

# Contents

<b>Introduction</b>	<b>vii</b>
<b>Acknowledgments</b>	<b>x</b>
<b>SECTION I. ENGINEERING PHILOSOPHY</b>	<b>1</b>
1. Pure versus applied science	3
2. The engineering design process	5
3. Design parameters	7
4. Evaluation functions	9
5. The influence of "fads" on design	12
6. The value of simplicity in design	14
7. Specialty devices in engineered systems	16
8. No details are minor	18
9. The new technology may be closer than we realize	21
10. A re-examination of engineering education	23
11. Education: the primary ingredient in the solution of the energy dilemma	25
12. The professional's role in energy management	27
13. A chronology of building systems technology, 1929 through 1979	31
14. Can we afford engineering?	39
<b>SECTION II. CONCEPTS OF ENERGY</b>	<b>41</b>
15. A primer on energy	43
16. A definition of energy	47
17. Energy is a unique commodity	49
18. Energy transportation	51
19. Infinite source	53
20. An energy resource standard	55
<b>SECTION III. ENERGY ECONOMICS</b>	<b>59</b>
21. Energy economics is a needed science	61
22. The energy hypothesis	63
23. A case history study illustrating the need for energy economics in design	66
24. Proposed format for organizing the study of building energy economics	76
25. Return to regionalism in building design	83
26. Infinite sink?	85
27. Second law concepts	88
<b>SECTION IV. ENERGY MANAGEMENT</b>	<b>91</b>
28. Energy management	93
29. Building automation systems	95

**xii CONTENTS**

30. The laundry list	97
31. Energy audits	100
32. The structure of electric utility rates	107
<b>SECTION V. CODES AND STANDARDS</b>	<b>111</b>
33. Local building codes and energy conservation	113
34. The value of standards to society	115
<b>SECTION VI. USES OF THE COMPUTER</b>	<b>119</b>
35. The potential for the computer in the design of building environmental systems	123
36. A reevaluation of computer use	125
37. The computer as a tool for energy analysis	127
38. Computer applications for systems design and analysis	134
<b>SECTION VII. FINANCIAL CONSIDERATIONS</b>	<b>145</b>
39. Energy-effective machinery can be self-financing (a case history)	147
40. Investment optimization: a methodology for life-cycle cost analysis	149
41. Single equation for cogeneration financial feasibility determination	158
<b>SECTION VIII. ENERGY SOURCE SYSTEMS</b>	<b>163</b>
42. Selecting an energy source and conversion system	165
43. The myth of free steam	167
44. An oil-fired integrated plant design	170
45. The status of total energy in 1980	181
<b>SECTION IX. LIQUID AND TWO-PHASE THERMAL FLUID SYSTEMS (HYDRONICS, STEAM, AND REFRIGERANTS)</b>	<b>183</b>
46. Hydronic systems overview	185
47. Integrated decentralized chilled water systems	190
48. A case study of an integrated decentralized chilled water system	198
49. Preheating outdoor air with transfer fluid systems	211
50. A state of the art update in steam technology	219
51. Vapor lock in refrigeration systems	222
<b>SECTION X. AIR SYSTEMS, ADJUSTING, AND BALANCING</b>	<b>225</b>
52. Correct use of the fan curve	227
53. Analysis of fan/system characteristics and applications	229
54. The relationships between system balance and energy use	236
<b>SECTION XI. MAINTENANCE MANAGEMENT AND RELIABILITY</b>	<b>241</b>
55. Planned versus failure maintenance	245
56. Lack of effective maintenance causes excessive energy consumption	247
57. Designing for reliability	249
58. Consumer concerns relating to durability, reliability, and serviceability	251
<b>SECTION XII. EVALUATING THE EFFECTIVENESS OF ENERGY UTILIZATION</b>	<b>255</b>
59. Thermodynamic versus system efficiency	257
60. Thermal effectiveness of a vapor compression cycle	259
61. Energy-effectiveness factor	261
<b>Appendix</b>	<b>268</b>
<b>Index</b>	<b>271</b>