SECTION 3

DISPERSED AND RENEWABLE ENERGY SYSTEMS

FOOTNOTES

- 1. Energy Committee of the Aspen Institute for Humanistic Studies, Second Annual R & D Workshop, "Decentralized Electricity and Cogeneration Options," Aspen, Co., July 13-17, 1979.
- 2. Stobaugh, Robert and Daniel Yergin, "Energy and Emergency Telescoped," Foreign Affairs, Vol. 58:3, pp. 593-594.
- 3. Brady, J. and B. Zimbler, "Conservation, Not Synfuels, Will Cut Oil Imports," Energy User News, August 18, 1980, p. 22.
- 4. Yergin, Daniel, "Conservation: The Key Energy Source," in Energy Future: Report of the Energy Project at the Harvard Business School, Robert Stobaugh and Daniel Yergin, ed(s)., Random House, N.Y., 1979, p. 166.
- 5. Table 3.2-1, "Residential Energy Consumption By Use," Source: Ibid., p. 9.
- 6. The Ford Foundation, "Energy Conservation: Opportunities and Obstacles," in Energy: The Next Twenty Years, Hans H. Landsberg, Chairman, Cambridge, Ma., 1979.
- 7. DOE/EIA, Monthly Energy Review, August, 1980, p. 17.
- 8. Yergin, op. cit., p. 154.
- 9. Brady and Zimbler, op. cit., p. l.
- 10. Yergin, op. cit., p. 152.
- II. Gray, Charles L., "The Potential for Improved Fuel Economy Between 1985 and 1995," as quoted before the U.S. Senate Committee on Energy and Natural Resources.
- 12. "The Reluctant Revolution," <u>Soft Energy Notes</u>, August-September, 1980, pp. 3-5.
- 13. Table 3.2-2, "Future Fleet Possibilities," Source: Ibid., p. 4.
- 14. Table 3.2-3, "Opportunities for Technological Research and Development in Support of Energy Conservation," Source: Committee on Nuclear and Alternative Energy Systems (CONAES), National Research Council, Energy in Transition: 1985-2010, W. H. Freeman and Co., San Francisco, Ca., 1980.

- 15. The Ford Foundation, op. cit., p. 138.
- 16. Ibid., pp. 147-152.
- 17. Hayes, Dennis, "Energy: The Case for Conservation," Worldwatch Paper, Vol. 4., Worldwatch Institute, Washington, D.C., 1976, p. 8.
- Office of Technology Assessment (OTA), Conservation and Solar Energy Programs of the Department of Energy: A Critique, U.S. Government Printing Office, Washington, D.C., 1980, p. 3.
- 19. Ibid., pp. 11-13.
- 20. California Energy Commission (CEC), 1979 Biennial Report, California State printing Office, Sacramento, Ca., 1979, p. 42.
- 21. Ibid., p. 35.
- 22. CONAES, op. cit., pp. 8-9.
- 23. Ibid., pp. 82-83.
- 24. Table 3.2-4, "Scenarios of Energy Demand: Totals," Source: CONAES, op. cit., pp. 82-83.
- 25. Figure 3.2-1, "Demand and Conservation Panel Projections of Total Primary Energy Use to the Year 2010 (Quads)," Source: CONAES, op. cit., p. 8.
- Table 3.2-5, "U.S. Energy Consumption (Quads)," Source: U.S. Department of Energy, Energy Conservation: Program Summary Document, FY 1981, Chapter 2, Washington, D.C., February, 1980, p. 7.
- 27. Ibid., Chapter 2, p. 1, and Chapter 7, p. 21.
- 28. The Ford Foundation, op. cit., p. 123.
- 29. CONAES, op. cit., p. 4.
- 30. Ibid., p. 14.
- 31. Sant, Roger W., The Least-Cost Energy Strategy: Minimizing Consumer Costs Through Competition, Energy Productivity Center, Mellon Institute, Arlington, Va., 1979, p. 4.
- 32. Ibid., p. 5.
- 33. Ibid., p. 46.

- "Putting Baseload to Work on the Night Shift," <u>EPRI Journal</u>, Vol. 5, No. 3, April, 1980, p. 6.
- 35. Ibid., p. 8.
- 36. PURPA, Sec. III, pp. 95-617.
- 37. Ibid., Sec. 115.
- 38. Cichetti, C. and J. Reinberg, "Electricity and Natural Gas Rate Issues," Annual Review of Energy, 1979, pp. 231-258.
- 39. Ibid., pp. 231-258.
- 40. Calsetta, Alfred B., Electric Utility Load Research Data Processing System, TVA, Gatlinburg, Te., October, 1979.
- 41. 1980 Conservation and Load Management Program, Southern California Edison Co., Rosemead, Ca., December, 1979, p. 205.
- 42. "Electrical Co-ops That Save Big Users Big Money," <u>Business Week</u>, August 4, 1980, p. 28.
- 43. Swet, C.J., "Seasonal Storage: Prospects and Problems," Lawrence Berkeley Laboratory, Thermal Energy Storage in Aquifers Workshop, May 10-12, 1979.
- 44. Lehr, Jay H., "Environmental Aspects of Low Temperature Thermal Energy Storage in Aquifers," Ibid., p. 34.
- 45. Cook, Earl, Man, Energy, Society, W. H. Freeman and Co., San Francisco, Ca., 1976, pp. 42-43.
- 46. Lehr, op, cit., pp. 35-36.
- 47. Science, May 17, 1974, p. 787.
- 48. Power, Vol. 123, No. 7, July, 1979, p. 43.
- 49. Science, May 24, 1974, p. 884.
- 50. Ibid., p. 885.
- 51. Post, Richard F. and Stephen F. Post, "Fly-Wheels," <u>Scientific American</u>, December, 1973, p. 17.
- 52. Ibid., pp. 19-21.
- 53. Ibid., p. 22.

- 54. <u>Science</u>, May 24, 1974, op. cit., p. 886.
- 55. <u>Science</u>, May 17, 1974, op. cit., p. 785.
- 56. Ibid., p. 785.
- 57. Figure 3.3-l, "Comparison of Energy-Storage Technologies," Source: <u>EPRI</u> Journal, op. cit.
- 58. Ibid., p. 6.
- 59. Figure 3.3-2, "German Load Management: 1968-1973," Source: Energy and Defense Project.
- 60. Asbury, J. G., R. F. Geise, and R. O. Mueller, "Electric Heat: The Right Price at the Right Time, <u>Technology Review</u>, December/January, 1980, p. 32.
- 61. Manufacturing Chemists Association, A Proven Way to Save Energy: Cogeneration, Washington, D.C., 1978, p. 2.
- 62. California Energy Commission (CEC), <u>Commercial Status</u>: <u>Electrical Generation and Non-Generation Technologies</u>, <u>Sacramento</u>, <u>Ca.</u>, <u>September</u>, 1979, p. 208.
- 63. Ibid., p. 208.
- 64. Williams, Robert H., "Industrial Cogeneration," Annual Review of Energy, Vol. 3, Annual Review, Inc., Palo Alto, Ca., 1978, p. 319.
- 65. Ibid., p. 320.
- 66. Ibid., pp. 318-320.
- 67. Kaufman, Alvin and Barbara Daly, "Cogeneration--Problems and Outlook," Congressional Committee Report, Centralized vs. Decentralized Energy Systems: Diverging or Parallel Roads?, May, 1979, p. 200.
- 68. Figure 3.4-1, "Conventional Electrical and Process Steam Systems Compared to a Cogeneration System," Source: Department of Energy Resource Planning Associates, Inc., Cogeneration: Technical Concepts Trends Prospects, September, 1978.
- 69. Figure 3.4-2, "Diagram Illustrations of Topping Cycle Cogeneration Systems," Source: Ibid.
- 70. Williams, op. cit., p. 320.
- 71. Herman, Stewart W. and James S. Cannon, Energy Futures: Industry and the New Technologies, Inform, Inc., New York, N.Y., 1976, p. 659.

- 72. Table 3.4-1, "Distinguishing Features of Topping Cycle Cogeneration Systems," The Comptroller General, Report to Congress, GAO, <u>Industrial Cogeneration</u>: What It Is, How It Works, Its Potential, EMD-80-7, April 29, 1980, p. 8.
- 73. Ibid., p. 10.
- 74. Figure 3.4-3, "Alternate Topping Cycles: Potassium Turbines," Source: Ibid.
- 75. Figure 3.4-4, "Combined Cycle Topping System," Source: Ibid.
- 76. The Comptroller General, op. cit., p. 261.
- 77. Kaufman, op. cit., pp. 220-222.
- 78. TOTEM: Technical Description, Brooklyn Union Gas, October, 1978, pp. 1-2.
- 79. TOTEM: Total Energy Module, Fiat Auto Group, September, 1977, p. 2.
- 80. Ibid., p. 7.
- 81. Ibid., p. 9.
- 82. Ibid., p. 11.
- 83. Clark, Wilson and E. Bassignana, et al., Transcript of January 21, 1980, TOTEM meeting, California Governor's Office, Sacramento, Ca.
- 84. CEC, Commercial Status, op. cit.
- 85. Thermo Electron Corporation, "Proposal for a 60 kw Gas Total Energy Module Based Upon Low-Cost Automotive Engines," Waltham, Ma., May 31, 1979.
- 86. The Energy Daily, August 17, 1978, p. 203.
- 87. Dow Chemical Company, <u>Energy Industrial Center Study</u>, prepared for the National Science Foundation, June, 1975.
- 88. Table 3.4-2, "Total Potential Energy Savings From Cogeneration and Estimated Market Penetration (Quads)," Source: Ibid.
- 89. Fagenbaum, Joel, "Cogeneration: An Energy Saver," IEEE Spectrum, August, 1980, p. 30.

- 90. Morgan, D.T. and J. P. Davis, "High Efficiency Decentralized Electrical Power Generation Utilizing Diesel Engines Coupled with Organic Working Fluid Rankine Cycle Engines Operating on Diesel Reject Heat," Thermo Electron Corp., November, 1979, p. 72.
- 91. Herman and Cannon, op. cit., p. 268.
- 92. Energy Daily, op. cit., p. 2.
- 93. Dow Chemical Company, op. cit., p. II.
- 94. Energy Daily, op. cit., p. l.
- 95. Power Engineering, March, 1978, p. 311.
- 96. Ibid., p. 311.
- 97. California Public Utilities Commission, Utilities Division, "Staff Report on California Cogeneration Activities," San Francisco, Ca., January, 1978, p. 7.
- 98. Cricton, Kyle, "Prospects for Cogeneration," Energy User News, 1980, p. 8.
- 99. Kaufman, op. cit., p. 205.
- 100. Dow Chemical Company, op. cit., p. 15.
- 101. Considine, Douglas M., ed., Energy Technology Handbook, McGraw-Hill Book Company, New York, 1977, pp. 4-59.
- 102. Ibid.
- 103. CEC, Commercial Status, op. cit., p. 259.
- 104. Lang, Rich, Fuel Cells in California, CEC, Alternative Implementation Division, April, 1977, p. 3.
- 105. Ibid.
- 106. Figure 3.5-1, "Hydrogen-Air Fuel Cell Schematic," Source: OTA, Application of Solar Technology to Today's Energy Needs, Vol. 1, June, 1978, p. 422.
- 107. Considine, op. cit., p. 4-60.
- 108. Ibid.
- 109. Cook, op. cit., p. 47.

- 110. Clark, Wilson, Energy for Survival, Anchor Books, New York, 1974, p. 219.
- III. Considine, op. cit., p. 4-60.
- U.S. Department of Energy, (DOE) Solar, Geothermal, Electric and Storage Systems Program Summary Document, March, 1978, p. 207.
- ll 3. Ibid.
- 114. Cook, op. cit.
- 115. Clark, op. cit.
- 116. U.S. DOE, op. cit.
- 117. Electric Power Research Institute, 1980-1984 Research and Development Program Plan, February, 1980, p. 209.
- 118. Ibid., p. 212.
- 119. CEC, Commercial Status, op. cit.
- 120. Lang, op. cit., p. 8.
- 121. Clark, Wilson, Discussions with Chinese electric power officials—Beijing, Nangzhon, Guangzhon, April-May, 1980.
- 122. U.S. Army Corpos of Engineers, National Program of Inspection of Dams, Office of the Chief of Engineers, Washington, D.C., May, 1975.
- 123. Institute for Water Resources, National Hydroelectric Power Resources Study, <u>Preliminary Inventory of Hydropower Resources</u>, Ft. Belvoir, Va., July, 1979.
- 124. Table 3.6-!, "Preliminary Inventory of Hydroelectric Power Resources National Total," Source: Ibid.
- 125. Ibid.
- 126. Ibid.
- 127. U.S. Department of Energy, Micro-Hydro Power, DOE/ET/01752-1, January, 1979, p. 28.
- 128. Ibid., p. 31.
- 129. Figure 3.6-l, "Rim-Generator Turbine," Source: Small-Scale Hydroelectric Power, DOE-NCAT, B-023-0379-l, .3M., p. 3.

- 130. Figure 3.6-2, "Bulb-Type Turbine," Source: Ibid., p. 3.
- 131. Figure 3.6-3, "Turbular-Type Turbine," Source: Ibid., p. 3.
- 132. Ibid., p. 3.

1.200

- Office of Technology Assessment (OTA), Application of Solar Technology to Today's Energy Needs, Volume II, Washington, D.C., September, 1978, p. 754.
- 134. Anderson, Bruce, Solar Energy: Fundamentals in Building Design, McGraw-Hill, New York, 1977, p. 38.
- 135. Ibid., p. 39.
- 136. Mazria, Edward, <u>The Passive Solar Energy Book</u>, Rodale Press, Emmaus, Pa., 1979, p. 28.
- 137. Ibid., pp. 73-84.
- 138. Howell, Yvonne and Justin A. Bereny, Engineer's Guide to Solar Energy, Barnes and Nobel Books, New York, N.Y., 1979.
- 139. Antolini, Holly L., ed., Sunset Homeowner's Guide to Solar Heating, Lane Publishing Co., Menlo Park, Ca., 1978.
- 140. Barnaby, Charles S., Philip Caesar and Bruce Wilcox, Solar for Your Present Home, California Energy Commission, Sacramento, Ca., 1977.
- 141. Figure 3.7-1, "Liquid Flat Plate Space Heating System," Source: Mazria, op. cit.
- 142. Figure 3.7-2, "Air and Liquid Collectors, Source: Ibid.
- 143. Office of Technology Assessment (OTA), Application of Solar Technology to Today's Energy Needs, Vol. 1, Washington, D.C., June, 1978, pp. 508-509.
- 144. Young, Frank, Electric Power Research Institute (EPRI), telephone communication based on data from Overview and Strategies for 1981-1985 Program Plan, Ocotober 1980.
- 145. "Present and Future of Solar Cooling," Solar Engineering, June, 1979, p. 14.
- 146. Ibid., p. 14.
- 147. "Component Choice is Limited," Solar Engineering, May 1979, p. 22.

- 147. "Collectors for Solar Cooling," Solar Engineering, May 1979, p. 38
- 149. Scholten, William and Henry Curran, "Active Cooling Update," Solar Age, June, 1979, p. 38.
- 150. Solar Engineering, June, 1979, op. cit., p. 15.
- 151. Scholten and Curran, op. cit., p. 39.
- 152. Figure 3.7-3, "An Adsorption Chiller," Source: OTA, Vol. I, op. cit., p. 525.
- 153. Asbury, J. and R. Mueller, "Solar Energy and Electric Utilies: Should They Be Interfaced?" Science, February 4, 1977.
- 154. Figure 3.8-1, "Central Receiver System," Source: Energy and Defense Project.
- 155. Holland, Elizabeth, "About Mirrors, Troughs, and Dishes," Solar Age, July, 1979, pp. 8-9.
- 156. "Bartow Barely Escapes House Budget Cutback," Solar Engineering, July, 1980, p. 17.
- 157. Hildebrant, A.F. and L.L. Vant-Hill, "Solar Tower Energey Collector," Technology Handbook, Douglas Considine, ed., 1977, pp. 6-26.
- 158. Solar Engineering, July, 1979, op. cit., p. 17.
- 159. Anderson, Bruce, "For A Smooth Transition," Solar Age, January, 1980, p. 13.
- 160. Solar Engineering, July 1979, op. cit., p. 17.
- 161. Ibid., p. 17.
- 162. Holland, op. cit., p. 7.
- 163. Loftness, Robert, Energy Handbook, Van Nostrand Reinhold Co., 1979, p. 352.
- 164. "Prospects for Solar Industrial Heat," Solar Engineering, March, 1980, p. 22.
- 165. Ibid., p. 22.
- 166. Holland, op. cit., p. 8.

- 167. Ibid., p. 9
- 168. Bessler, Mike, "Potential Applications of Solar Salt Gradient Ponds for the Colorado River Water Quality Improvement Program," U.S. Department of the Interior, Denver, Co., June 1980.
- 169. Neilsen, Carl E., "Nonconvective Salt Gradient Solar Ponds," from Non-Convecting Solar Pond Workshop Proceedings, Desert Research Institute, University of Nevada, July, 1980.
- 170. Ibid.
- 171. Wittenberg, Layton J. and Marc J. Harris, "City of Miamisburg Heats Pool with Salt Gradient Solar Pond," Solar Engineering, April, 1980, pp. 26-28.
- 172. Ibid.
- 173. Ormat Turbines, Ltd., "The Solar Pond Development Program in Israel," From Non-Convecting Solar Pond Workshop Proceedings, op. cit.
- 174. "Salton Sea Study to Determine Electrical Generation Potential," <u>Solar Engineering</u>, April, 1980, pp. 20-24.
- 175. "Dead Sea Project to Supply Multi-Megawatts of Power," Solar Engineering, April 1980, p. 24.
- 176. The California Governor's Office of Planning and Research in cooperation with the California Department of Water Resources, The California Water Atlas, 1979.
- 177. Figure 3.8-3, "Salton Sea Solar Pond Concept" Source: Solar Engineering, April, 1980, p. 20.
- 178. Ormat Turbines, Ltd., op. cit.
- 179. Ibid.
- 180. OTA, Renewable Ocean Energy Sources, Part I, Washington, D.C., May, 1978, p.7.
- 181. Figure 3.9-1, "Diagram of An Ocean Thermal Energy Conversion System," Source: "Power from the Sea," Rand Research Review, Vol. IV, No. 2, Rand Corporaton, Santa Monica, Ca., 1979.
- 182. CEC, Commerical Status, op. cit., p. 168
- 183. OTA, Renewable Ocean Energy Sources, op. cit., p. 21.
- 184. Ibid., p. 19.

- 185. Ibid., p. 23.
- 186. Figure 3.9-2, "S.S. Ocean Energy Converter," Source: "S.S. Ocean Energy Converter Dedicated," DOE News, July 5, 1980.
- 187. Ibid.
- 188. OTA, Application of Solar Technology to Today's Energy Needs, Vol. 1, op. cit., p. 25.
- 189. Monegon, Ltd., The Future of Solar Electricity, 1980-2000: Developments in Photovoltaics, Gaithersburg, Md., January, 1980, p. 42.
- 190. Backus, Charles E., Photovoltaics in the 1980's, Vol. 3.2, American Section of the International Solar Energy Society, Inc., Proceedings of the Annual Meeting, Phoenix, Arizona, AS/ISES, 1980.
- 191. Table 3.10-1, "Key Milestones for National Photovoltaic Coversion Program," OTA, Application of Solar Technology to Today's Energy Needs, Vol. 1, op. cit., p. 394.
- 192. Coffel, Steve, "Photovoltaics: Electricity from Sunshine," Alternative Sources of Energy, March/April, 1980.
- 193. Clark, Cheryl, "Costs May Speed Solar Energy Use," <u>Sacramento Bee</u>, (Report on California Energy Commission Hearings of July 31, August 1, 1980.)
- 194. Monegon, Ltd., op. cit.
- 195. Figure 3.10-1, "A Typical Photovoltaic Device," Source: OTA, Application of Solar Technology to Today's Energy Needs, Vol. 1, op. cit., p. 396.
- 196. Figure 3.10-2, "Sample Reflecting or Refracting Concentrator Designs," Source: Monegon, Ltd., Vol. 1, op. cit., p. 59.
- 197. Clark, C., op. cit.
- 198. "T(exas) I(nstruments) on Schedule with PV Program," Solar Engineering, July, 1980.
- 199. "Photovoltaics for Federal Facilities," Solar Engineering, September, 1979.
- 200. "Markets for Navigational Aids, Remote Villages, and Even Banks," Solar Engineering, February, 1979.

- 201. Ibid.
- 202. Clark, C., op. cit.
- 203. Ibid.
- 204. OTA, Application of Solar Technology to Today's Energy Needs, Vol. 1, op. cit., p. 422.
- 205. Ibid., p. 423.
- 206. State of California, Solar Business Office, <u>Using Solar Technology for California Agriculture</u>, November, 1980, p. 89.
- 207. Ibid., p. 89.
- 208. Table 3.11-1, "Energy Efficiency Ratings," Source: Energy and Defense Project.
- 209. Office of Technology Assessment (OTA), Energy from Biological Processes, U.S. Government Printing Office, Washington, D.C., August, 1980, p. 3.
- 210. Bethel, James S., et. al., <u>Energy From Wood</u>, Unpublished report to the Office of Technology Assessment (OTA), Congress of the United States, Washington, D.C., January, 1979, p. 8.
- 211. U.S. Congress, OTA, <u>Materials and Energy From Municipal Waste: Resource Recovery and Recycling From Municipal Solid and Beverage Container Deposit Legislation</u>, Vol. 1, July, 1979.
- 212. Figure 3.11-1, "Bioconversion Processes and Products," Source: Energy and Defense Project.
- 213. Schiefelbein, G.F., "Biomass Energy Systems Program, An Overview of Thermochemical Conversion Activities," from the Third Annual Biomass Energy Systems Conference Proceedings, DOE/SERI TP-33-285, Golden Co., October, 1979, p. 3111.
- 214. Goss, John and Richard Lang, <u>Demonstration of a Pilot Plant Gas Producer Using Biomass Residues</u>, California Energy Commission, Sacramento, Ca., July, 1980.
- 215. Figure 3.11-2, "Thermochemical Conversion Pathways for Fuels from Biomass," Source: Ann, Y.K., et al., "Research and Evaluation of Biomass Resources/Conversion/Utilization Systems," SERI/TP-33-285, op. cit., p. 467.
- 216. Seth, et. al., "The Potential for Biomass Lequefaction," SERI/TP-33-285, op. cit., pp. 131-451.

- 217. Ushiba, et. al., "Catalytic Conversion of Biomass to Fuel," SERI/TP-33-285, op. cit., p. 451.
- 218. Benemann, J.R. and N.M. Weare, "Hydrogen Evolution by Nitrogen-Fixing Anabaena Cylindrica Cutures," Science, Vol. 184, No. 4133, April 12, 1974, pp. 174, 175. Also, Benemann, J.R. and J.C. Weissman, "Hydrogen Production by Nitrogen-Starved Culture of Anabaena Cylindrica, Applied Environmental Microbiology, Vol. 33, No. 1, January, 1977, pp. 123-131.
- 219. Kispert, R.G., et al., <u>Fuel Gas Production From Solid Waste</u>, Report No. 1258, Dynatech R/D Co., Cambridge, Ma., January 31, 1975.
- 220. Figure 3.11-3, "Methane Fermentation (Anaerobic Digestion) A Three Stage Process," Source: Smith, K.D., "Methane Systems: Principles and Practice," Energy Prime, (Revised, 1978), Dell Publishing Co., New York, pp. 196-207.
- 221. Table 3.11-2, "Fermentation Compared to Thermochemical Conversion," Source: Energy and Defense Project.
- 222. McCarty, P., et. al., Heat Treatment of Organics for Increasing Anaerobic Biodegradability, U.S. E.R.D.A. Grant No. ERDA-EYU-76-5-03-0326-DA-44, Stanford University, Stanford, Ca., June, 1977.
- 223. Hamburg, Bill, Dual Fuels, Inc., Motebello, Ca., personal communication and site visit to the pilot project constructed by Dual Fuels, Inc., and erected at the Municipal sewage treatment plant in Modesto, Ca.
- 224. Abeles, T.P., L. DeBaere, D. Ellsworth, and D. Freedman, Energy and Economic Assessment: Anaerobic Digesters and Biofuels for Rural Waste Management, Environmental Protection Agency, Contract #R-804-347-010, Rice Lake, Wi., June, 1978.
- 225. Baumann, Hazen, and Taignaides, "Sludge Digestion of Farm Animal Wastes," Compost Science, Vol. 4, (2), Summer, 1963, pp. 26-28.
- 226. Table 3.11-3, "Projected Maximum Alcohol Production from U.S. Biomass REsources," Source: U.S. Department of Energy, <u>The Report of the Alcohol Fuels Policy Review</u>, DOE/PE-0012, National Technical Information Service, Springfield, Va., June, 1979.
- 227. Table 3.11-4, "Biomass Feedstocks Immediately Available for Ethanol Fuel Production," Source: Ibid.
- 228. Table 3.11-5, "Biomass Feedstocks Potentially Available for Ethanol Fuel Production," Source: Ibid.

- 229. Figure 3.11-4, "Fuels from Biomass," Source: U.S. Department of Energy, Fuels form Biomass Program Summary, DOE/ET-0022/1, UC-61, Technical Information Center, Oakridge, Tn., January, 1978.
- 230. Table 3.11-6, "Biomass Conversion Processes," Source: Benemann, John R., Biofuels: A Survey, ER-746-SR, EPRI, Palo Alto, Ca., June, 1978, pp. 4-8.
- 231. State of California, Division of Oil and Gas, "Geothermal Hot Line," Vol. 9, No. 3, September, 1979, p. 10.
- 232. U.S. DOE, op. cit., p. 127.
- 233. Figure 3.12-1, "Representative U.S. Geothermal Projects," Source: Whitaker, Ralph, "Tapping the Main Stream of Geothermal Energy," <u>EPRI Journal</u>, Vol. V., No. 4, May, 1980, p. 9.
- 234. CEC, Commercial Status: op. cit., p. 117.
- 235. Rosen, L.C., and C.R. Molenkamp, An Environmental Overview of Geothermal Development, The Geysers—Calistoga KGRA, Vol. 2, Lawrence Livermore Laboratory, July, 1978.
- 236. CEC, Commercial Status, op. cit.
- 237. Figure 3.12-2, "Dry Steam Process Using Surface Condensers," Source: Ibid.
- 238. Figure 3.12-3, "Geothermal Dry Steam Cycle and Emissions Points," Source: Ibid.
- 239. Figure 3.12-4, "Two Stage, Flashed Steam Power Generation Process," Source: Ibid.
- 220. Figure 3.12-5, "Binary Power Generation Process," Source: Ibid.
- 241. Kruger, Paul, "Geothermal Energy," Annual Review of Energy, Annual Reviews, Inc., Palo Alto, Ca., 1976, p. 159.
- 242. State of California, Division of Oil and Gas, "Geothermal Hot Line," Vol. 10, No. 1, January, 1980, p. 4.
- 243. U.S. DOE, op. cit., p. 153.
- 244. Ibid, p. 143.
- 245. CEC, Commercial Status, op. cit.

- 246. Geothermal Resources Council, <u>Direct Utilization of Geothermal Energy: A</u>
 Technical <u>Handbook</u>, Report No. 7, 1979.
- 247. Table 3.12-1, "Temperatures Required for Commercial, Industrial, and Agricultural Process Heat from Geothermal Source," Source: Renewables and Alternative Technologies Synopsis, Staff Draft, (CEC), Sacramento, Ca., September, 1980.
- 248. Ibid., p. 13.
- 249. Table 3.12-2, "Worldwide Direct Use of Geothermal Energy," Source: Ibid.
- 250. Ibid., p. 14.
- 251. Ibid., p. 14.
- 252. Blackwell, Charles A., Neil Book, and E. Hunter Herron, A Geothermal Direct Use, Economic and Engineering Study, Vol. 1, Department of Energy, August, 1979.
- 253. Ibid., p. 32.
- 254. Figure 3.13-1, "Mod-2 Wind Turbine Configuration, Diameter: 91m, Rated Power: 2.5MW," Source: Boeing Engineering and Construction Company.
- 255. Figure 3.13-2, "Poseidon L-180 Type Design, Diameter: 180m, Rated Power: 20MW," Source: Ljungstrom, Dr. Olle, "New Concepts in Vertical Axis Wind Turbines and Applications to Large Multi-MW Sizes Off-Shore Wind Turbine Systems," AIAA/SERI Wind Energy Conference Proceedings, AIAA Paper No. 80-0620, Boulder, Co., April 9-11, 1980.
- 256. Figure 3.13-3, "Cost of Wind Generators," Source: Arthur D. Little, Inc., Large Wind Turbine Generator Performance Assessment, Technology Status Report No. 1, EPRI AP-1317, Project 1348-1, January, 1980.
- 257. Ibid.
- 258. Putoff, R.L., et. al., "Installation and Checkout of the DOE/NASA Mod-1 2000 KW Wind Turbine Generator," AIAA/SERI Wind-Energy Conference Proceedings, AIAA Paper No. 80-0638.
- 259. Table 3.13-1, "Specifications of SWECS Under Development by DOE/Rocky Flats," Source: Rockwell International.
- 260. Figure 3.13-4, "Advanced SWECS Under Development (1-2 kw and 8 kw)," Source: Rockwell International.

100

- 261. Figure 3.13-5, "Annual Average Wide Power (Watts/M²) at 50M," Source: Battelle Pacific Northwest Laboratories.
- 262. Figure 3.13-6, "Annual Energy Output," Source: NASA Lewis Research Center.
- 262. Little, op. cit.
- 264. Habron, B.R., et. al., "Wind-Turbine Power Improvement with Modern Airfoil Sections and Multiple-Seed Generators," AIAA Paper No. 80-863.
- 265. Andersen, T.S., and H..S. Kirschbaum, "Multi-Speed Electrical Generator Application to Wind Turbines," AIAA/SERI Wind Energy Conference Proceedings, AIAA Paper No. 80-635.
- 266. Thomas, R.L., And R.M. Donovan, "Comments on Low-Cost Megawatt Size Wind Turbines," Large Wind Turbine Design Characteristics and R & D Conference, NASA Conference Publication 2106, DOE Conference Publication CONF-7904111, Cleveland, Oh., April 24-26, 1979.
- 267. Ginosar, M., A Large-Scale Wind Energy Program for the State of California, Doctoral Dissertation, Department of Environmental Science and Engineering, UCLA, 1979.
- 268. Lindley, C. and W. Melton, "Electric Utility Application of Wind Energy Conversion Systems on the Island of Oahu," Aerospace Corporation Contract E(49-18)-2439, Publication ATR-78-(7598)-1/UC-60, February 23, 1979.
- 269. Wegley, H., et. al., "A Siting Handbook for Small Wind Energy Conversion Systems," Publication PNL-2521 Rev. 1/UC-60, Battelle Pacific Northwest Laboratory, March, 1980.
- 270. Kornreich, T., "Environmental Issues Assessment," Proceedings of the Workshop on Economic and Operational Requirements and Status of Large Scale Wind System, Monterey, Ca., March 28-30, 1979.
- 271. Ibid.
- 272. Ibid.
- 273. Johanson, E.E., et. al., "Markets for Wind Energy Systems, When Where and What Price," AIAA/SERI Wind Energy Conference Proceedings, AIAA Paper No. 80-0613.
- 274. Table 3.13-2, "80MW Wind Farm Land Area Requirement and Number of Units," Source: Energy and Defense Project.
- 275. Table 3.13-3, "Number of Plants Required to Satisfy U.S. Electrical Demand," Source: Energy and Defense Project.

- 276. Table 3.13-4, "Wind Systems as Potential Targets," Source: Energy and Defense Project.
- 277. Little, Arthur D., Inc. "Distributed Energy Systems: A Review of Related Technologies," Department of Energy Contract No. EX-76-C-01-3871, DOE PEO3871-01/UC-60, November, 1979.
- 278. Manasse, F.K., "An Integrated Approach to Energy Supply for Small Communities," AIAA/SERI Wind Energy Conference Proceedings, AIAA Paper No. 80-0651.
- 279. Spaulding, A.P., "Wind Energy Systems MPI-200 Kilowatt Wind Turbine Generator," from NASA Conference Proceedings on Large Wind Turbine Design and R & D, op. cit.
- 280. Ibid.
- 281. Anonymous, "R & D on Salinity and Wave Power Urged," Chemical and Engineering News, June 14, 1976, pp. 28-29.
- 282. Congressional Research Service, Science Policy Research Division, Energy from the Ocean, Library of Congress, April, 1978, p. 83.
- 283. Leishman, J.M. and G. Scobie, "The Development of Wave Power," Report No. EAU M25, Ibid., p. 103.
- 284. Figure 3.14-1, "Scripps Wave Generator," Source: Energy and Defense Project.
- 285. Department of Energy, Ocean Energy Systems, A Program Summary, DOE/ET-0118, Government Printing Office, Washington, D.C., 1979, p. 198.
- 286. Ross, D., Energy from the Waves, Pergamon Press, Ltd., Oxford, England, 1979, pp. 85-97.
- 287. Ibid., pp. 71-84.
- 288. Figure 3.14-2, "The Cockerell Raft," Source: Energy and Defense Project.
- 289. Ross, op. cit., pp. 62-70.
- 290. Figure 3.14-3, "A Wave Energy System," Source: Leishman, J.M., and G. Scobie, op. cit.
- 291. Congressional Research Service, op. cit., pp. 106-109.

- 292. McCormick, Michael E., Salinity Gradients Tides and Waves as Energy, Conference Proceedings, "Energy from the Oceans Fact or Fantasy?" Report No. 76-1, UNC-SC-76-04, N. Carolina Coastal Plains Center for Marine Development Services, Raleigh, N.C., pp. 33-42.
- 293. Ross, op. cit., pp. 28-38.
- 294. Shelpuk, B., Director of the Wave Power Program of the Solar Energy Research Institute (SERI), personal communication.
- 295. Ibid.
- 296. Ibid.
- 297. Probert, K., and R. Mitchell, "Wave Energy and the Environment," New Scientist," August 2, 1978, pp. 37-373.
- 298. Battelle Memorial Institute, <u>Energy Production</u>, U.S. Department of Energy Contract EY-76-(06-1803), February, 1980.
- 299. Table 3.15-1, "An Estimate of the Cost Incentives Used to Stimulate Energy Production (In Billions of 1978 Dollars)," Source: Ibid.
- 300. Brady, J., and B. Zimbler, "Conservation, Not Synfuels, Will Cut Imports," Energy User News, August 18, 1980, p. 22.
- 301. Table 3.15-2, "Energy Supply and Demand in the Year 2050," Source: Nadis, Steven, J., "An Optimal Solar Strategy," Environment, Vol. 21, No. 9, November, 1979.
- 302. Table 3.15-3, "A Proposed Long Term Solar Energy Economy," Source: Ibid.
- 303. Ibid.