CHAPTER 3. INITIAL COSTS, SERVICE LIFE AND ANNUAL EXPENSE FACTORS OF FACILITIES AND EQUIPMENT

3-1. GENERAL. Tabulations are included for estimated service life and annual expense factors of equipment and facilities for lighting, refrigeration, cooking, domestic hot water and space heating to be used to compare relevant alternative utility combinations only. The tabulations are approximate national averages and should be used as a guide in preparing the life-cycle cost of utility systems described in Chapter l. The tabulations may be used in preparing Form HUD-5l994 if they correspond to local conditions. The tabulations should be adjusted if local conditions differ. The tabulations should not be used for budgeting purposes, establishing rental schedules or estimating construction costs.

3-2. INITIAL COSTS AND SERVICE LIFE.

a. Initial costs should be obtained from the equipment manufacturer, architect/engineer, or the HUD Field Office. In the absence of actual local cost data, use commercially available cost estimation guides.

b. The service life in years are for properly designed, installed and maintained equipment for the particular conditions. These years should not be modified unless local experience has the approximate average service life of the facility. For example, equipment in projects built during the past ten years should have incurred a portion of their normal service life and would not necessarily indicate the average annual replacement expense over a 20-year period, the study-life of the analysis.

3-3. ANNUAL CHARGES FOR REPLACEMENT. The annual expense factors for replacement are a percent of the initial cost. If initial cost percentages were deposited each year in a Sinking Fund at 5 percent interest, enough money would accumulate to replace the equipment at the end of the service life. If local experience indicates service life different from those listed, the following tabulations may be used:

Service Life-Yrs.	Annual Expense Factor	Service Life-Yrs.	Annual Expense Factor	Service Life-Yrs.	Annual Expense Factor
1	100.00	15	4.63	29	1.60
2	48.76	16	4.23	30	1.51
3	31.72	17	3.87	31	1.41
4	23.20	18	3.55	32	1.33
5	18.10	19	3.27	33	1.25
6	14.70	20	3.02	34	1.18
7	12.28	21	2.80	35	1.11

8	10.47	22	2.60	36	1.04
9	9.07	23	2.41	37	0.98
10	7.95	24	2.25	38	0.93
11	7.04	25	2.10	39	0.88
12	6.28	26	1.96	40	0.83
13	5.65	27	1.83	50	0.48
14	5.10	28	1.71		

3-4. PROCEDURE FOR MAKING ADJUSTMENTS. A facility or an equipment item may be modified based on local conditions as stated in paragraph 3-3, but a corresponding adjustment must be made in the annual charges for replacement.

a. If a change is made in initial cost but not in service life, the new initial cost is multiplied by the annual expense factor to obtain the adjusted annual charges for replacement for dollars per dwelling unit.

b. If a service life change is made, the corresponding annual expense factor for replacements is selected from paragraph 3-3. The initial equipment cost is multiplied by the new annual expense factor to obtain the new annual charges for dollars per dwelling unit.

c. The annual expense factors should not be modified because of local experience unless the approximate average service life of the considered facility is covered.

3-5. ANNUAL EXPENSES FOR MAINTENANCE AND REPAIRS. The annual-expense factors for maintenance and repairs are a percent of the initial costs and are averaged over the equipment's service life. If local experience indicates that the annual expenses for maintenance and repair are significantly different from the amount determined by multiplying the annual-expense factor times the initial costs, then locally developed factors should be utilized.

TABLE I
ELECRICAL SYSTEM

Equipment and Service Life	Annual-Expense Factors: Estimated Service Life in Years	Replacements	Maint. and Repairs	Total
Substation				
Outdoor	40	0.83%	1.50%	2.33%
Indoor	40	0.83	1.16	1.99
Exterior Distribution				
Overhead	24	2.25	1.25	3.50
Underground	26	1.96	1.24	3.20
Interior Wiring	37	0.98	1.82	2.80

Checkmeters	20	3.02	4.00	7.02

TABLE II
NATURAL GAS SYSTEMS

Facility or Equipment	Estimated Service Life in Years	Annual-Expense Factors: Replace-ments	Maint. and Repairs	Total
Exterior Distribution	20	3.02%	1.00% 2/	4.02% 1/
Interior Piping	40	0.83	0.50	1.33
Checkmeters	30	1.51	3.50 2/	5.01 2/

1/ This table covers only the additional facilities necessary to supply domestic hot water from a project-operated space heating system. Where a complete and separate project-operated domestic hot water system is proposed, the initial costs of the necessary boilers and other heating equipment will be approximately 30 percent of the values shown for such items in Table IV.

2/ Installation of this equipment may justify the use of demand limiting devices. The cost of such devices should be added to these costs.

TABLE III
PROJECT OPERATED DOMESTIC HOT WATER EQUIPMENT

Facility or Equipment	Estimated Service Life in years	Annual Expense Factors: Replace-ments	Maint. and Repairs	Total
Boilers and Auxiliaries 1/				
Storage Tanks With heater coils	20	3.02%	2.00%	5.02%
Circulating Pumps	15	4.63	2.00	6.63
Exterior Piping System (copper tubing)				
Fabricated Conduit	20	3.02	2.00	5.02
Concrete Trench	30	1.51	1.25	2.76
Interior Piping in Buildings				
Galvanized Steel	20	3.02	2.50	5.52
Galvanized W.I.	20	3.02	2.50	5.52
Copper	40	0.83	2.00	2.83
Electric Storage Water Heaters with Lined Tanks 2/				
Row Houses and				

Apartments	20	3.02	1.00	4.02
Hi-Rise Apartments	20	3.02	1.00	4.02

1/ This table covers only the additional facilities necessary to supply domestic hot water from a project-operated space heating system. Where a complete and separate project-operated domestic hot water system is proposed, the initial costs of the necessary boilers and other heating equipment will be approximately 30% of the values shown for such items in Table IV.

2/ Installation of this equipment may justify the use of demand limiting devices. The cost of such devices should be added to these costs.

TABLE IV

PROJECT OPERATED SPACE HEATING EQUIPMENT

Facility or Equipment	Estimated Service Life in years	Annual-Expense Factors: Replace-ments	Maint. and Repairs	Total
Boilers and Auxiliaries Except Fuel Firing Equipment 1/				
Low Pressure Steam or Forced Hot Water	30	1.51%	1.50%	3.01%
High Pressure Steam	30	1.51	1.50	3.01
Fuel Firing Equipment 1/				
Gas Burner	25	2.10	1.00	3.10
Oil Burner (Light Oil)	25	2.10	1.50	3.60
Oil Burner (Heavy Oil) 2/	25	2.10	2.00	4.10
Exterior Piping System (Fabricated Conduit Methods or Concrete Trenches) If possible, lay out system and make preliminary estimate of cost. Otherwise the following figures, when properly adjusted may be used for estimating:				
Two-Story Buildings	20	3.02	2.00	5.02
Three-Story Buildings	20	3.02	2.00	5.02
Multi-Story Buildings	20	3.02	2.00	5.02
Piping, Radiators and Specialties in buildings	40	0.83	1.25	2.08
Electrical Work	37	0.98	1.82	2.80

1/ Includes capacity for domestic hot water. For space heating only, use 70% of the applicable amounts. Cost for oil equipment includes cost for oil storage tanks.

2/ Add 20% for Combination Gas-Oil burner.

TABLE V

INDIVIDUAL DWELLING DOMESTIC HOT WATER EQUIPMENT

Facility or Equipment	Estimated Service Life in years	Annual-Expense Factors: Replacements	Maint. and Repairs	Total
Automatic Storage Water Heaters(30 Gallons) 1/				
Gas Lined Tank 2/	10	7.95%	1.00%	8.95%
Oil Lined Tank 2/	12	6.28	2.25	8.53
Electric Lined Tank 2/	10	7.95	1.00	8.95
Storage Tank (30 Gallons) Lined Tank 2/	20	3.02	1.00	4.02
Indirect Coil in Boiler	20	3.02	1.00	4.02
Hot Water Piping				
Galvanized Steel	20	3.02	2.50	5.52
Galvanized W.I.	20	3.02	2.50	5.52
Copper	40	0.83	2.00	2.83

1/ Heaters of the same storage capacity but with different fuels may not produce the same amount of hot water per hour. The size of the heater should be checked for adequacy of hot water supply and conformance to utility company requirements, and costs adjusted as necessary.

2/ Cement, glass, porcelain, or similar lining.

TABLE VI

INDIVIDUAL DWELLING SPACE HEATING EQUIPMENT

Estimated	Annual-Expense Factors: Maint.

Facility or Equipment	Service Life in years	Replace-ments	Maint. and Repairs	Total
Space (Room) Heater				
Electric	15	4.63%	1.00%	5.63%
Gas	15	4.63	2.00	6.63
Oil	12	6.28	2.50	8.78
Wall Furnace (Recessed heaters)				
Gas	15	4.63	2.03	6.66
Forced Warm Air System				
Gas				
Furnace with integral burner, blower and controls	20	3.02	1.50	4.52
Duct Work	30	1.51	1.00	2.51
Elect. Conn.	30	1.51	0.50	2.01
Oil				
Furnace with integral burner, blower and controls	20	3.02	1.75	4.77
Duct Work	30	1.51	1.00	2.51
Elect. Conn.	30	1.51	0.50	2.01
Oil Tank and Piping	20	3.02	1.50	4.52
Hot Water System				
Gas				
Complete System with integral boiler-burner unit and controls	30	1.51%	1.25%	2.76
Pump	15	4.63	2.00	6.63
Elect. Conn.	30	1.51	0.50	2.01

TABLE VI (Con't)

INDIVIDUAL DWELLING SPACE HEATING EQUIPMENT

Facility or Equipment	Estimated Service Life in Years	Annual-Expense Factors: Replace-ments	Maint. and Repairs	Total
Oil				
Complete System without burner, with controls	30	1.51	1.25	2.76
Burner	20	3.02	2.00	5.02
Pump	15	4.63	2.00	6.63
Elect. Conn.	30	1.51	0.50	2.01
Oil Tank and Piping	20	3.02	1.50	4.52

Electric (Exc. Wiring)				
Baseboard	40	0.82	0.50	1.32
Ceiling Cable	40	0.82	0.50	1.32
Forced Air Wall Heaters	20	3.02	1.00	4.02
Package Furnace (Exc. Ducts)				
w/dx Elec. Cooling	20	3.02	1.50	4.52
Heat Pump (inc. Cooling)	11	7.04	10.00	17.04
Hydronic Boiler	20	3.02	1.25	4.27
Package Terminal (Heating and Cooling)	15	4.63	10.00	14.63

TABLE VII

STRUCTURAL AND RELATED ITEMS

Facility or Equipment	Estimated Service Life in Years	Annual-Expense Factors: Replace-ments	Maint. and Repairs	Total
Additional Roads for Fuel Deliveries	40	0.83%	.50%	1.33%
Boiler Rooms in Basement of Dwelling Buildings (Including stack) (Up to 200 DU) 1/				
Oil or Gas Fired	40	0.83	.50	1.33
Furnace Room in Dwelling	40	0.83	.50	1.33
Full Basements 2/				
Under 3-StoryBldg.	40	0.83	.50	1.33
Crawl Spaces (3' - 0")				
Under2-StoryBldg.	40	0.83	.50	1.33
prefabricated Flues - Metal				
All Fuels (One-and Two-Story)	20	3.02	.50	3.52
Prefabricated Flues - Ceramic				
All Fuels (One-and Two-Story)	30	1.51	.50	2.01

1/ For larger boiler rooms or for central plants, sketches should be prepared for estimated costs.

2/ Additional cost over that of a floor slab on the ground.

TABLE VII (Cont')

STRUCTURAL AND RELATED ITEMS

Facility or Equipment	Estimated Service Life in Years	Annual-Expense Factors: Replace-ments	Maint. and Repairs	Total
Flues (Continued)				
Single 8" x 8" Masonry				
1-Story Flat Roof	40	0.83%	.79%	1.62%
1-Story Pitch Roof	40	0.83	.63	1.46
2-Story Flat Roof	40	0.83	.53	1.36
2-Story Pitch Roof	40	0.83	.48	1.31
Add for Basement	40	0.83	.50	1.33
Two 8" x 8" Masonry (for two dwellings)				
1-Story Flat Roof	40	0.83	.75	1.58
1-Story Pitch Roof	40	0.83	.59	1.42
2-Story Flat Roof	40	0.83	.50	1.33
2-Story Pitch Roof	40	0.83	.42	1.25
Add for Basement	40	0.83	.50	1.33
One 8" x 8" and one 8"x 4" Masonry (for two dwellings)				
1-Story Flat Roof	40	0.83	.89	1.72
1-Story Pitch Roof	40	0.83	.74	1.57
2-Story Flat Roof	40	0.83	.58	1.41
2-Story Pitch Roof	40	0.83	.47	1.30
Add for Basement	40	0.83	.50	1.33
Two 8" x 8" and two 8"x 4" Masonry (for two dwellings)				
1-Story Flat Roof	40	0.83	.70	1.53
1-Story Pitch Roof	40	0.83	.53	1.36
2-Story Flat Roof	40	0.83	.45	1.28
2-Story Pitch Roof	40	0.83	.38	1.21
Add for Basement	40	0.83	.50	1.33

Table VIII

COOKING AND AIR-CONDITIONING EQUIPMENT

Facility or Equipment	Estimated Service Life in years	Annual-Expense Factors: Replace-ments	Maint. and Repairs	Total
Ranges				
Electric	10	7.95	3.13	11.08

Gas	10	7.95	2.50	10.45
Electric Air Conditioning Systems Thru-Wall-l5,OOO BTU (a),(b),(c)	10	7.95	5.0	12.95
Central Dwelling Unit - 1 1/2 - 2 Ton (a)(b)	15	7.95	10.0	17.95
Heat Pump (a),(b),(c)	15	7.04	10.0	17.04
Package Terminal Heating & Cooling	15	4.63	10.0	14.63
Electric Motor Compressor With Chiller (b),(c)	20	3.02	5.0	8.02
Gas Air Conditioning Systems - Air Cooled Absorption Heating & Cooling	15	4.63	10.0	14.63
Water Cooled Absorption 25 to 100 Tons (b),(c)1/	20	3.02	5.0	8.02

(a) Single & Twin Houses
(b) Row Houses and Garden Apartments
(c) Hi-Rise Apartments

1/ Chiller and piping added to high temperature or steam boiler.