5 degrees north
    C) 23.5 degrees south
    D) 66.5 degrees south

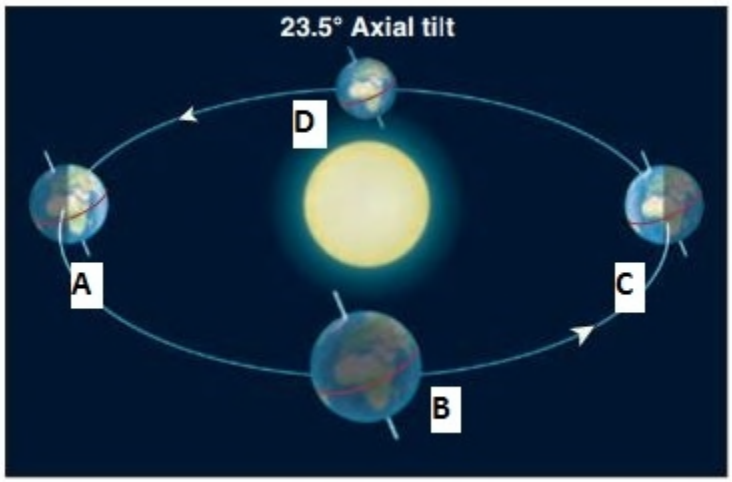
22. The Antarctic Circle is located at _____ latitude.
    A) 66.5 degrees north
    B) 23.5 degrees north
    C) 23.5 degrees south
    D) 66.5 degrees south

23. The Tropic of Cancer is located at _____ latitude.
    A) 66.5 degrees north
    B) 23.5 degrees north
    C) 23.5 degrees south
    D) 66.5 degrees south

24. On the _____ all locations within the Arctic Circle receive 24 hours of daylight.
    A) June solstice
    B) September equinox
    C) December solstice
    D) March equinox

25. On the _____ all locations within the Antarctic Circle receive 24 hours of daylight.
    A) June solstice
    B) September equinox
    C) December solstice
    D) March equinox

Use the following to answer questions 26-29:



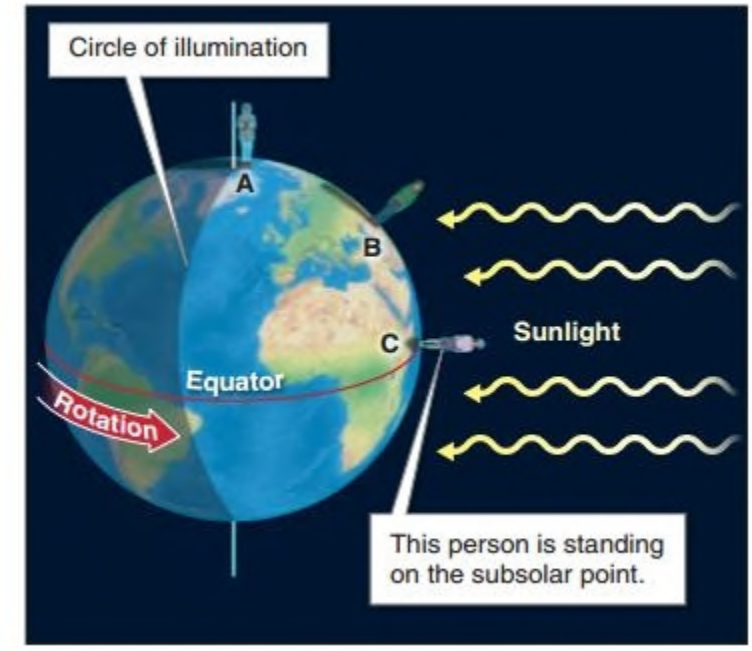
26. Looking at the figure, what seasonal marker occurs at position A?
    A) June solstice
    B) December solstice
    C) March equinox
    D) September equinox

27. Looking at the figure, what seasonal marker occurs at position B?
    A) June solstice
    B) December solstice
    C) March equinox
    D) September equinox

28. Looking at the figure, what seasonal marker occurs at position C?
    A) June solstice
    B) December solstice
    C) March equinox
    D) September equinox

29. Looking at the figure, what seasonal marker occurs at position D?
    A) June solstice
    B) December solstice
    C) March equinox
    D) September equinox

Use the following to answer question 30:



30. Which date is shown in this figure?
    A) June 21
    B) December 21
    C) March 20
    D) August 21

31. The heat-index temperature is caused by _____.
    A) humidity
    B) ocean currents
    C) convection in the atmosphere
    D) sun angle

32. Ninety-five degrees Fahrenheit is equal to _____ degrees Celsius.
    A) 20
    B) 25
    C) 30
    D) 35

33. Zero degrees Celsius is equal to _____ degrees Fahrenheit.
    A) 0
    B) 12
    C) 32
    D) 212

34. One degree of change in Celsius is equal to _____ degrees of change in Fahrenheit.
    A) 1.8
    B) 2
    C) 2.3
    D) 4

35. Water boils at _____ degrees Fahrenheit.
    A) 0
    B) 32
    C) 100
    D) 212

36. Water boils at _____ degrees Celsius.
    A) 0
    B) 32
    C) 100
    D) 212

37. Water freezes at _____ degrees Fahrenheit.
    A) 0
    B) 32
    C) 100
    D) 212

38. Water freezes at _____ degrees Celsius.
    A) 0
    B) 32
    C) 100
    D) 212

39. Circulation of heat in the oceans and atmosphere is an example of energy movement through _____.
    A) conduction
    B) convection
    C) radiation
    D) seasonality

40. Absorption of sunlight by Earth's surface is an example of _____.
    A) conduction
    B) convection
    C) radiation
    D) seasonality

41. Heat traveling through an iron rod stuck in a fire is an example of _____.
    A) conduction
    B) convection
    C) radiation
    D) seasonality

42. The highest temperature officially recorded on Earth was where?
    A) in Libya
    B) in Death Valley, California
    C) near Phoenix, Arizona
    D) in the Atacama Desert in Chile

43. The lowest temperature ever officially recorded was in _____.
    A) Alaska
    B) Siberia
    C) Antarctica
    D) Montana

44. On a climate diagram, the horizontal axis is always _____.
    A) temperature
    B) precipitation
    C) months of the year
    D) humidity

45. The temperature of 1 gram of water will rise _____ degree(s) Celsius when 1 calorie is added to it.
    A) 1
    B) 2
    C) 3
    D) 5

46. The temperature of 1 gram of dry sand will rise about _____ degree(s) Celsius when 1 calorie is added to it.
    A) 1
    B) 2
    C) 3
    D) 5

47. At a given location the sea level air temperature is 30 degrees Celsius. Based on the average environmental lapse rate, what is the most likely temperature at 5,000 meters in mountains near that same sea level location?
    A) 20 degrees Celsius
    B) 10.5 degrees Celsius
    C) 0.5 degrees Celsius
    D) -2.5 degrees Celsius

48. Which location has the lowest average annual temperature?
    A) near the equator and at a low elevation
    B) near the equator and at a high elevation
    C) at a high latitude and at a low elevation
    D) at a high latitude and high elevation

49. Which location has the highest annual temperature range?
    A) near the equator and near the ocean
    B) near the equator and far inland
    C) at a high latitude and near the ocean
    D) at a high latitude and far inland

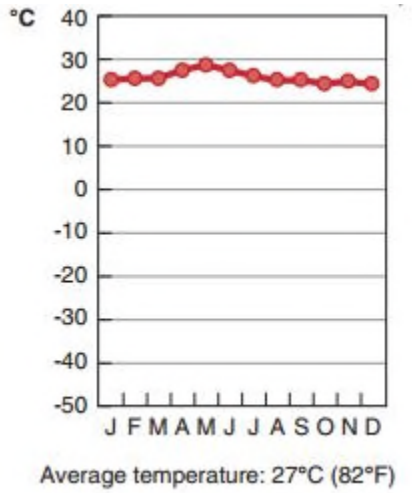
50. The continental effect _____ the annual temperature range.
    A) increases
    B) decreases
    C) has no effect on
    D) is unrelated to

51. Which does not cause the continental effect?
    A) the specific heat of water
    B) condensation of water
    C) mixing of water
    D) transparency of water

52. The Southern Hemisphere has _____ average annual temperature range compared to the Northern Hemisphere.
    A) a higher
    B) a lower
    C) the same
    D) a cooler

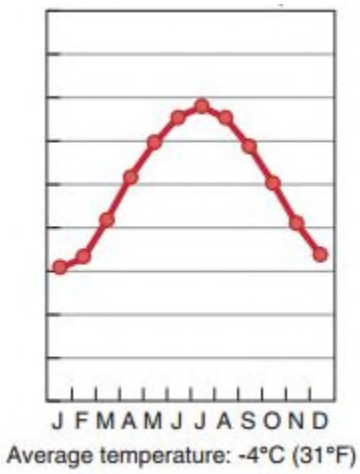
53. Which location has the highest annual temperature range?
    A) northern North America
    B) north and central Eurasia
    C) northeastern Eurasia
    D) Australia

Use the following to answer question 54:



54. Which location does this climate diagram best match?
    A) high latitude and coastal
    B) high latitude and high elevation
    C) low latitude and coastal
    D) low latitude and high elevation

Use the following to answer question 55:



55. Which location does this climate diagram best match?
    A) high latitude and coastal
    B) high latitude and inland
    C) low latitude and coastal
    D) low latitude and inland

56. Hotter objects emit _____ than relatively cooler objects.
    A) longer wavelengths
    B) shorter wavelengths
    C) shorter wavelengths at a faster rate
    D) longer wavelengths at a faster rate

57. Terrestrial radiation peaks at _____ micrometers.
    A) 10
    B) 17
    C) 20
    D) 33

58. Solar radiation peaks at _____ micrometers.
    A) 0.1
    B) 0.5
    C) 1
    D) 3.2

59. Which color has the longest photon wavelength?
    A) red
    B) orange
    C) yellow
    D) green

60. Which wavelength causes sunburns?
    A) red
    B) orange
    C) ultraviolet
    D) infrared

61. Which describes insolation traveling through Earth's atmosphere?
    A) transmission
    B) scattering
    C) reflection
    D) absorption

62. Which will most likely happen to insolation if it strikes snow?
    A) transmission
    B) scattering
    C) reflection
    D) absorption

63. Which will most likely happen to insolation if it strikes vegetation?
    A) transmission
    B) scattering
    C) reflection
    D) absorption

64. The sky is blue because of _____.
    A) Rayleigh scattering
    B) the color of the oceans
    C) absorption of blue photons of light
    D) the color of molecules in the atmosphere

65. Grass is green because it _____.
    A) emits green photons
    B) absorbs green, and reflects all other colors
    C) absorbs all colors, but green is reflected
    D) transmits green

66. Clouds are white because they _____.
    A) emit white photons
    B) absorb all colors equally
    C) reflect all colors equally
    D) absorb all colors, but reflect white

67. Rainbows are caused by _____.
    A) reflected sunlight
    B) absorbed sunlight
    C) refracted sunlight
    D) transmitted sunlight

68. What happens after an object absorbs a photon of energy?
    A) The temperature of the object decreases.
    B) The object changes states of matter.
    C) The temperature of the object increases.
    D) The object remains unaffected.

69. Which has the potentially highest albedo?
    A) clouds
    B) bare rock
    C) vegetation
    D) asphalt

70. The radiative equilibrium temperature of an object (such as Earth's lower atmosphere) will remain unchanged as long as _____.
    A) incoming energy is greater than outgoing energy
    B) incoming energy is less than outgoing energy
    C) incoming energy is equal to outgoing energy
    D) there is no incoming or outgoing energy

71. What would happen to Earth's radiative equilibrium temperature if Earth's albedo were lowered?
    A) It would decrease.
    B) It would increase.
    C) It would not change.
    D) It is unknown.

72. The temperature of Earth's surface is approximately _____ degrees Celsius.
    A) 12
    B) 14.6
    C) 17
    D) 18.3

73. Without _____ Earth's atmosphere would not have a natural greenhouse effect.
    A) a global heat engine
    B) radiative equilibrium temperature
    C) insolation
    D) greenhouse gases

74. The atmosphere is heated mostly by _____.
    A) counter-radiation from clouds
    B) counter-radiation from gases in the atmosphere
    C) Earth's surface
    D) the oceans

75. Overall, what percentage of solar radiation is reflected by Earth?
    A) 7 percent
    B) 23 percent
    C) 30 percent
    D) 70 percent

76. What percentage of solar radiation is reflected by clouds and the atmosphere?
    A) 7 percent
    B) 23 percent
    C) 30 percent
    D) 70 percent

77. Overall, what percentage of solar radiation is absorbed by Earth?
    A) 7 percent
    B) 23 percent
    C) 30 percent
    D) 70 percent

78. The surface of the land and oceans absorbs _____ percent of solar radiation.
    A) 7 percent
    B) 23 percent
    C) 47 percent
    D) 56 percent

79. Because of the greenhouse effect, which emits the most longwave radiation?
    A) the land surface
    B) clouds
    C) greenhouse gases
    D) the oceans

80. At which latitude does the amount of absorbed solar radiation equal the amount of energy emitted by Earth?
    A) 23.5 degrees
    B) 37 degrees
    C) 45 degrees
    D) 50 degrees

81. At high latitudes, Earth radiates _____ energy than it absorbs.
    A) less
    B) more
    C) the same amount
    D) Earth does not radiate energy.

82. The _____ is the result of heating inequalities across latitudes.
    A) natural greenhouse effect
    B) urban heat island
    C) global heat engine
    D) electromagnetic spectrum

83. If the Sun stopped shinning, the global heat engine would _____.
    A) shut down
    B) be enhanced
    C) remain unchanged
    D) Solar energy does not relate to the global heat engine.

84. What percentage of the energy the world uses comes from fossil fuels?
    A) 50 percent
    B) 65 percent
    C) 70 percent
    D) 85 percent

85. By the middle of the century, about how much energy could come from fossil fuels?
    A) 20 percent
    B) 40 percent
    C) 60 percent
    D) 80 percent

86. Which is not among the problems with fossil fuels?
    A) They are finite.
    B) They produce pollution.
    C) They are available in large amounts.
    D) They are politically volatile.

87. Which is not an example of a renewable energy?
    A) coal
    B) sunlight
    C) geothermal heat
    D) wind

88. About 101,000 terawatts of energy are delivered to Earth each day by the Sun. Worldwide, society consumes about _____ terawatts of energy.
    A) 15
    B) 25
    C) 40
    D) 76

89. Which has the most potential as a renewable energy source in terms of the theoretical maximum energy production?
    A) biomass
    B) geothermal
    C) wind
    D) hydroelectric

90. Meteorological seasons refer to the changing of weather conditions over the course of a year.
    A) True
    B) False

91. Astronomical seasons refer to the changing position of the Sun, Moon, and stars.
    A) True
    B) False

92. Earth's axis is tilted 25 degrees.
    A) True
    B) False

93. If Earth's axial tilt were to increase, seasonality would decrease.
    A) True
    B) False

94. Earth is closer to the Sun in January than in July.
    A) True
    B) False

95. The Tropic of Capricorn occurs at 23.5 degrees north latitude.
    A) True
    B) False

96. Sunlight becomes less diffuse at high latitudes.
    A) True
    B) False

97. Only in the tropics can the solar altitude be 90 degrees.
    A) True
    B) False

98. The subsolar point moves as high as 38 degrees latitude north and south.
    A) True
    B) False

99. Temperature is the average kinetic movement of molecules in a substance, measured by a thermometer.
    A) True
    B) False

100. The heat-index temperature is determined by measuring atmospheric humidity and temperature.
    A) True
    B) False

101. The Kelvin scale has no negative numbers.
    A) True
    B) False

102. When two objects of different temperatures come into contact, heat will flow from the object with a lower temperature to the object with a higher temperature.
    A) True
    B) False

103. The greater the temperature contrast between two objects in contact, the faster heat will flow from one to the other.
    A) True
    B) False

104. Copper is a good insulator. Air is a good conductor.
    A) True
    B) False

105. The difference between the highest and lowest air temperatures for a given location is called the temperature range.
    A) True
    B) False

106. Lines of equal temperature are called *isotherms*.
    A) True
    B) False

107. Water has a lower specific heat than dry sand.
    A) True
    B) False

108. The Gulf Stream current reduces the annual temperature range for Northern Europe.
    A) True
    B) False

109. All locations in the tropics are warm.
    A) True
    B) False

110. New York City, located on the coast, has a strongly maritime climate.
    A) True
    B) False

111. All objects emit electromagnetic radiation.
    A) True
    B) False

112. Most of Earth's electromagnetic radiation is in short wavelengths.
    A) True
    B) False

113. Most solar electromagnetic radiation is in long wavelengths.
    A) True
    B) False

114. Ultraviolet radiation has shorter wavelengths than visible light.
    A) True
    B) False

115. Transmission is the absorption of electromagnetic energy by an object.
    A) True
    B) False

116. Alpenglow forms as light is scattered in the atmosphere.
    A) True
    B) False

117. The term *insolation* is short for “incoming solar radiation.”
    A) True
    B) False

118. Radiometers are used to measure the amount of reflected shortwave radiation at Earth's surface.
    A) True
    B) False

119. Snow has a lower albedo than vegetation.
    A) True
    B) False

120. Earth's albedo is highest in tropical regions.
    A) True
    B) False

121. The lower albedo of cities and the materials of which they are made create the urban heat island effect.
    A) True
    B) False

122. Renewable energy does not put ancient carbon in the atmosphere.
    A) True
    B) False

123. Photovoltaic (PV) panels generate electricity from sunlight.
    A) True
    B) False

124. Solar panels on rooftops are an example of centralized solar energy production.
    A) True
    B) False

125. One of the world's most intense sunlight regions is equatorial Africa.
    A) True
    B) False

126. In the United States, the most intense sunlight occurs in Florida.
    A) True
    B) False

127. Concentrated solar power (CSP) generates electricity by creating steam from water heated by sunlight.
    A) True
    B) False

128. Desert organisms such as the California desert tortoise are not harmed by solar power farms.
    A) True
    B) False

129. What presiding body compiles daily global temperature recordings? About how many stations are used to monitor Earth's atmospheric temperature?

130. Why is deep and clear water colored blue?

131. Do rainbows only occur where it is raining? Explain.

132. Is there an urban heat island where you live? What information would you need to acquire to answer this question?

133. Explain what the global heat engine is and how it is fundamentally important to atmospheric systems.

134. What are biomass, geothermal, and hydroelectric energy sources? How does each generate electricity? What does it mean to say that they are renewable?

135. Give examples of centralized and decentralized solar energy production. Discuss the strengths and weaknesses of both.

Answer Key

1. C
2. A
3. B
4. A
5. A
6. C
7. D
8. A
9. D
10. C
11. A
12. D
13. C
14. D
15. B
16. C
17. D
18. C
19. A
20. A
21. C
22. D
23. B
24. A
25. C
26. B
27. C
28. A
29. D
30. C
31. A
32. D
33. C
34. A
35. D
36. C
37. B
38. A
39. B
40. C
41. A
42. B
43. C
44. C

45. A
46. D
47. D
48. D
49. D
50. A
51. B
52. B
53. B
54. C
55. B
56. C
57. A
58. B
59. A
60. C
61. A
62. C
63. D
64. A
65. C
66. C
67. C
68. C
69. A
70. C
71. B
72. B
73. D
74. C
75. C
76. B
77. D
78. C
79. C
80. B
81. B
82. C
83. A
84. D
85. D
86. C
87. A
88. A
89. C
90. A

91. A
92. B
93. B
94. A
95. B
96. B
97. A
98. B
99. A
100. A
101. A
102. B
103. A
104. B
105. A
106. A
107. B
108. A
109. B
110. B
111. A
112. B
113. B
114. A
115. B
116. A
117. A
118. A
119. B
120. B
121. A
122. A
123. A
124. B
125. B
126. B
127. A
128. B
129. Global Historical Climatology Network. There are about 75,000 stations in use worldwide.
130. The color of the oceans is not related to the color of the sky. Instead, like a filter, ocean water absorbs longer wavelengths of reds and yellows before shorter wavelengths of blue, leaving blue wavelengths to perceive.
131. Rainfall isn't required for rainbows to form. Rainbows form wherever there is sunlight, drops of water in the sky, and an observer to see the effect. Sprinklers, waterfalls, and whale spouts all can create rainbows.

132. Only students living in large cities may have an urban heat island. Average temperature data would have to be used to compare the averages between the city interior and nearby surrounding rural areas.
133. The global heat engine is the convective movement of heat energy out of the tropics to middle and high latitudes. The oceans moves about 40 percent of the energy, and the atmosphere moves about 60 percent. This heat movement gives rise to wind and storm systems.
134. Biomass generates power by burning organic material, such as agricultural wastes or plant oils. Geothermal generates power from Earth's internal heat. Hydroelectric refers to the generation of electricity from rivers by means of turbines on dams. Each is renewable because the source of energy never runs out.
135. Decentralized solar energy production includes putting solar panels on rooftops, in parking lots, and on any other available surface in urban and rural settings. Two strengths of the decentralized approach are 1) homeowners can take part in producing carbon-free energy, and 2) this approach does not require large tracts of land that could be habitats for organisms. One problem with decentralized solar energy production is that in many cases it is not yet cost-effective. The centralized solar energy approach creates a single area with intensive energy production, either through an expanse of solar panels or the concentrated solar power technique. Generally, energy produced through a centralized approach must be transported long distances because large spaces are not typically available near large population centers where energy is in demand. Transporting electricity long distances can be inefficient and wasteful.