

# CATALOG OF ENERGY SYSTEMS

## Footnotes for catalog tables

**a** 1 Bbl. crude Oil is equivalent to 4.83 mmBtu after 17% loss due to refining, transportation, etc. Combined electrical generation, transmission, and distribution efficiency is 29 percent.

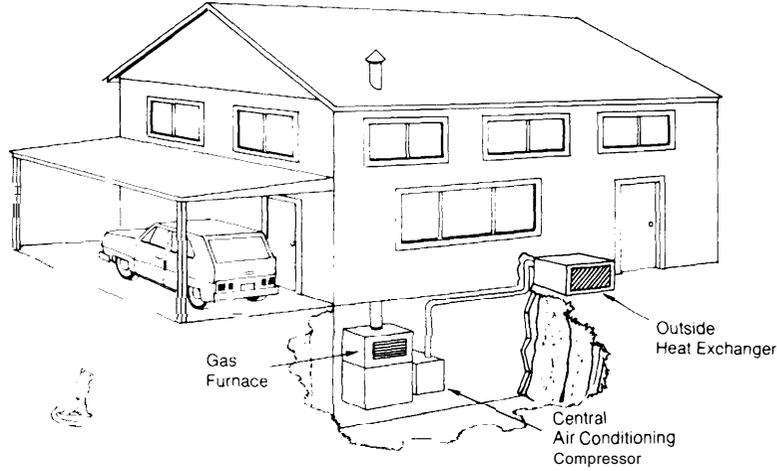
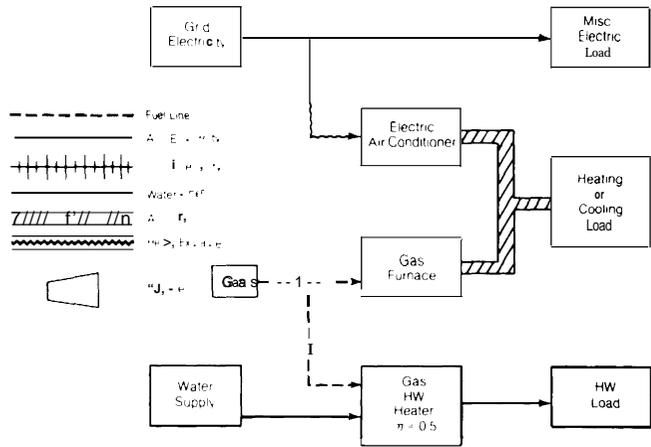
**b** The energy Cost escalation assumptions are described in detail in chapter II, volume II. In all cases, 5.5 percent inflation is assumed.

**C** The other costs assume that the energy equipment is owned by the building owners (see page 97). The equipment in the conventional communities is also owned by the owners of each of the buildings, while in the other communities, it is owned by a municipal utility. In all cases, the parenthesized costs assume ownership by an investor-owned utility using normalized accounting.

**d** "1985 Startup" is the same as "1976 Startup" except that fuel costs have escalated for 9 years. For ease of comparison with "1976 Startup," 5.5 percent inflation between 1976 and 1985 has been removed.

**e** These levelized prices are computed from the price paid for energy in the reference nonsolar system.

Table IV-1.-Albuquerque: Conventional System—Single Family House Using Gas Heat, Hot Water, and Central Electric A/C (SF-1)



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Gas furnace	45 M Btu/h 15 S/M Btu/h		\$675	0	15
2. Ductwork			425	0	30
3. Central electric a/c	1.85 tons	430 \$/ton	796	\$30	10
4. Gas HW Heater	40 gal	225 ea.	225	0	15
<b>TOTAL</b>			<b>\$2,121</b>	<b>\$30</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-1)

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
Total with no incentives	116.	(128.)	153.	(165.)	226.	(238.)
Total with 20% IT	116.	(128.)	153.	[165.]	226.	(238.)
Total with full incentives	116.	(128.)	153.	(165.)	226.	[238.]
<b>2. 1985 Startup<sup>d</sup></b>						
(capital related costs)	29.	[41.]	29.	(41.)	29.	[41.]
(operating & maintenance costs)	4.	[4.]	4.	(4.)	4.	(4.)
(fuel bill)	36.	(36.)	73.	(73.)	108.	(108.)
(electric bill)	48.	(48.)	67.	(67.)	146.	(146.)
Total with no incentives	116.	(128.)	173.	(185.)	287.	(299.)
Total with 20% ITC	116.	(128.)	173.	(185.)	287.	(299.)
Total with full incentives	116.	(128.)	173.	(185.)	287.	[299.]

**ANNUAL ENERGY FLOWS (Conventional reference system is SF-1)**

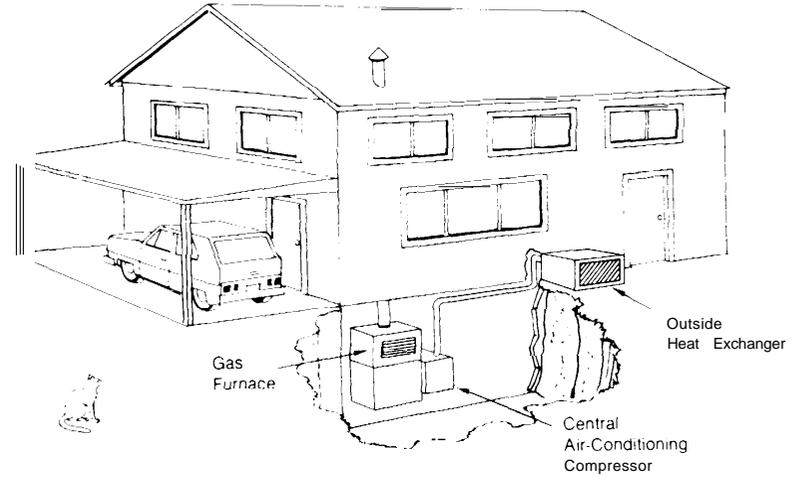
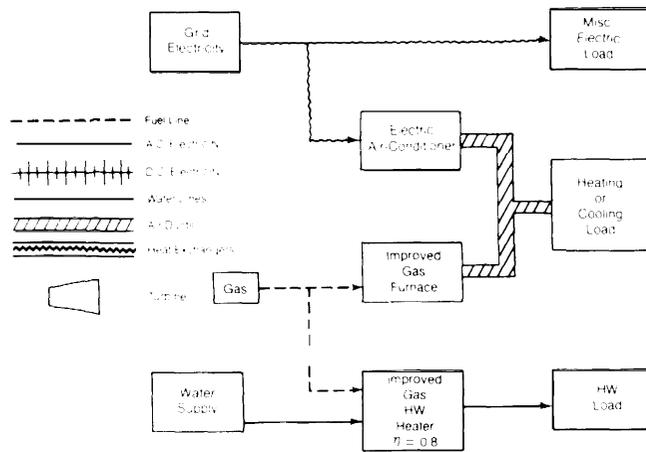
	Energy consumed by ref. system	Backup consumed solar/conservation	W/ Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	11.3	11.3	0.
Fuel consumed onsite (MMBtu/unit)	164.	164.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup>	62.	62.	0.
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			5.2

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-1)

Levelized cost of solar energy or 'conservation' energy <sup>c</sup>	Type of incentives given				
	No incentives		20% ITC		Full incentives
\$/MMBtu primary (a)	N/A	(N/A)	N/A	(N/A)	N/A (N/A)
¢/kWh electricity	N/A	(N/A)	N/A	(N/A)	N/A (N/A)
<b>Escalation of conventional energy cost</b>					
Levelized price paid for conventional energy <sup>b,*</sup>	Constant real energy prices		Energy price escalation I		Energy price escalation II
	\$/MMBtu primary	3.37	4.86	7.80	
¢/kWh electricity	3.97	5.73	9.18		

Table IV-2.—Albuquerque: Conventional System—Single Family House Using Improved Gas Heat, Hot Water, and Central Electric A/C



A. ITEMIZED COST OF COMPONENTS

Component	Size	Unit cost	First cost (incl. O & P)	Annual Life O & M (yrs)
1. Gas furnace.....	45M Btuh	17 \$/M Btuh	\$765	0
2. Ductwork.....			425	0
3. Central electric a/c.....	1.85 tons	430 \$/ton	796	\$30
4. Gas water heater.....	40 gal	\$275 ea.	275	0
<b>TOTAL.....</b>			<b>\$2,261</b>	<b>\$30</b>

B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>

(Conventional reference system is SF-1)

	Escalation of conventional energy costs		
	constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
<b>a. Costs using solar (conservation) system:</b>			
Total with no incentives.....	111. (123.)	143. (155.)	210. (223.)
Total with 20% IT.....	111. (123.)	142. (155.)	210. (223.)
Total with full incentives.....	110. (122.)	142. (154.)	210. (222.)
<b>b. Costs using conventional reference system.....</b>	<b>117.</b>	<b>154.</b>	<b>226.</b>
<b>2. 1985 Startup<sup>d</sup></b>			
<b>a. Costs using solar (conservation) system:</b>			
(capital related costs).....	31. (43.)	31. (43.)	31. (43.)
(operation & maintenance costs).....	4. (4.)	4. (4.)	4. (4.)
(fuel bill).....	28. (28.)	58. (58.)	85. (85.)
(electric bill).....	48. (48.)	67. (67.)	146. (146.)
Total with no incentives.....	111. (123.)	160. (172.)	266. (278.)
Total with 20% IT.....	111. (123.)	160. (172.)	266. (278.)
Total with full incentives.....	110. (122.)	159. (171.)	265. (277.)
<b>b. Costs using conventional reference system.....</b>	<b>117.</b>	<b>174.</b>	<b>287.</b>

C. EFFECTIVE COST OF ENERGY TO CONSUMER

(Conventional reference system is SF-1)

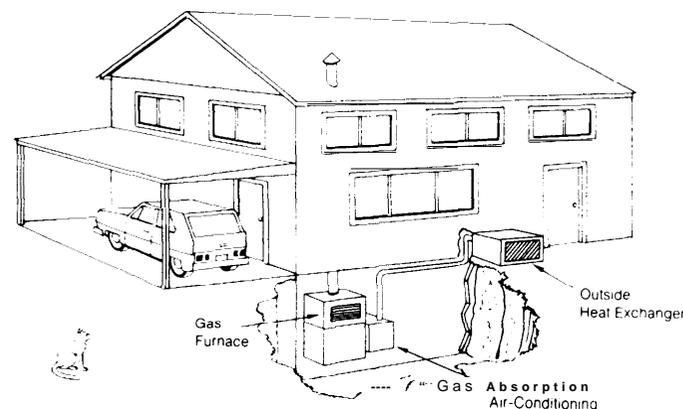
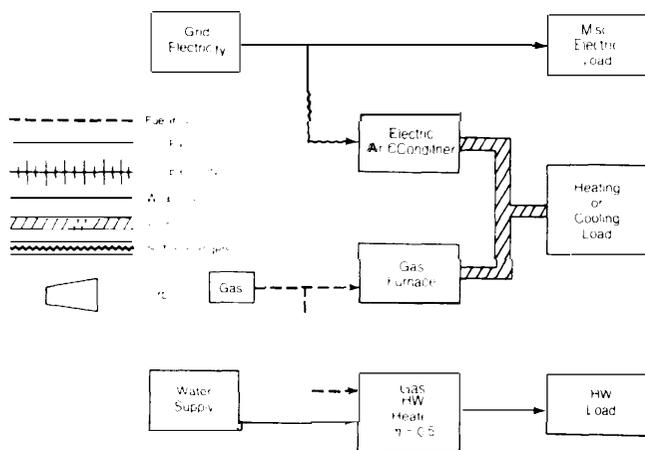
ANNUAL ENERGY FLOWS

(Conventional reference system is SF-1)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit).....	11.3	11.3	0.
Fuel consumed onsite (MMBtu/unit).....	164.	129.	21.4
Total energy requirement (bbl crude equiv.) <sup>a</sup> .....	62	54.	11.9
Electricity sold to grid annually (MWh, entire building).....			
Annual peak electricity demand (kW, entire building).....			5 <sup>2</sup>

Levelized cost of solar energy or 'conservation' energy <sup>a</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel.....	.61 (4.84)	.53 (4.77)	.43 (4.56)
¢/kWh electricity.....	.71 (5.70)	.62 (5.62)	.51 (5.36)
<b>Levelized price paid for conventional energy<sup>b*</sup></b>			
		Escalation of conventional energy costs	
	Constant real energy prices	Energy price escalation I	Energy price escalation II
\$/MMBtu primary fuel.....	3.37	4.86	7.80
¢/kWh electricity.....	3.97	5.73	9.28

Table IV-3.—Albuquerque: Conventional System— Insulated Single Family House Using Gas Heat, Hot Water, and Central Electric A/C



A. ITEMIZED COST OF COMPONENTS

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Gas furnace.....	.31 M Btu/h	15 \$/M Btu/h	\$465	0	15
2. Ductwork.....	—	—	425	0	30
3. Central electric coil.....	1.3 tons	430 \$/ton	559	\$30	10
4. Gas water heater.....	40 gal	225 ea.	225	0	15
5. Extra insulation, storm doors and windows.....	—	—	981	0	30
<b>TOTAL</b> .....			<b>\$2,655</b>	<b>\$30</b>	

B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>

(Conventional reference system is SF-1)

	Escalation of conventional energy costs			
	Constant real energy prices	Energy price escalation I	Energy price escalation II	Energy price escalation III
<b>1. 1976 Startup</b>				
a. <b>Costs using solar (conservation) system:</b>				
Total with no incentives.....	106.	(1 19.)	136.	(149.)
Total with 20% ITC.....	105.	(1 19.)	135.	(149.)
Total with full incentives.....	103.	(1 16.)	133.	(146.)
b. <b>Costs using conventional reference system</b> .....	116.		153.	226.
<b>2. 1985 Startup<sup>d</sup></b>				
a. <b>Costs using solar (conservation) system:</b>				
(capital related costs).....	30.	(43.)	30.	(43.)
(operation & maintenance costs).....	4.	(4.)	4.	(4.)
(fuel bill).....	26.	(26.)	54.	(54.)
(electric bill).....	46.	(46.)	65.	(65.)
Total with no incentives.....	106.	(119.)	153.	(166.)
Total with 20% ITC.....	105.	(119.)	152.	(165.)
Total with full incentives.....	103.	(116.)	150.	(162.)
b. <b>Costs using conventional reference system</b> .....	116.		173.	287.

C. EFFECTIVE COST OF ENERGY TO CONSUMER

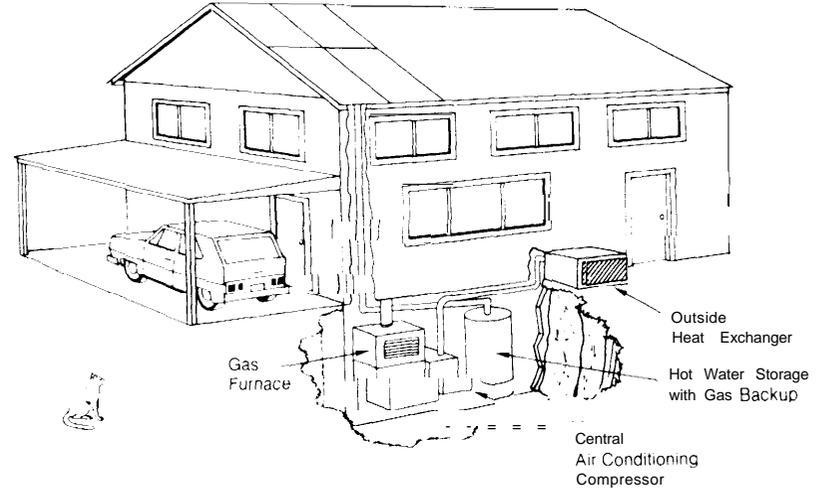
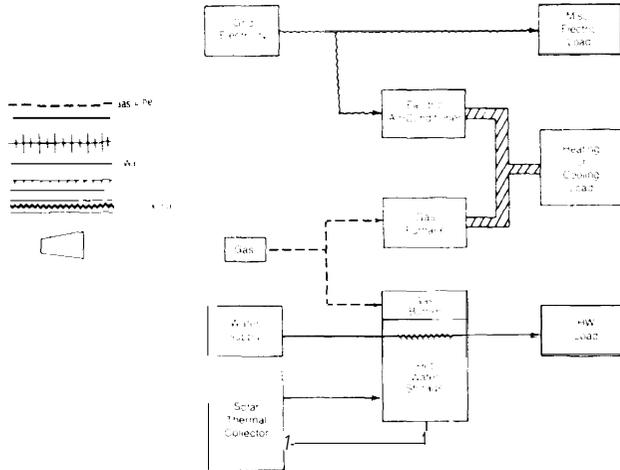
(Conventional reference system is SF-1)

ANNUAL ENERGY FLOWS (Conventional reference system is SF-1)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit).....	11.3	10.7	4.9
Fuel consumed onsite (MMBtu/unit).....	164.	121.	26.4
Total energy requirement (bbl crude equiv.) <sup>a</sup> .....	62.	51.	16.8
Electricity sold to grid annually (MWh, entire building).....			0.
Annual peak electricity demand (kW, entire building).....			4.3

Levelized cost of solar energy or 'conservation' energy <sup>c</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel.....	.22 (3.38)	.01 (3.21)	-.45 (2.62)
¢/kWh electricity.....	.26 (3.98)	.02 (3.77)	-.54 (3.08)
<b>Levelized price paid for conventional energy<sup>b,*</sup></b>			
\$/MMBtu primary fuel.....	3.37	4.86	7.80
¢/kWh electricity.....	3.97	5.73	9.18

**Table IV.4.—Albuquerque: Solar Hot Water System—Single Family House Using Flat-Plate Collectors (1977 Prices); Building Equipped With SF-1 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Gas furnace	45M Btuh	15 \$/M Btuh	\$675	0	15
2. Ductwork	—	—	425	0	30
3. Central electric a/c	1.85 tons	430 \$/ton	796	\$30	10
4. Hot water storage with gas fired backup (including heat exchanger)	100 gal	\$380	380	0	30
5. Pumps and control	—	\$250	250	0	10
6. Insulated steel pipe	75 ft	\$2.6/ft	195	0	30
7. Flat plate solar collectors	10 m <sup>2</sup>	143 \$/m <sup>2</sup>	1430	0	30
—Collector cost @ 95 \$/m <sup>2</sup>			950	0	15
—Installation @ 16 \$/m <sup>2</sup>			160	0	15
—Transportation @ \$ 3/m			30	0	15
—Overhead and profit= 25%			270	0	15
<b>TOTAL</b>			<b>\$4,151</b>	<b>\$30</b>	

\*½ installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs.

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-1)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	11.3	11.3	0.
Fuel consumed onsite (MMBtu/unit)	164.	117.	28.7
Total energy requirement (bbl crude equiv.) <sup>a</sup>	62.	52.	15.9
Electricity sold to grid annually (MWh, entire building)	0.	0.	0.
Annual peak electricity demand (kW, entire building)	5.2	5.2	0.

**8. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>bc</sup>**

(conventional reference system is SF-1)

	Escalation of conventional energy costs			
	Constant real energy prices	Energy price escalation I	Energy price escalation II	
<b>1. 1976 Startup</b>				
<b>a. Costs using solar (conservation) system:</b>				
Total with no incentives	127.	148.	157.	(178.)
Total with 20% IT...	124.	146.	154.	[176.]
Total with full incentives	120.	136.	150.	[166.]
<b>b. Costs using conventional reference system</b>	117.	154.	216.	(232.)
<b>2. 1985 Startup<sup>d</sup></b>				
<b>a. Costs using solar (conservation) system:</b>				
(capital related costs)	50.	(71.)	50.	(71.)
(operation & maintenance costs)	4.	(4.)	4.	(4.)
(fuel bill)	25.	(25.)	52.	(52.)
(electric bill)	48.	(48.)	67.	(67.)
Total with no incentives	127.	148.	174.	[195.]
Total with 20% IT...	124.	146.	170.	[192.]
Total with full incentive	120.	136.	166.	[182.]
<b>b. Costs using conventional reference system</b>	117.	174.	270.	(286.)

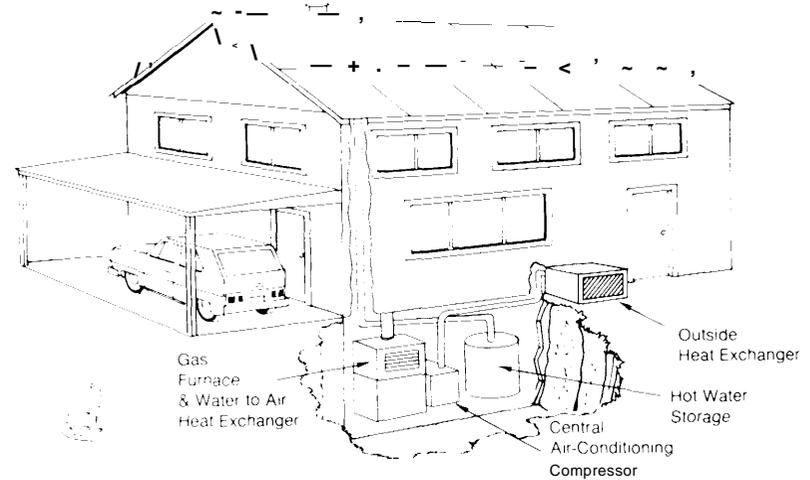
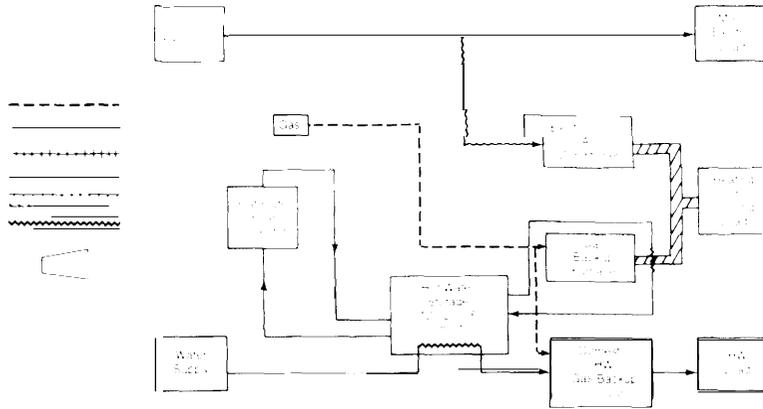
**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-1)

Levelized cost of solar energy or 'conservation' energy <sup>e</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	5.33 (10.64)	4.50 (9.94)	3.41 (7.58)
¢/kWh electricity	6.27 (12.53)	5.30 [11.69]	4.01 [8.92]
<b>Levelized price paid for conventional energy<sup>b*</sup></b>			
\$/MMBtu primary fuel	3.37	4.86	7.80
¢/kWh electricity	3.97	5.73	9.18



**Table IV-6.—Albuquerque: Solar Hot Water and Heating System—Single Family House Using Flat-Plate Collectors (1977 Prices), Low Temperature Thermal Storage; Building Equipped With SF-1 Space Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life " (yrs)
1. Gas furnace	45 M Btuh	15 \$/M Btuh	\$675	0	15
2. Central electric O/C	1.85 tons	430 \$/ton	796	\$30	10
3. Ductwork	—	—	425	0	30
4. Collectors and associated costs	45 m <sup>2</sup>	143 \$/m <sup>2</sup>	● 3,218	0	15
—Collectors @ 95 \$/m <sup>2</sup>			● 3,218	0	30
—Installation @ 16 \$/m <sup>2</sup>					
—Transportation @ 3 \$/m <sup>2</sup>					
—25 % overhead and profit					
5. 3/4" insulated steel pipe	125 ft	\$4.1	513	0	30
6. Storage (without plumbing)	200 kWh	\$2.05/kWh	410	0	30
7. Pump, controls, and heat exchanger	—	\$650	650	0	10
<b>TOTAL</b>			<b>\$9,905</b>	<b>\$30</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>991c</sup>**

(Conventional reference system is SF-1)

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
a. Costs using solar (conservation) system:						
Total with no incentives	173.	(222.)	192.	(240.)	248.	(297.)
Total with 20% IT...	161.	(211.)	179.	(230.)	236.	(286.)
Total with full incentives	144.	(175.)	163.	(194.)	219.	(250.)
b. Costs using conventional reference system	117.		154.		226.	
<b>2. 1985 Startup<sup>a</sup></b>						
o. Costs using solar (conservation) system:						
(capital related costs)	112.	(160.)	112.	(160.)	112.	(160.)
(operation & maintenance costs)	4.	(4.)	4.	(4.)	4.	(4.)
(fuel bill)	9.	(9.)	19.	(19.)	28.	(28.)
(electric bill)	48.	(48.)	67.	(67.)	146.	(146.)
Total with no incentive!	173.	(222.)	202.	(251.)	290.	(338.)
Total with 20% ITC	161.	(211.)	190.	(240.)	277.	(328.)
Total with full incentives	144.	(175.)	173.	(204.)	261.	(292.)
b. Costs using conventional reference system	117.		174.		287.	

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-1)

Levelized cost of solar energy or "conservation" energy <sup>a</sup>	Type of incentives given		
	No incentive	20% ITC	Full Incentives
\$/MMBtu primary fuel	8.15 (12.93)	6.92 [11.B8]	5.30 (8.37)
¢/kWh electricity	9.60 (15.22)	8.14 (13.98)	6.23 (9.85)
<b>Levelized price paid for conventional energy<sup>b</sup>*</b>			
	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
\$/MMBtu primary fuel	3.37	4.86	7.80
¢/kWh electricity	3.97	5.73	9.18

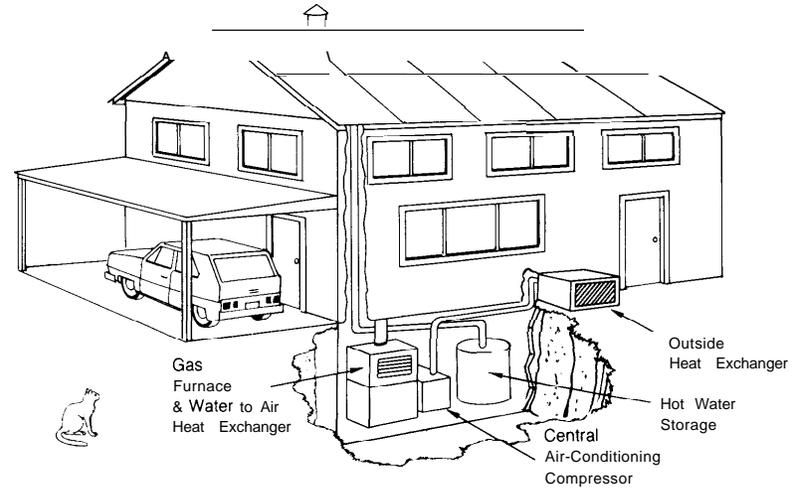
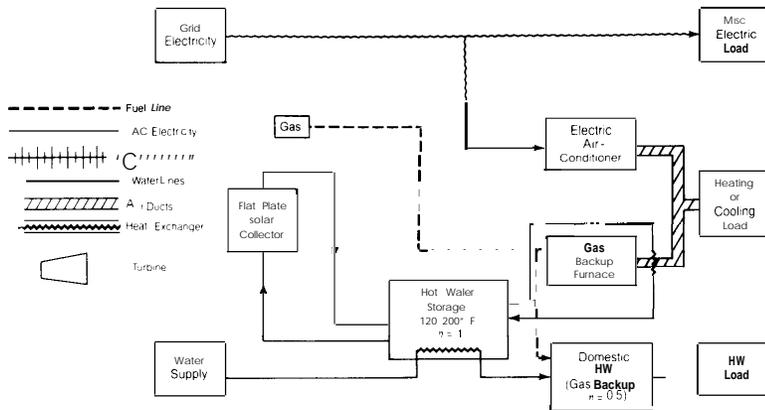
• 1/2 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-1)

	Energy consumed by ref. system	Backup consumed w/ solar conservation	Energy saved (% of total)
Net Electricity (bought/sold) (MWh/unit)	11.3	11.3	-1
Fuel consumed onsite (MMBtu/unit)	164.	42.	74.1
Total energy requirement (bbl/crude equiv. <sup>a</sup> )	62.	36.	41.0
Electricity sold to grid annually (MWh, entire building)			5.2
Annual peak electricity demand (kW, entire building)			5.2

**Table IV-7.—Albuquerque: Solar Hot Water and Heating System—Single Family House Using Flat-Plate Collectors (Possible Future Price), Low-Temperature Thermal Storage; Building Equipped With SF-1 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O & P)	Annual O & M	Life (yrs)
1. Gas furnace	45 M Btuh	15 \$/M Btuh	\$675	0	15
2. Control electric a/c	1.85 tons	430 \$/ton	796	\$30	10
3. Ductwork			425	0	30
4. Collectors and associated costs	45 m <sup>2</sup>	86 \$/m <sup>2</sup>	● 1,935	○ 1,935	○ 30
—Collectors @ 50 \$/m <sup>2</sup>					
—Installation @ 16 \$/m <sup>2</sup>					
—Transportation @ 3 \$/m <sup>2</sup>					
—25% overhead and profit					
5. 1/2" insulated steel pipe	125 ft	\$4.1	513	0	30
6. Storage (without plumbing)	200 kWh	\$2.05/kWh	410	0	30
7. Pump, controls, and heat exchanger		\$650	500	0	10
<b>TOTAL</b>			<b>\$7,189</b>	<b>\$30</b>	

• 24 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs.

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-1)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	11.3	11.3	-1
Fuel consumed onsite (MMBtu/unit)	164.	42.	74.1
Total energy requirement (bbl crude equiv.) <sup>a</sup>	62.	36.	41.0
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			5.2

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-1)

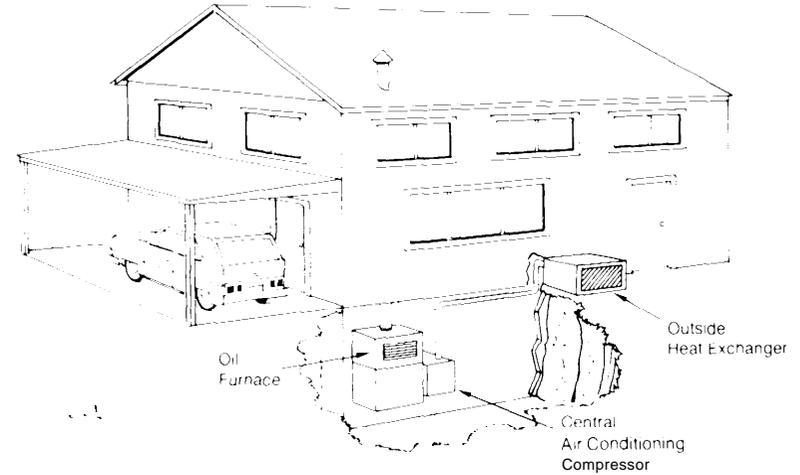
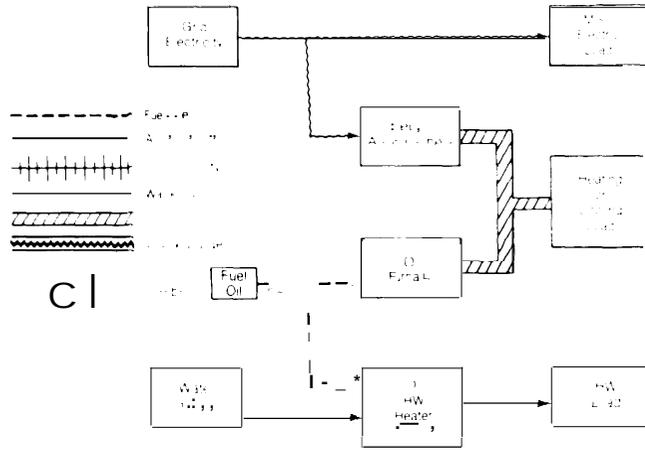
	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
1. 1976 Startup			
o. Casts using solar (conservation) system:			
Total with no incentives	144.	(179.)	163.
Total with 20% IT	136.	(172.)	154.
Total with full incentives	125.	(149.)	14.
b. Costs using conventional reference system	117.	154.	200.
2. 1985 Startup <sup>d</sup>			
a. Costs using solar (conservation) system:			
(capital related costs)	82.	(118.)	82.
(operation & maintenance costs)	4.	(4.)	4.
(fuel bill)	9.	(9.)	19.
(electric bill)	48.	(48.)	67.
Total with no incentives	144.	(179.)	173.
Total with 20% IT	136.	(172.)	165.
Total with full incentives	125.	(149.)	154.
b. Costs using conventional reference system	117.	174.	226.

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-1)

Levelized cost of solar energy or "conservation" energy <sup>e</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	5.27 (8.76)	4.47 (8.07)	3.41 (5.79)
¢/kWh electricity	6.20 (10.30)	5.26 (9.50)	4.01 (6.81)
Levelized price paid for conventional energy <sup>b,e</sup>			
	Constant real energy prices	Energy price escalation I	Energy price escalation II
\$/MMBtu primary fuel	3.37	4.86	7.80
¢/kWh electricity	3.97	5.73	9.18

Table IV-8.—Albuquerque: Conventional System—Single Family House Using Oil Heating and Central Electric A/C (SF-5)



A. ITEMIZED COST OF COMPONENTS

Component	Size	Unit cost	First cost <sup>a</sup> (incl. O&P)	Annual O&M	Life (yrs)
1. Oil furnace e.....	4.5 M Btuh	23 \$/M Btuh	\$1,030	\$30	15
2. Ductwork .....	—	—	425	0	30
3. Central electric a/c.....	1.85 tons	430 \$/ton	796	30	10
4. Gas hot water heater.....	40 gal	225 ea.	225	0	15
<b>TOTAL.....</b>			<b>\$2,476</b>	<b>\$60</b>	

B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>  
(Conventional reference system is SF-5)

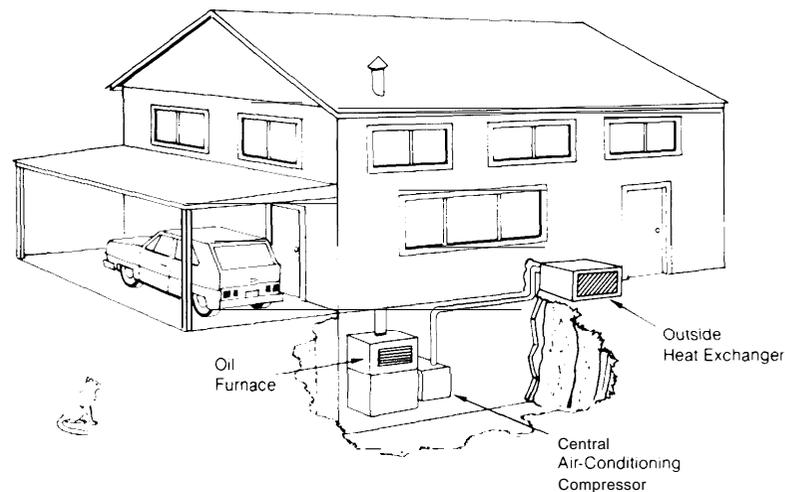
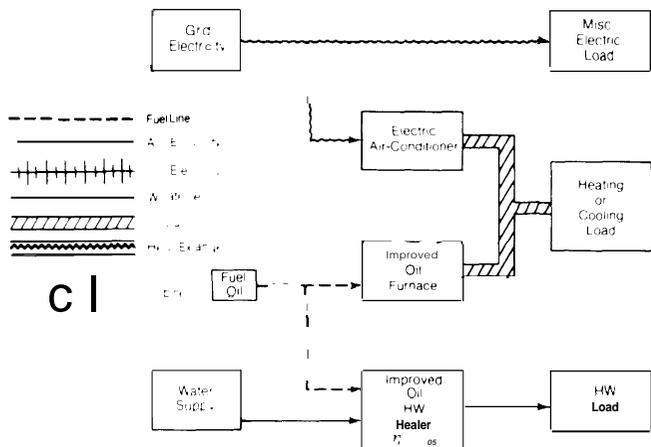
	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
Total with no incentives .....	179.	(193.)	212.	(226.)	358.	(372.)
Total with 20% IT.....	179.	[193.]	212.	[226.]	358.	(372.)
Total with full incentives.....	179.	(193.)	212.	[226.]	358.	(372.)
<b>2. 1985 Startup<sup>d</sup></b>						
(capital related costs) .....	33.	[47.]	33.	[47.]	33.	[47.]
(operation & maintenance costs).....	9.	(9.)	9.	(9.)	9.	(9.)
(fuel bill).....	88.	[88.]	120.	(120.)	268.	[268.]
(electric bill).....	49.	[49.]	68.	[68.]	14s.	[148.]
Total with no incentives .....	179.	(193.)	230.	[244.]	4s8.	(472.)
Total with 20% IT.....	179.	(193.)	230.	(24.)	458.	(472.)
Total with full incentives .....	179.	(193.)	230.	[244.]	458.	(472.)

C. EFFECTIVE COST OF ENERGY TO CONSUMER  
(Conventional reference system is SF-5)

ANNUAL ENERGY FLOWS (Conventional reference system is SF-5)			
	Energy consumed by ref. system	Backup co. summed w/ dar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit).....	11.5	11.5	0
Fuel consumed onsite (MMBtu/unit).....	205.	205.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup> .....	71.	71.	0.
Electricity sold to grid annually (MWh, entire building).....			0.
Annual peak electricity demand (kW, entire building).....			5.2

Levelized cost of solar energy or 'conservation' energy <sup>a</sup>	Type of incentives given			
	No incentives	20% ITC		Full incentives
\$/MMBtu primary fuel.....	N/A	(N/A)	N/A	(N/A)
¢/kWh electricity.....	N/A	(N/A)	N/A	(N/A)
	Escalation of conventional energy costs			
	Constant real energy prices	Energy price escalation I		Energy price escalation II
Levelized price paid for conventional energy <sup>b,*</sup>				
\$/MMBtu primary fuel.....	4.82	5. w		7.15
¢/kWh electricity.....	5.67	7.05		13.12

Table IV.9.—Albuquerque: Conventional System—Single Family House Using Improved Oil Heating and Central Electric A/C (SF-5)



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs)
1. Oil furnace	45 M Btu/h 25 \$/M Btu/h		\$1,120	\$30	15
2. Ductwork			425	0	30
3. Central electric a/c	1.85 tons	430 \$/ton	796	30	10
4. Gas water heater	40 gal	\$275 ea.	275	0	15
<b>TOTAL</b>			<b>\$2,616</b>	<b>\$60</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b, c</sup>**  
(Conventional reference system is SF-5)

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
<b>0. Costs using solar (conservation) system:</b>						
Total with no incentives	163.	(178.)	192.	(207.)	320.	(334.)
Total with 20% ITC	163.	(177.)	192.	(206.)	319.	(334.)
Total with full incentives	163.	(177.)	192.	[206.]	319.	(333.)
<b>b. Costs using conventional reference system</b>						
	179.		212.		358.	
<b>2. 1985 Startup<sup>a</sup></b>						
<b>a. Costs using solar (conservation) system:</b>						
(capital related costs)	35.	[50.]	35.	[50.]	35.	[50.]
(operation & maintenance costs)	9.	(9.)	9.	(9.)	9.	(9.)
(fuel bill)	69.	(69.)	94.	(94.)	211.	[211.]
(electric bill)	50.	(50.)	70.	(70.)	152.	(152.)
Total with no incentives	163.	(178.)	208.	(223.)	407.	(421.)
Total with 20% ITC	163.	(177.)	208.	(223.)	406.	(421.)
Total with full incentives	163.	(177.)	208.	(222.)	406.	(420.)
<b>b. Costs using conventional reference system</b>						
	179.		231.		458.	

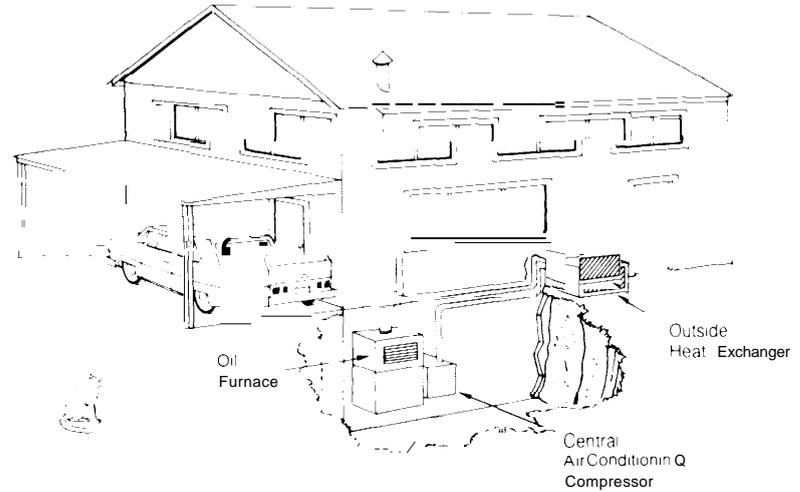
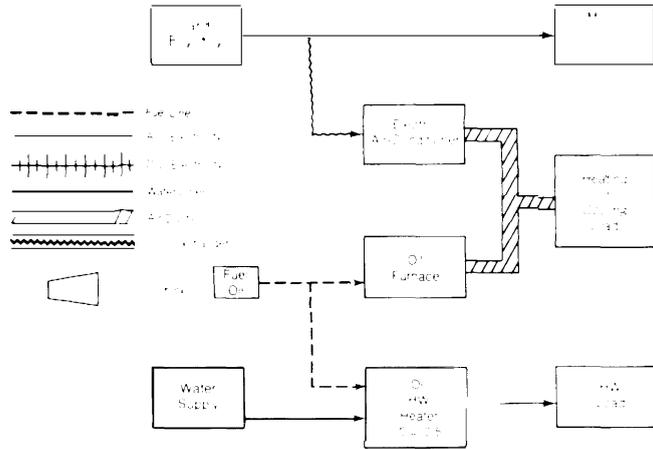
**C. EFFECTIVE COST OF ENERGY TO CONSUMER**  
(Conventional reference system is SF-5)

**ANNUAL ENERGY FLOWS**  
(Conventional reference system is SF-5)

	Energy consumed by ref. system	Backup consumed w/ 5010r/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	11.5	11.9	-3.5
Fuel consumed onsite (MMBtu/unit)	205.	161.	21.4
Total energy requirement (bbl crude equiv.) <sup>a</sup>	71.	63.	11.5
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			5.2

Levelized cost of solar energy or 'conservation' energy <sup>c</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	.54 (4.94)	.48 (4.89)	.39 (4.69)
¢/kWh electricity	.64 (5.82)	.56 (5.75)	.45 (5.52)
<b>Escalation of conventional energy costs</b>			
Levelized price paid for conventional energy <sup>b, e</sup>	Constant real energy prices	Energy price escalation I	Energy price escalation II
	\$/MMBtu primary fuel	4.82	5.99
¢/kWh electricity	5.67	7.05	7.12

Table IV-10.— Albuquerque: Conventional System—Insulated Single Family House Using Oil Heating and Central Electric A/C (IF-5)



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Oil furnace ..	31 M Btuh	23 \$/M Btuh	\$713	\$30	15
2 . Ductwork	—	—	425	0	30
3. Central electric a/c . . .	1.3 tons	430 \$/ton	559	30	10
4 Gas water heater . . . . .	40 gal	225 ea.	225	0	15
5. Extra insulation, storm doors and windows . . . . .	—	—	981	0	30
<b>TOTAL</b> . . . . .			<b>\$2,903</b>	<b>\$60</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>bc</sup>**

(Conventional reference system is SF-5)

	Escalation of conventional energy costs			
	Constant real energy prices	Energy price escalation I	Energy price escalation II	
<b>1. 1976 Startup</b>				
<b>a. Costs using solar (conservation) system:</b>				
Total with no incentives . . . . .	153.	(167.)	180.	[194.] 298. (313.)
Total with 20% ITC . . . . .	152.	[166.]	179.	[194.] 298. (312.)
Total with full incentives . . . . .	150.	[165.]	177.	[192.] 296. (310.)
<b>b. Costs using conventional reference system . . . . .</b>	179.	212.	358.	
<b>2. 1985 Startup<sup>d</sup></b>				
<b>a. Costs using solar (conservation) system:</b>				
(capital related costs) . . . . .	33.	(47.)	33.	(47.) 33. (47.)
(operation & maintenance costs) . . . . .	9.	(9.)	9.	(9.) 9. (9.)
(fuel bill) . . . . .	65.	(65.)	89.	(89.) 198. (198.)
(electric bill) . . . . .	46.	(46.)	65.	(65.) 140. (140.)
Total with no incentives . . . . .	153.	(167.)	195.	(209.) 379. (394.)
Total with 20% ITC . . . . .	152.	(166.)	194.	(209.) 379. (393.)
Total with full incentives . . . . .	150.	(165.)	192.	(207.) 377. (391.)
<b>b. Costs using conventional reference system . . . . .</b>	179.	230.	458.	

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

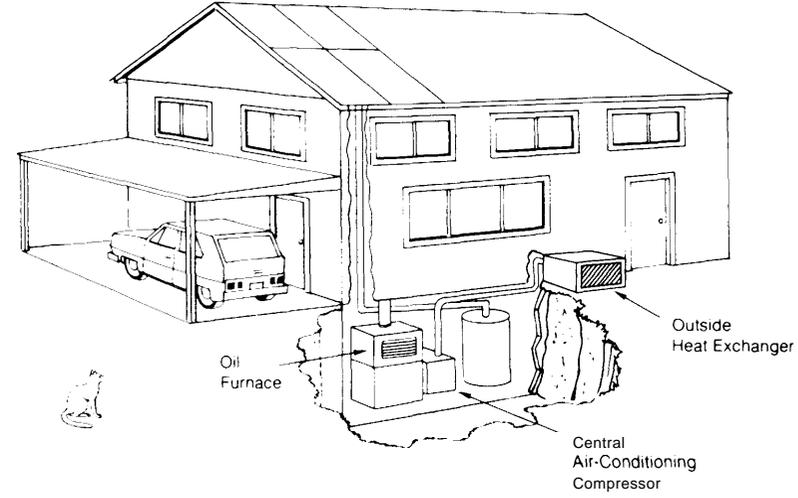
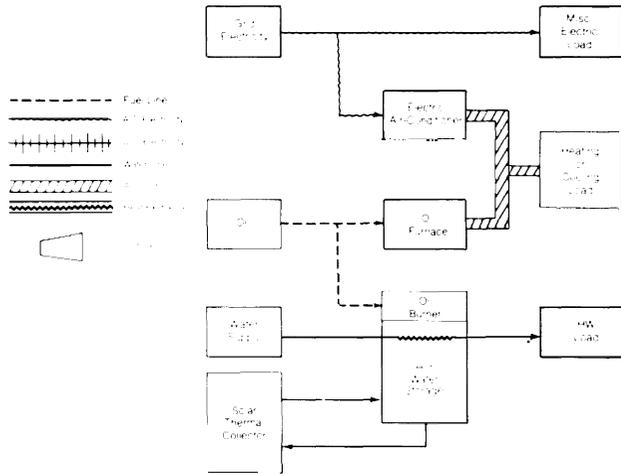
(Conventional reference system is SF-5)

Levelized cost of solar energy or 'conservation' energy <sup>e</sup>	Type of incentive <sup>f</sup> given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel . . . . .	-.08 (2.69)	-.21 (2.58)	-.51 (2.21)
¢/kWh electricity . . . . .	-10 (3.16)	-25 (3.03)	.60 (2.60)
	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>Levelized price paid for conventional energy<sup>g*</sup></b>			
\$/MMBtu primary fuel . . . . .	4.82	5 w-	11.15
¢/kWh electricity . . . . .	5.67	7.05	13.12

**ANNUAL ENERGY FLOWS (Conventional reference system is SF-5)**

	Energy consumed by ref. system	Backup consumed solar/conservation	w/ Energy saved (% of total)
Net Electricity (bought + sold) (MWh/unit) . . . . .	11.5	10.7	6.5
Fuel consumed onsite (MMBtu/unit) . . . . .	205.	151.	26.4
Total energy requirement (bbl crude equiv.) <sup>h</sup> . . . . .	71.	58.	18.5
Electricity sold to grid annually (MWh, entire building) . . . . .			0.
Annual peak electricity demand (kW, entire building) . . . . .			4.3

**Table IV-11.—Albuquerque: Solar Hot Water System—Single Family House Using Fiat. Plate Collectors (1977 Prices); Building Equipped With SF-5 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs)
1. Oil furnace	45M Btuh	23 \$/M Btuh	\$1,030	\$30	15
2. Ductwork			425	0	30
3. Central electric O/C	1.85 tons	430 \$/ton	796	30	10
4. Hot water storage with electric backup (including heat exchanger)	100 gal	\$380	380	0	30
5. Pumps and control	—	\$250	250	0	10
6. Insulated steel pipe	75 ft	\$2.6/ft	195	0	30
7. Flat plate solar collectors	10 m <sup>2</sup>	143 \$/m <sup>2</sup>	715	0	30
—Collector cost @ 95 \$/m <sup>2</sup>			715	0	15
—Installation @ 16 \$/m <sup>2</sup>					
—Transportation @ 33/m					
—Overhead and profit= 25%					
<b>TOTAL</b>			<b>\$4,506</b>	<b>\$60</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**  
(Conventional reference system is SF-5)

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
a. Costs using solar (conservation) system:						
Total with no incentives	174.	(197.)	201.	(224.)	319.	(342.)
Total with 20% ITC	171.	(194.)	198.	(221.)	316.	(339.)
Total with full incentives	166.	(185.)	194.	(212.)	312.	(330.)
b. Costs using conventional reference system	179.		212.		358.	
<b>2. 1985 Startup<sup>d</sup></b>						
0. Costs using solar (conservation) system:						
(capital related costs)	54.	(77.)	54.	(77.)	54.	(77.)
(operation & maintenance costs)	9.	(9.)	9.	(9.)	9.	(9.)
(fuel bill)	63.	(63.)	86.	(86.)	191.	(191.)
(electric bill)	48.	(48.)	67.	(67.)	146.	(146.)
Total with no incentives	174.	(197.)	216.	(239.)	400.	(423.)
Total with 20% ITC	171.	(194.)	213.	(236.)	397.	(420.)
Total with full incentives	166.	(185.)	209.	(227.)	393.	(411.)
b. Costs using conventional reference system	179.		231.		458.	

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**  
(Conventional reference system is SF-5)

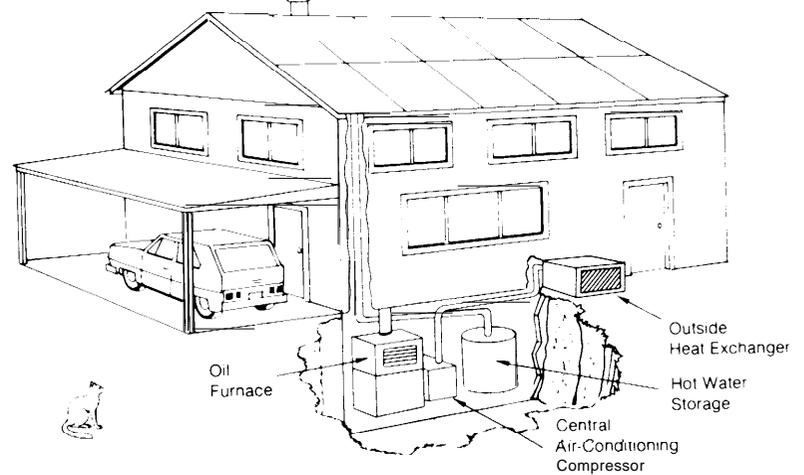
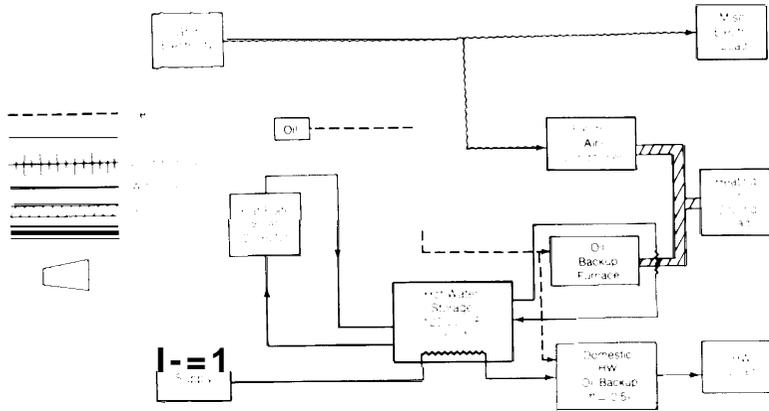
Levelized cost of solar energy or 'conservation' energy <sup>c</sup>	Type of incentives given					
	No incentives		20% ITC		Full incentives	
\$/MMBtu primary fuel	4.10	(8.58)	3.46	(8.03)	2.62	(6.22)
¢/kWh electricity	4.83	(10.10)	4.08	(9.46)	3.09	(7.32)
<b>Levelized rice paid for conventional energy<sup>b,*</sup></b>						
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
\$/MMBtu primary fuel	4.82		5.99		11.15	
¢/kWh electricity	5.67		7.05		13.12	

<sup>a</sup> 1/2 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS**  
(Conventional reference system is SF-5)

	Energy consumed by ref. system	Backup consumed solar/conservation	w/ Energy saved (% of total)
Net Electricity (bought-sold)(MWh/unit)	11.5	11.3	1.7
Fuel consumed on site (MMBtu/unit)	205.	146.	28.7
Total energy requirement (bbl crude equiv.) <sup>a</sup>	71	5a.	18.0
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			5.2

**Table IV-12.—Albuquerque: Solar Hot Water and Heating System—Single Family House Using Flat-Plate Collectors (1977 Prices); Low-Temperature Thermal Storage; Building Equipped With SF-5 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O & P)	Annual O&M	Life (yrs)
1. Oil furnace	45M Btuh	23 \$/M Btuh	\$1,030	\$30	15
2. Centrolelectric	1.85 tons	430 \$/ton	796	30	10
3. Ductwork			425	0	30
4. Collectors and associated costs	45 m <sup>2</sup>	143 \$/m <sup>2</sup>	3,218	0	15
—Collectors @ 95 \$/m <sup>2</sup>			3,218	0	30
—Installation @ 16 \$/m <sup>2</sup>					
—Transportation @ 3 \$/m <sup>2</sup>					
—25% overhead and profit					
5. 3/4" insulated steel pipe	125 ft	\$4.1	513	0	30
6. Storage (without plumbing)	200 kWh	\$2.05/kWh	410	0	30
7. Pump, controls, and heat exchanger		\$650	650	0	10
<b>TOTAL</b>			<b>\$10,260</b>	<b>\$60</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**  
(Conventional reference system is SF-5)

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
<b>0. Costs using solar (conservation) system:</b>						
Total with no incentives	196.	(246.)	213.	(264.)	289.	(339.)
Total with 20% ITC	183.	(235.)	201.	(253.)	276.	(328.)
Total with full incentives	167.	(200.)	184.	(218.)	260.	(293.)
<b>b. Costs using conventional reference system</b>			179.	212.	358.	
<b>2. 1985 Startup<sup>a</sup></b>						
<b>0. Costs using solar (conservation) system:</b>						
(capitol related costs)	116.	(167.)	116.	(167.)	116.	(167.)
(operation & maintenance costs)	9.	(9.)	9.	(9.)	9.	(9.)
(fuel bill)	23.	(23.)	31.	(31.)	69.	(69.)
(electric bill)	48.	(43.)	67.	(67.)	146.	(146.)
Total with no incentives	196.	(246.)	223.	(274.)	340.	(391.)
Total with 20% ITC	183.	(235.)	211.	(263.)	328.	(380.)
Total with full incentives	167.	(200.)	194.	(227.)	311.	(344.)
<b>b. Costs using conventional reference system</b>			179.	231.	458.	

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-5)

<sup>a</sup> If installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-5)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought, sold) (MWh/unit)	11.5	11.3	1.7
Fuel consumed onsite (MMBtu/unit)	205.	53.	74.1
Total energy requirement (bbl/crude equiv.) <sup>a</sup>	71.	39.	45.4
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			5.2

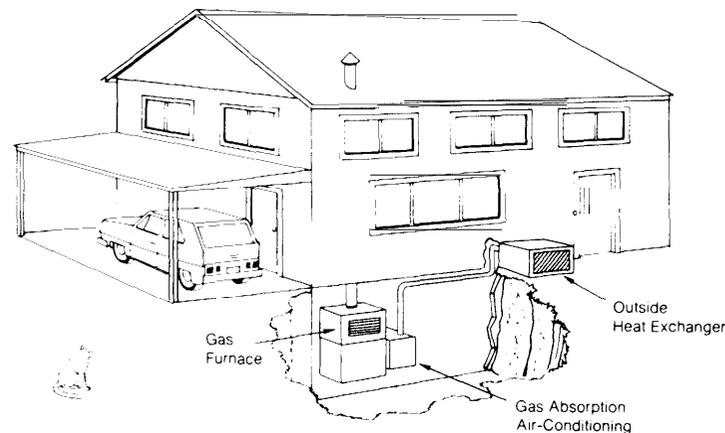
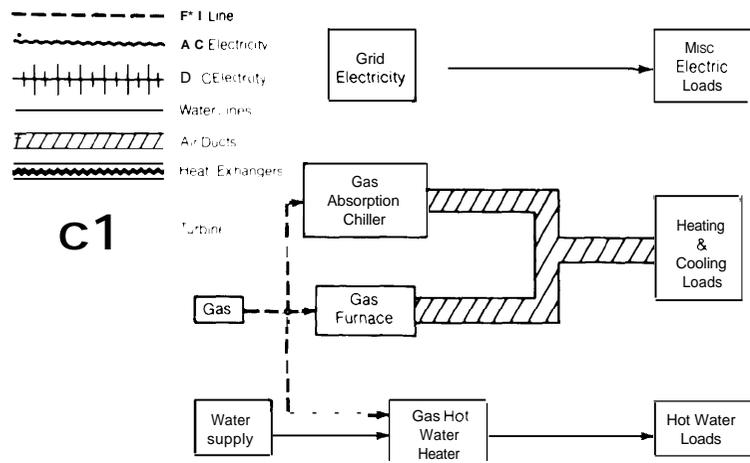
**Levelized cost of solar energy or "conservation" energy<sup>a</sup>**

	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	6.42 (10.34)	5.45 (9.51)	4.17 (6.75)
¢/kWh electricity	7.56 (12.17)	6.41 (11.19)	4.91 (7.94)

**Escalation of conventional energy costs**

	Type of incentives given		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>Levelized price paid for conventional energy<sup>b-a</sup></b>			
\$/MMBtu primary fuel	4.82	5.99	11.15
¢/kWh electricity	5.67	7.05	13.12

Table IV-13.-Albuquerque: Conventional System-Single Family House With Gas Heat and Hot Water and Gas-Powered Absorption A/C (IF-7)



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl O&P)	Annual O&M	Life (yrs)
1. Gas furnace	45 MBtu/h	15 \$ /MBtu/h	\$675	\$0	15
2 Ductwork	—	—	425	0	30
3 Central absorption A/C	1.85 tons	850 \$/ton	1,570	20	15
4 Gas water heater	40 gal.	225 ea.	225	0	15
<b>TOTAL FOR BUILDING</b>			<b>\$2,895</b>		<b>\$20</b>

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

[Conventional reference system is SF-7]

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
Total with no incentives	122.	(138.)	165.	(180.)	233.	(249.)
Total with 20% IT	122.	(138.)	165.	(180.)	233.	(249.)
Total with full incentives	122.	(138.)	165.	(180.)	233.	(249.)
<b>2. 1985 Startup<sup>d</sup></b>						
(capital related cost)	35.	(50.)	35.	(50.)	35.	(50.)
(operation & maintenance costs)	3.	(3.)	3.	(3.)	3.	(3.)
(fuel bill)	47.	(47.)	97.	(97.)	143.	(143.)
(electric bill)	37.	(37.)	53.	(53.)	114.	(114.)
Total with no incentives	122.	(138.)	187.	(203.)	295.	(310.)
Total with 20% IT	122.	(138.)	187.	(203.)	295.	(310.)
Total with full incentives	122.	(138.)	187.	(203.)	295.	(310.)

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-7)

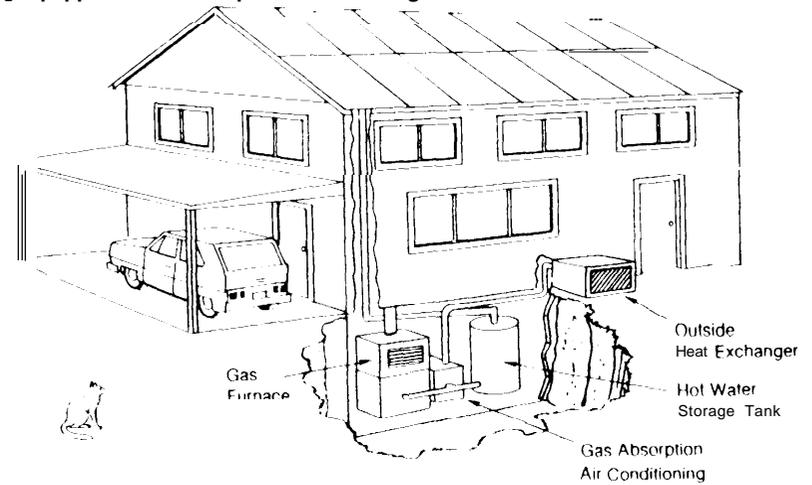
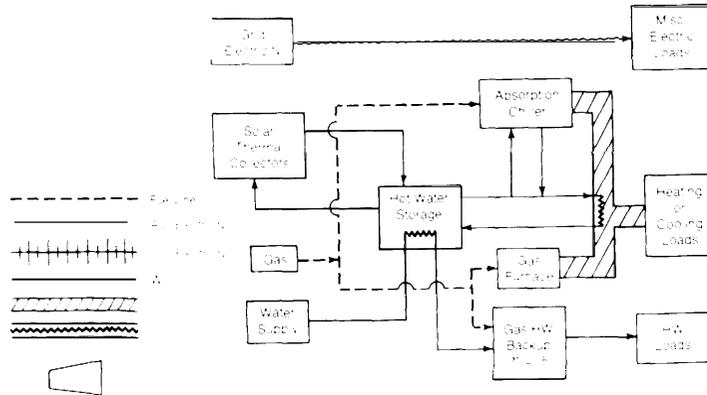
**ANNUAL ENERGY FLOWS**

[Conventional reference system is SF-7]

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	8.0	8.0	0.
Fuel consumed onsite (MMBtu/unit)	218.	218.	0.
<b>Total energy requirement (bbl crude equiv.)<sup>a</sup></b>	<b>65.</b>	<b>65.</b>	<b>0.</b>
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			3.5

Levelized cost of solar energy or 'conservation' energy <sup>d</sup>	Type of incentives given					
	No incentive		20% ITC		Full incentives	
\$ / MMBtu primary fuel	N/A	(N/A)	N/A	(N/A)	N/A	(N/A)
¢ / kWh electricity	N/A	(N/A)	N/A	(N/A)	N/A	(N/A)
<b>Levelized price paid for conventional energy<sup>b,*</sup></b>	Constant real energy prices		Energy price escalation I		Energy price escalation II	
\$ / MMBtu primary fuel	3.25		4.87		7.51	
¢ / kWh electricity	3.82		5.73		8.84	

Table IV-14-Albuquerque: Solar Hot Water, Heating, and Cooling System—Single Family House Using Flat-Plate Collectors (1977 Prices); Low-Temperature Thermal Storage; Building Equipped With SF-7 Space-Conditioning



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl O&P)	Annual O & M	Life (yrs)
1. Gas furnace...	45 MBtuh	15\$ MBtuh	\$660	\$0	15
2 Ductwork			425	0	30
3. Absorption A/C.	1.85 tons	850 \$/ton	1,570	20	15
4 Storage tank	200 kWh	2.05 \$/kWh	410	0	30
5 Heat exchanger, pump, and controls			650	0	10
6 Insulated steel pipe	125 ft.	4.1 \$/ft.		0	30
7 Flat plate solar collectors	45 m <sup>2</sup>	143 \$/m <sup>2</sup>	3,218	0	30
—Collector cost @ 95 \$/m <sup>2</sup>			3,218		
—Installation @ 16 \$/m <sup>2</sup>					
—Transportation @ 3 \$/m <sup>2</sup>					
—Overhead and profit equals 25 percent					
<b>TOTAL FOR BUILDING</b>			<b>\$13,729</b>	<b>\$2000</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-7)

	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
1. 1976 Startup			
0. Costs using solar (conservation) system:			
Total with no incentives	167. [219.]	183. [235.]	228. [280.]
Total with 20% IT	154. [208.]	170. [224.]	215. [269.]
Total with full incentives	138. [173.]	154. [189.]	199. [234.]
b. Costs using conventional reference system	122.	165.	233.
2. 1985 Startup <sup>a</sup>			
a. Costs using solar (conservation) system:			
(capital related costs)	117. (170.)	117. (170.)	117. (170.)
(operation & maintenance costs)	3. (3.)	3. (3.)	3. (3.)
(fuel bill)	9. (9.)	19. (19.)	28. (28.)
(electric bill)	37. (37.)	53. (53.)	114. (114.)
Total with no incentives	167. (219.)	192. (244.)	262. (314.)
Total with 20% IT	154. (208.)	179. (233.)	249. (304.)
Total with full incentives	138. (173.)	163. (198.)	233. (268.)
b. Costs using conventional reference system	122.	187.	295.

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-7)

installed collector cost assumed replaced in 15 yrs with total replacement in 10 yrs

**ANNUAL ENERGY FLOWS**

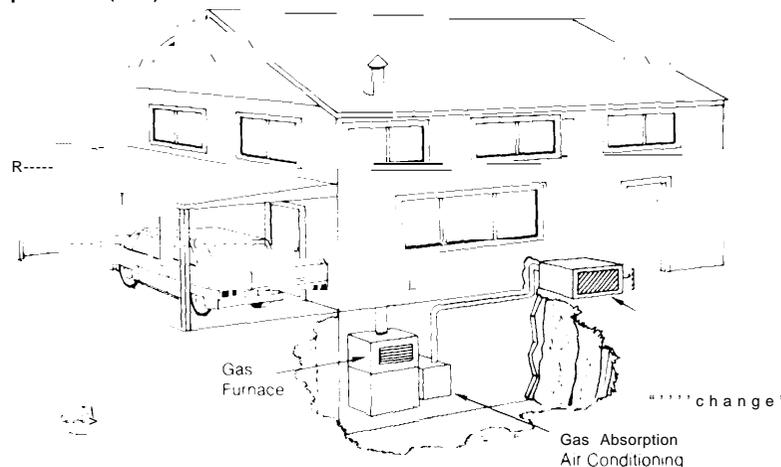
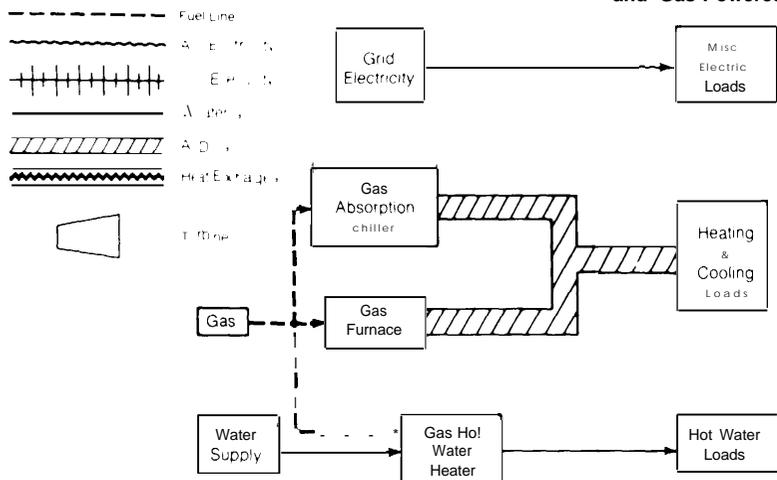
(Conventional reference system is SF-7)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved [% of total]
Net Electricity (baught-said) (MWh/unit)	8.0	8.0	80.7
Fuel consumed onsite (MMBtu/unit)	218.	42.	56.2
Total energy requirement (bbl crude equiv.) <sup>a</sup>	65.	28.	
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			3.5

Levelized cost of solar energy or "conservation" energy <sup>a</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	5.64 (9.21)	4.7B (8.48)	3.66 (6.05)
¢/kWh electricity	6.63 (10.83)	5.63 (99B)	4.31 (7.12)
Levelized price paid for conventional energy <sup>b*</sup>			
\$/MMBtu primary fuel	3.25	4.87	7.51
¢/kWh electricity	3.82	5.73	8.84



**Table IV-16.—Albuquerque: Conventional System— Insulated Single Family House With Gas Heat, Hot Water, and Gas-Powered Absorption A/C (IF-7)**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs)
1. Gas furnace	31 MBtu/h	15 \$/MBtu/h	\$465	0	15
2. Ductwork			425	0	30
3. Central absorption a/c	1.3 tons	850 \$/ton	1,100	\$20	15
4. Gas water heater	40 gal.	225 ea.	225	0	15
5 Extra insulation, storm doors and windows			981	0	30
<b>TOTAL FOR BUILDING</b>			<b>\$3,196</b>	<b>\$20</b>	
<b>TOTAL PER UNIT</b>			<b>\$3,196</b>	<b>\$20</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is IF-7)

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
Total with no incentives	110.	(126.)	145.	(161.)	206.	(222.)
Total with 20% ITC	110.	(126.)	145.	(161.)	206.	(222.)
Total with full incentives	110.	(126.)	145.	(161.)	206.	(222.)
<b>2. 1985 Startup<sup>d</sup></b>						
(capital related costs)	34.	(49.)	34.	(49.)	34.	(49.)
(operation & maintenance costs)	3.	(3.)	3.	(3.)	3.	(3.)
(fuel bill)	37.	[37.]	75.	(75.)	111.	(111.)
(electric bill)	37.	[37.]	52.	(52.)	112.	(112.)
Total with no incentives	110.	(126.)	163.	(179.)	264.	(276.)
Total with 20% ITC	110.	(126.)	163.	(179.)	260.	(276.)
Total with full incentives	110.	(126.)	163.	(179.)	260.	(276.)

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

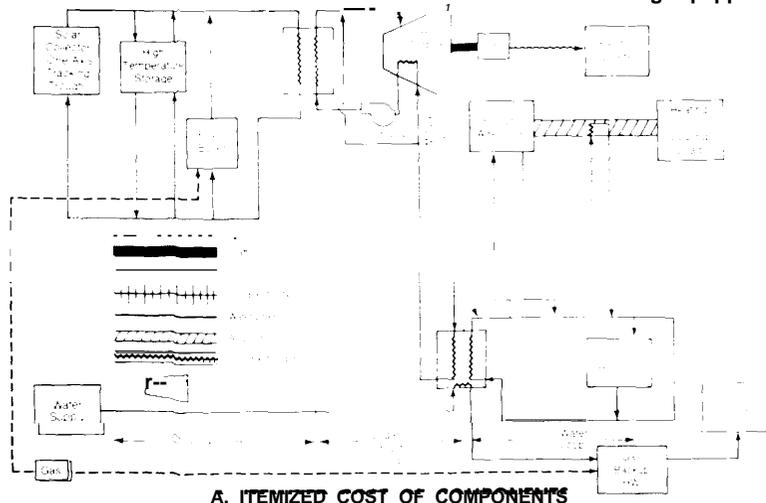
(Conventional reference system is IF--)

ANNUAL ENERGY FLOWS (Conventional reference system is IF-7)			
	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	7.8	7.8	0
Fuel consumed onsite (MMBtu/unit)	169.	169.	0.
Total energy requirement (bbi crude equiv.) <sup>a</sup>	54.	54.	0.
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			3.4

Levelized cost of solar energy or 'conservation' energy <sup>c</sup>	Type of incentives given					
	No incentives		Full incentive			
\$/MMBtu primary fuel	N/A	(N/A)	N/A	(N/A)	N/A	(N/A)
¢/kWh electricity	N/A	(N/A)	N/A	(N/A)	N/A	(N/A)
Levelized price paid for conventional energy <sup>b,*</sup>	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
	\$/MMBtu primary fuel	3.37	4.97	7.79		
¢/kWh electricity	3.96	5.84	9.17			



**Table IV-1 8.—Albuquerque: Solar Heat Engine Cogeneration System—Insulated Single Family House Using ORCS With Cooling Tower, One-Axis Tracking Collector (Possible Future Design), High-Temperature Thermal Storage, Gas Backup; Building Equipped With IF-7 Space-Conditioning**



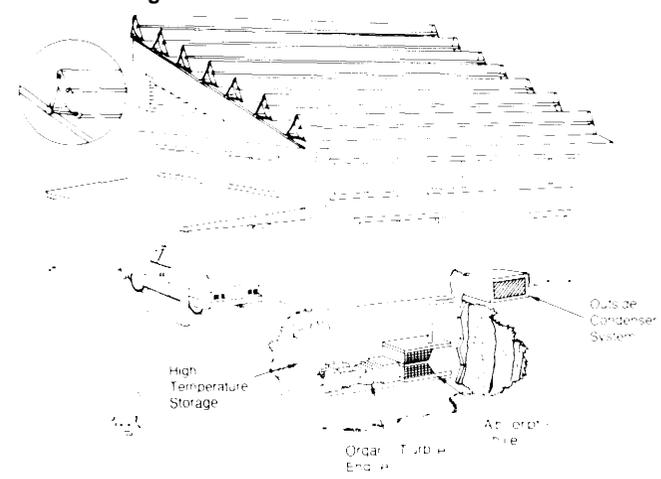
**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl O&P)	Annual O&M (y IS)	Life
1. One axis E-W tracking collector	46 m <sup>2</sup>	129 \$/m <sup>2</sup>	\$.2970	0	30
—Collector @ 80 \$/m <sup>2</sup>			.2970	0	15
—Installation @ 20\$ m <sup>2</sup>					
—Shipping @ 3\$/m <sup>2</sup>					
—overhead and profit 25%					
2 High temperature oil storage	80 kWh	19 \$/kWh	1,520	0	30
3. Fossil boiler-cast iron	21.7 kW	47 \$/kW	1,000	0	15
4 Absorption a/c	1.4 tons	850 \$/ton	1,200	\$20	10
5 Water-to-air heat exchanger	9 kW	10 \$/kW	90	0	15
6. Insulated steel pipe	125 ft	4.1 \$/ft	513	0	30
7 Heat exchanger, pumps and controls	—	—	500	0	10
8. Ductwork	—	—	425	0	30
9. Extra insulation, storm doors and windows	—	—	981	0	30
10. Organic turbine (installed with cooling tower, controls, and high temp heat exchanger, and generator.	4.3 kW	490 \$/kW	2,110	30	15
<b>TOTAL FOR BUILDING</b>			<b>\$14,279</b>	<b>\$50</b>	
<b>TOTAL PER UNIT</b>			<b>\$14,279</b>	<b>\$50</b>	

<sup>1</sup>, installed collector cost assumed replaced in 15 yrs with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS (Conventional reference System is IF-7)**

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	7.8	0.	100.0
Fuel consumed on site (MMBtu/unit)	169.	84.	50.3
Total energy requirement (bbl crude equiv.) <sup>1</sup>	54.	17.	67.8
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			0.



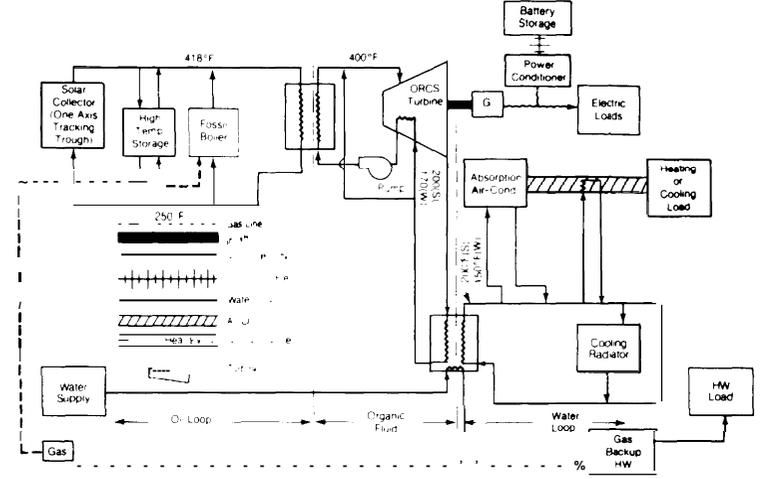
**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b, c</sup>**  
(Conventional reference system is IF-7)

	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
<b>a. Costs using solar (conservation) system:</b>			
Total with no incentives	183. (255.)	196. (268.)	207. (279.)
Total with 20% ITC	166. (240.)	178. (253.)	189. (264.)
Total with full incentives	125. (189.)	138. (202.)	149. (213.)
<b>b. Costs using conventional reference system</b>	110.	145.	206.
<b>2. 1985 Startup<sup>d</sup></b>			
<b>a. Costs using solar (conservation) system:</b>			
(capital related costs)	158. (230.)	158. (230.)	158. (230.)
(operation & maintenance costs)	7. (7.)	7. (7.)	7. (7.)
(fuel bill)	18. (18.)	37. (37.)	55. (55.)
(electric bill)	0. (0.)	0. (0.)	0. (0.)
Total with no incentives	183. (255.)	203. (275.)	221. (292.)
Total with 20% ITC	166. (240.)	185. (259.)	203. (277.)
Total with full incentives	125. (189.)	144. (209.)	162. (227.)
<b>b. Costs using conventional reference system</b>	110.	145.	206.

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**  
(Conventional reference system is IF-7)

Levelized cost of solar energy or "conservation" energy <sup>a</sup>	Type of incentive given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	8.72 [13.58]	7.51 [12.55]	4.77 (9.12)
¢/kWh electricity	10.26 [15.99]	8.84 [14.77]	5.62 (10.74)
<b>Levelized price paid for conventional energy<sup>b, c</sup></b>			
\$/MMBtu primary fuel	3.37	4.97	7.79
¢/kWh electricity	3.96	5.84	9.77

**Table IV-19.—Albuquerque: Solar Heat Engine Cogeneration System— Insulated Single Family House Using ORCS With Cooling Tower, One-Axis, Tracking Collector (Possible Future Design), Battery Electrical and High Temperature Thermal Storage, Gas Backup; Building Equipped With IF-7 Space-Conditioning**



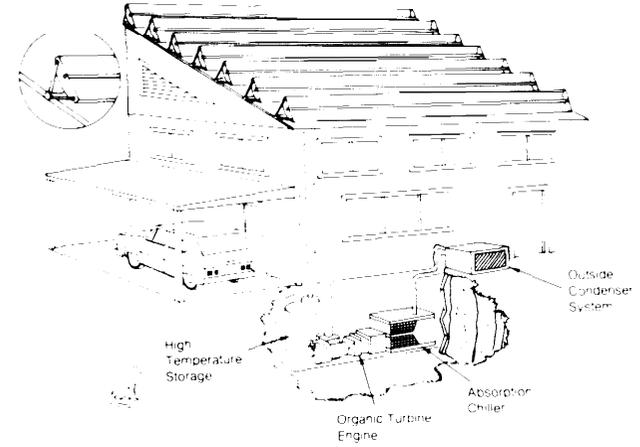
**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs)
1. One axis E-W tracking collector	46 m <sup>2</sup>	129 \$/m <sup>2</sup>	\$2,970	0	30
—Collector @ 80 \$/m <sup>2</sup>			2,970	0	15
—Installation @ 20 \$/m <sup>2</sup>					
—Shipping @ 3 \$/m <sup>2</sup>					
—Overhead and profit = 25%					
2. High temperature oil storage	100 kWh	17 \$/kWh	1,700	0	30
3. Fossil boiler-cast iron	21.7 kW	47 \$/kW	1,000	0	15
4. Absorption A/C	1.4 tons	850 \$/ton	1,200	20	10
5. Water-to-air heat exchanger	9 kW	10 \$/kW	90	0	15
6. Insulated steel pipe	125 ft.	4.1 \$/ft.	513	0	30
7. Heat exchanger, pumps, and controls	—	—	500	0	10
8. Ductwork	—	—	425	0	30
9. Extra insulation, storm doors and windows	—	—	981	0	30
10. Organic turbine (installed with cooling tower, controls, and high temp. heat exchanger and generator.	4.3 kW	490 \$/kW	2,110	30	15
11. Battery and space	10 kWh	78 \$/kWh	780	6	10
12. Power conditioner	5 Kw	124 \$/kW	580	6	30
<b>TOTAL FOR BUILDING</b>			<b>\$15,819</b>	<b>\$62</b>	
<b>TOTAL PER UNIT</b>			<b>\$15,819</b>	<b>\$62</b>	

\*2 installed collector cost assumed replaced in 15 yrs with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS (Conventional reference system is IF-7)**

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	7.8	0.	100.0
Fuel consumed onsite (MMBtu/unit)	169.	95.	43.9
Total energy requirement (tbl crude equiv.) <sup>a</sup>	54.	20.	63.7
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			0.



**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is IF-7)

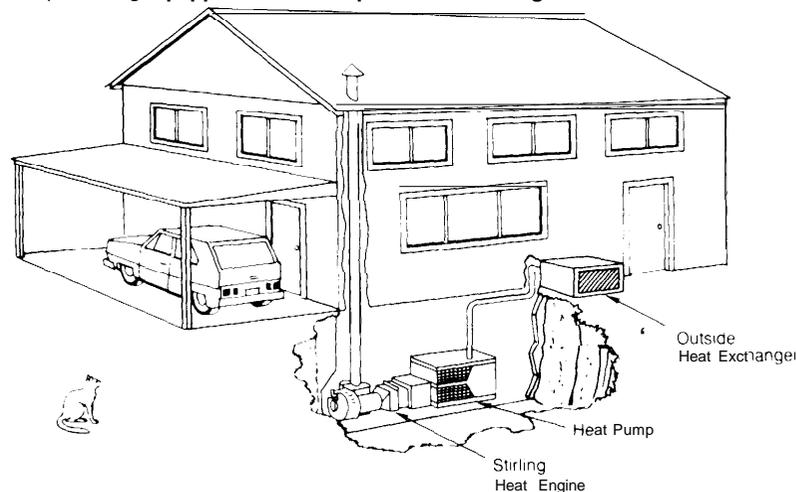
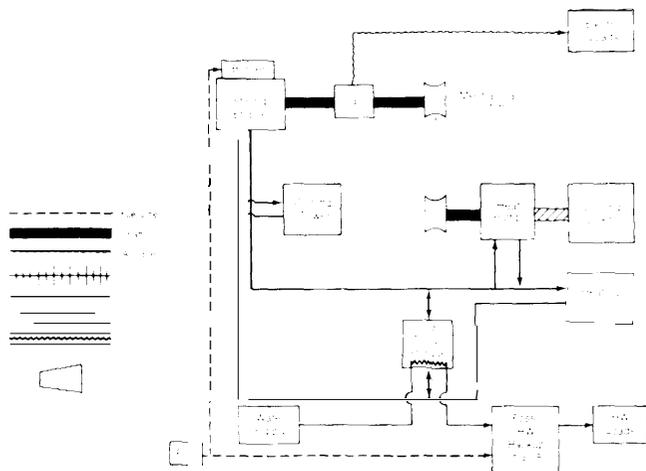
	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
<b>a. Costs using solar (conservation) system:</b>						
Total with no incentives	207.	(287.)	221.	(301.)	234.	(314.)
Total with 20% ITC	187.	(270.)	201.	(284.)	214.	(297.)
Total with full incentives	141.	(212.)	155.	(226.)	168.	(239.)
<b>b. Cost using conventional reference system</b>	110.		145.		200.	
<b>2. 1985 Startup<sup>d</sup></b>						
<b>a. Costs using solar (conservation) system:</b>						
(capital related costs)	177.	(257.)	177.	(257.)	177.	(257.)
(operation & maintenance costs)	9.	(9.)	9.	(9.)	9.	(9.)
(fuel bill)	21.	(21.)	42.	(42.)	62.	(62.)
(electric bill)	0.	(0.)	0.	(0.)	0.	(0.)
Total with no incentives	207.	(287.)	229.	(309.)	249.	(329.)
Total with 20% ITC	187.	(270.)	209.	(291.)	229.	(312.)
Total with full incentives	141.	(212.)	163.	(234.)	183.	(254.)
<b>b. Cost using conventional reference system</b>	110.		145.		200.	

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is IF-7)

Levelized cost of solar energy or "conservation" energy <sup>e</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	10.83 (16.59)	9.37 (15.34)	6.04 (11.18)
¢/kWh electricity	12.75 (19.52)	11.02 (18.05)	7.11 (13.16)
<b>Levelized price paid for conventional energy<sup>b,*</sup></b>			
\$/MMBtu primary fuel	3.37	4.97	7.79
¢/kWh electricity	3.96	5.84	9.17

Table IV-20.—Albuquerque: Conventional Heat Engine Cogeneration System— Insulated Single Family House Using Stirling Engine (Low Efficiency) Direct-Drive Heat Pump, Gas Hot Water; Building Equipped With IF-9 Space Conditioning



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs)
1. Heat Pump.....	1.30 tons	800 \$/ton	\$1,040	\$50	10
2. Ductwork.....	—	—	425	0	30
3. Low temperature hot water storage.....	50 kWh	2 \$/kW	100	0	30
4. Fossil water heater.....	40 gal	225 eo.	225	0	15
5. Stirling engine ( $\eta=0.32$ ).....	7.2 kW	188 \$/kW	1,360	100	10
—Engine (less generator) @ 150 \$/kW					
—Overhead and profit @ 25%					
6. Generator.....	.55kW	37 \$/kW	204	0	10
7. Heat exchanger.....	—	33\$ ea.	33	0	30
8. Extra insulation, storm doors and windows.....	—	—	981	0	30
<b>TOTAL.....</b>			<b>\$4,358</b>	<b>\$150</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**  
(Conventional reference system is IF-7)

	Escalation of conventional energy costs			
	Constant real energy prices	Energy price escalation I	Energy price escalation II	
<b>1. 1976 Startup</b>				
a. Costs using solar (conservation) system:				
Total with no incentives.....	113.	(137.)	135.	(158.)
Total with 20% ITC.....	111.	(136.)	133.	(157.)
Total with full incentives.....	107.	(130.)	128.	(151.)
b. Costs using conventional reference system.....	110.		145.	206
<b>2. 1985 Startup<sup>d</sup></b>				
a. Costs using solar (conservation) system:				
(capital related costs).....	60.	[84.]	60.	[84.]
(operation & maintenance costs).....	22.	(22.)	22.	(22.)
Fuel bill.....	31.	(31.)	63.	(63.)
Electric bill.....	0.	(0.)	0.	(0.)
Total with no incentives.....	113.	(137.)	146.	(170.)
Total with 20% ITC.....	111.	(136.)	144.	(168.)
Total with full incentives.....	107.	(130.)	140.	(163.)
b. Costs using conventional reference system.....	110.		163.	260.

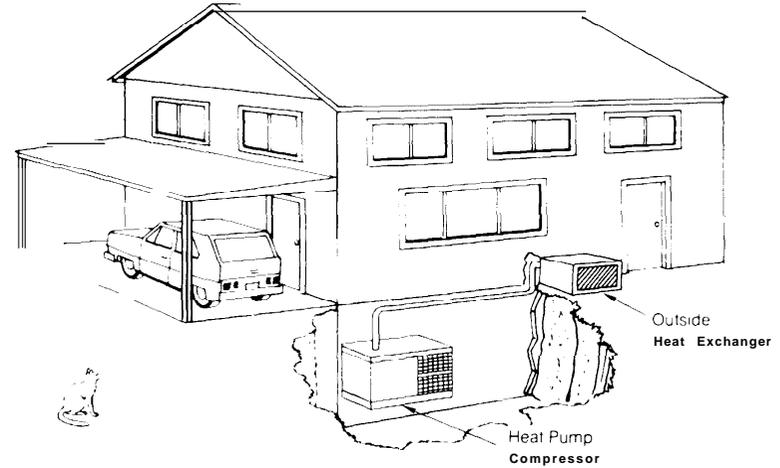
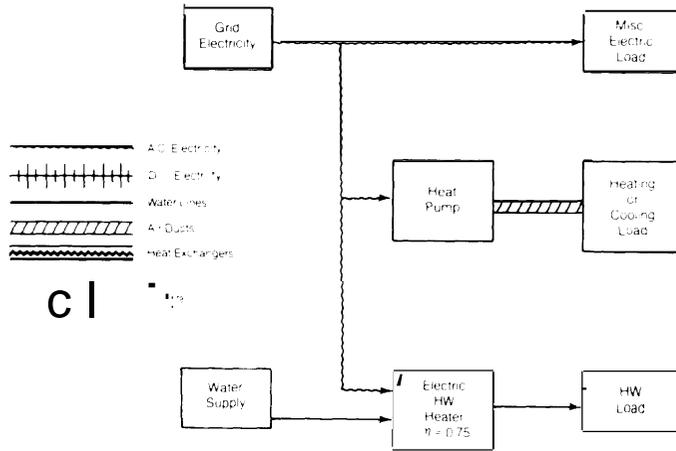
**C. EFFECTIVE COST OF ENERGY TO CONSUMER**  
(Conventional reference system is IF-7)

**ANNUAL ENERGY FLOWS (Conventional reference system is IF-7)**

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit).....	7.8	0.	100.0
Fuel consumed on site (MMBtu/unit).....	169.	142.	16.1
Total energy requirement (bbl crude equiv.) <sup>a</sup> .....	54.	30.	45.6
Electricity sold to grid annually (MWh, entire building).....			0.
Annual peak electricity demand (kW, entire building).....			0.

Levelized cost of solar energy or conservation energy <sup>a</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel.....	4.63 (7.04)	4.45 (6.88)	4.02 (6.34)
¢/kWh electricity.....	5.45 (8.28)	5.23 (8.09)	4.73 (7.46)
<b>Levelized price paid for conventional energy<sup>b</sup></b>			
	Constant real energy prices	Energy price escalation I	Energy price escalation II
\$/MMBtu primary fuel.....	3.37	4.97	7.79
¢/kWh electricity.....	3.96	5.84	9.17

Table IV-21.—Albuquerque: Conventional System—All Electric Single Family House Using Heat Pump Heating (SF-2)



A. ITEMIZED COST OF COMPONENTS

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Heat pump	.185 tons	800 \$/ton	\$1,480	\$50	10
2. Ductwork	—	—	425	0	30
3. Electric water heater	40 gal	225 ea.	225	0	15
<b>TOTAL</b>			<b>\$2,130</b>	<b>\$50</b>	

B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>

[Conventional reference system is SF-2]

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
Total with no incentive	156.	(169.)	186.	(199.)	310.	(322.)
Total with 20% IT	156.	(169.)	186.	(199.)	310.	(322.)
Total with full incentives	156.	(169.)	186.	(199.)	310.	(322.)
<b>2. 1985 Startup<sup>d</sup></b>						
(capital related costs)	32.	(44.)	32.	(44.)	32.	(44.)
(operation & maintenance costs)	7.	(7.)	7.	(7.)	7.	(7.)
(fuel bill)	0.	(0.)	0.	(0.)	0.	(0.)
(electric bill)	117.	(117.)	164.	(164.)	355.	(355.)
Total with no incentives	156.	(169.)	203.	(216.)	395.	(407.)
Total with 20% IT	156.	(169.)	203.	(216.)	395.	(407.)
Total with full incentives	156.	(169.)	203.	(216.)	395.	(407.)

C. EFFECTIVE COST OF ENERGY TO CONSUMER

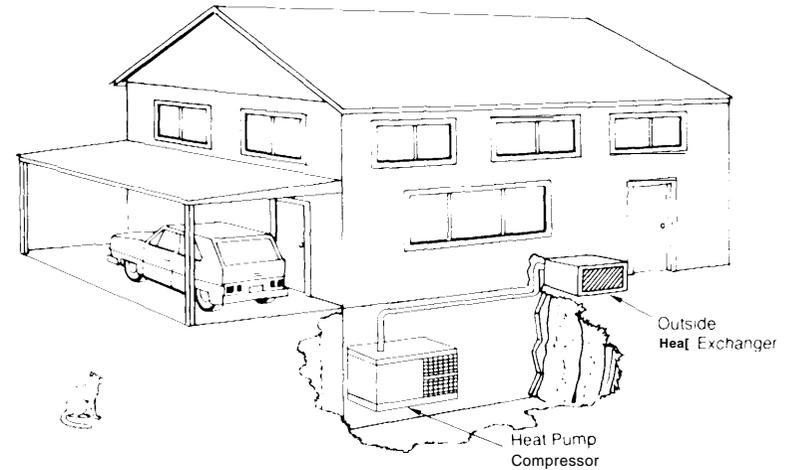
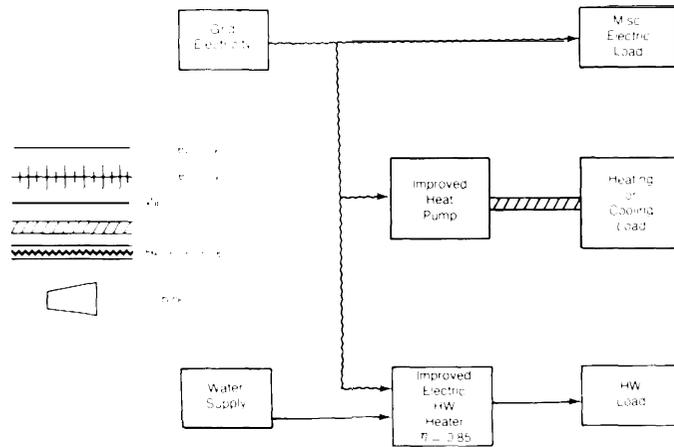
(Conventional reference system is SF-2)

**ANNUAL ENERGY FLOWS** (Conventional reference system is SF-2)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	32.5	32.5	0.
Fuel consumed onsite (MMBtu/unit)	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup>	79.	79.	0.
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			25.6

Levelized cost of solar energy or "conservation" energy <sup>a</sup>	Type of incentives given			
	No incentives		Full incentives	
\$/MMBtu primary fuel	N/A	(N/A)	N/A	(N/A)
¢/kWh electricity	N/A	(N/A)	N/A	(N/A)
<b>Levelized price paid for conventional energy<sup>b,c</sup></b>	<b>Escalation of conventional energy costs</b>			
	Constant real energy prices		Energy price escalation I	
\$/MMBtu primary fuel	3.66	4.61	4.61	8.47
¢/kWh electricity	4.31	5.42	5.42	9.97

Table IV.22.—Albuquerque: Conventional System—All Electric Single Family House Using Improved Heat Pump Heating (High Price) (SF-2)



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs)
1. Heat pump.....	1.85 tons	1,440 \$/ton	\$2,660	\$50	10
2. Ductwork.....	—	—	425	0	30
3. Electric water heater.....	40 gal	225 ea.	225	0	15
<b>TOTAL.....</b>			<b>\$3,310</b>	<b>\$50</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-2)

	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
<b>a. Costs using solar (conservation) system:</b>			
Total with no incentives.....	162. (181.)	188. (208.)	295. (315.)
Total with 20% IT.....	160. (180.)	186. (206.)	293. (313.)
Total with full incentives.....	155. (174.)	182. (201.)	289. (308.)
<b>b. Costs using conventional reference system.....</b>	156.	186.	370.
<b>2. 1985 Startup<sup>a</sup></b>			
<b>0. Costs using solar (conservation) system:</b>			
(capital related costs).....	53. (73.)	53. (73.)	53. (73.)
(operation & maintenance costs).....	7. (7.)	7. (7.)	7. (7.)
(fuel bill).....	0. (0.)	0. (0.)	0. (0.)
(electric bill).....	101. (101.)	142. (142.)	309. (309.)
<b>Total with no incentives.....</b>	<b>162. (181.)</b>	<b>203. (222.)</b>	<b>369. (389.)</b>
<b>Total with 20% IT.....</b>	<b>160. (180.)</b>	<b>201. (221.)</b>	<b>367. (387.)</b>
<b>Total with full incentives.....</b>	<b>155. (174.)</b>	<b>196. (215.)</b>	<b>363. (382.)</b>
<b>b. Costs using conventional reference system.....</b>	156.	203.	395.

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

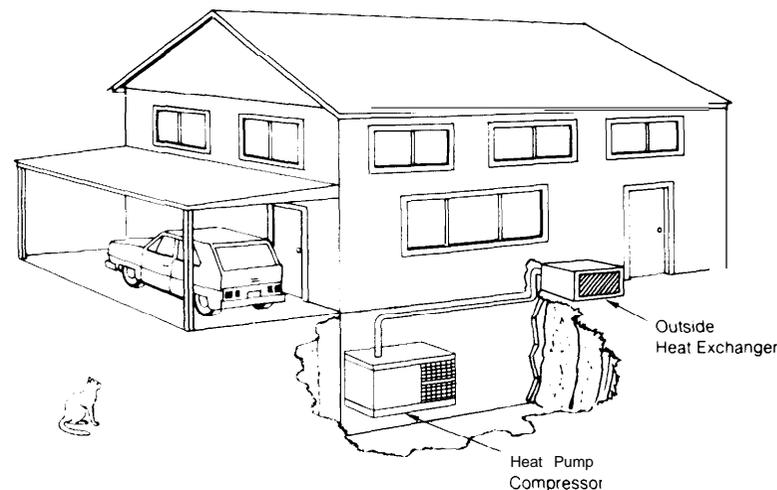
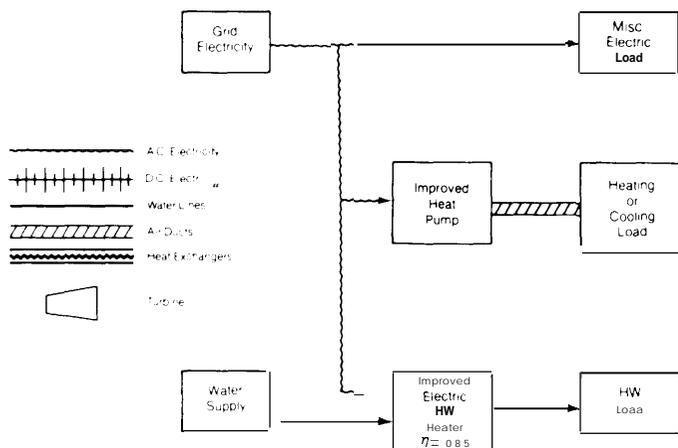
(Conventional reference system is SF-2)

**ANNUAL ENERGY FLOWS (Conventional reference system is SF-21)**

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved ("f" of total)
Net Electricity (bought-sold) (MWh/unit).....	32.5	27.8	14.5
Fuel consumed on site (MMBtu/unit).....	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup> .....	79.	68.	14.5
Electricity sold to grid annually (MWh, entire building).....			0.
Annual peak electricity demand (kW, entire building).....			25.6

Levelized cost of solar energy or "conservation" energy <sup>a</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel.....	4.48 (8.77)	4.06 (8.42)	3.13 (7.25)
¢/kWh electricity.....	5.27 (10.32)	4.78 (9.91)	3.69 (8.54)
<b>Levelized price paid for conventional energy<sup>b,c</sup></b>			
	Constant real energy prices	Energy price escalation I	Energy price escalation II
\$/MMBtu primary fuel.....	3.66	4.61	8.47
¢/kWh electricity.....	4.31	5.42	9.97

**Table IV-23.—Albuquerque: Conventional System—All Electric Single Family House Using Improved Heat Pump Heating (Low Price) (SF-2)**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs)
1. Heat pump	1.85 tons	960 \$/ton	\$1,780	\$50	10
2. Ductwork	—	—	425	0	30
3. Electric water heater	40 gal	225 ea.	225	0	15
<b>TOTAL</b>			<b>\$2,430</b>	<b>\$50</b>	

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-2)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	32.5	27.8	14.5
Fuel consumed onsite (MMBtu/unit)	0	0	0
Total energy requirement (bbl/crude equiv.) <sup>a</sup>	79	68	14.5
Electricity sold to grid annually (MWh, entire building)			0
Annual peak electricity demand (kW, entire building)			25.6

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-2)

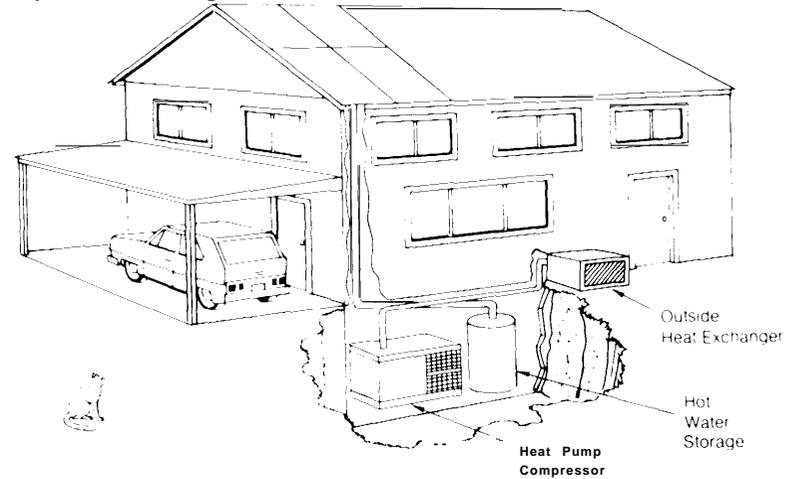
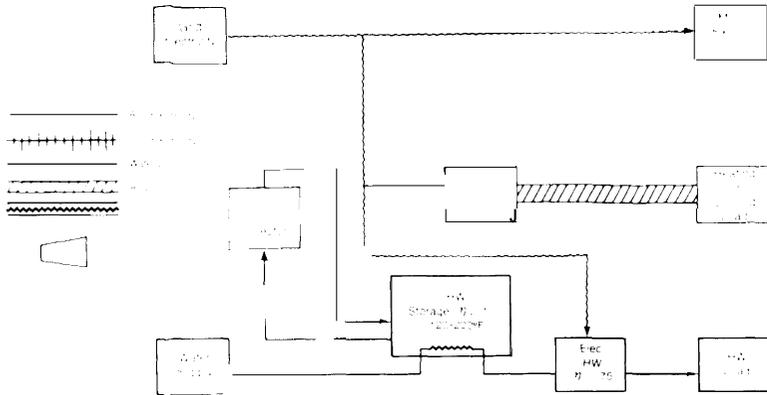
	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
<b>a. Costs using solar (conservation) system:</b>						
Total with no incentives	147.	(160.)	173.	(187.)	280.	(294.)
Total with 20% ITC	146.	(160.)	172.	(186.)	279.	(293.)
Total with full incentives	145.	(159.)	172.	(185.)	279.	(292.)
<b>b. Costs using conventional reference system</b>	157.		187.		310.	
<b>2. 1985 Startup<sup>d</sup></b>						
<b>a. Costs using solar (conservation) system:</b>						
(capital related costs)	38.	(52.)	38.	(52.)	38.	(52.)
(operation & maintenance costs)	7.	(7.)	7.	(7.)	7.	(7.)
(fuel bill)	0.	(0.)	0.	(0.)	0.	(0.)
(electric bill)	101.	(101.)	142.	(142.)	309.	(309.)
Total with no incentives	147.	(160.)	187.	(201.)	354.	(368.)
Total with 20% ITC	146.	(160.)	187.	(201.)	353.	(367.)
Total with full incentives	145.	(159.)	186.	(200.)	353.	(366.)
<b>b. Costs using conventional reference system</b>	157.		204.		395.	

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-2)

Levelized cost of solar energy or 'conservation' energy <sup>c</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	1.15 (4.16)	1.04 (4.07)	.90 (3.78)
¢/kWh electricity	1.35 (4.90)	1.23 (4.50)	1.06 (4.45)
<b>Levelized price paid for conventional energy<sup>b,*</sup></b>	<b>Escalation of conventional energy costs</b>		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
\$/MMBtu primary fuel	3.66	4.61	8.47
¢/kWh electricity	4.31	5.42	9.97

**Table IV-24 .—Albuquerque: Solar Hot Water System—Single Family House Using Flat-Plate Collectors (1977 Prices); Building Equipped With SF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1 Heat pump	1.85 tons	800 \$/tons	\$1,480	50	10
2 Ducting	—	—	425	0	30
3 Hot water storage with electric backup (including heat exchanger).	100 gal	\$355	355	0	30
4 Pumps and controls	—	\$250	250	0	10
5 Insulated steel pipe	75 ft	\$2.6/ft	195	0	30
6 Flat plate solar collectors	10 m <sup>2</sup>	143 \$/m <sup>2</sup>	● 715	0	15
— Collector cost @ 95 \$/m <sup>2</sup>					
— Installation @ 16 \$/m <sup>2</sup>					
— Transportation @ \$3/m <sup>2</sup>					
— Overhead and profit= 25%					
<b>TOTAL</b>			<b>\$4,135</b>	<b>\$50</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-2)

	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
1. 1976 Startup			
a. Costs using solar (conservation) system:			
Total with no incentives	147.	(169.)	261. (283.)
Total with 20% IT	144.	(166.)	258. (280.)
Total With full incentives	140.	(157.)	254. (271.)
b. Costs using conventional reference system	157.	187.	310.
2. 1985 Startup <sup>a</sup>			
a. Costs using solar (conservation) system:			
(capital related costs)	53.	(74.)	53. (74.)
(operation & maintenance costs)	7.	(7.)	7. (7.)
(fuel bill)	0.	(0.)	0. (0.)
(electric bill)	87.	(87.)	122. (122.)
Total with no incentives	147.	(169.)	264. (264.)
Total with 20% IT	144.	(166.)	322. (343.)
Total with full incentives	140.	(157.)	317. (334.)
b. Costs using conventional reference system	157.	204.	395.

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-2)

Levelized cost of solar energy or conservation energy <sup>a</sup>	Type of incentive given		
	No incentives	20% ITC	Full incentive!
\$/MMBtu primary fuel	2.30 (4.65)	1.94 (4.34)	1.47 (3.33)
¢/kWh electricity	2.70 (5.47)	2.28 (5.11)	1.73 (3.92)
<b>Levelized price paid for conventional energy<sup>b,*</sup></b>			
\$/MMBtu primary fuel	3.66	4.61	8.47
¢/kWh electricity	4.31	5.42	9.97

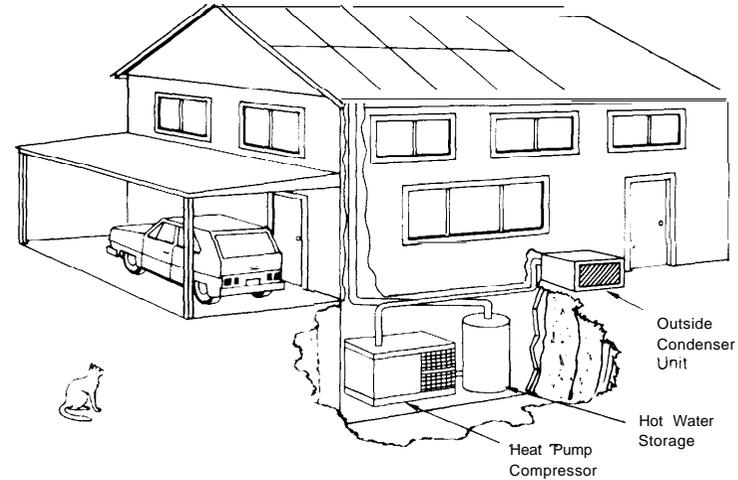
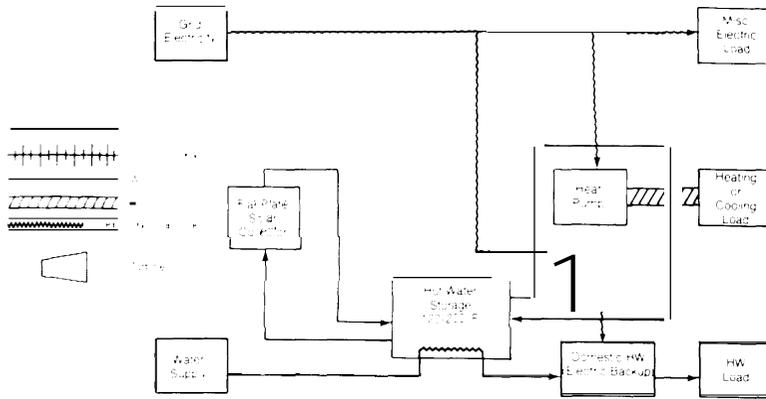
<sup>a</sup> 1/2 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs.

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-2)

	Energy consumed by ref. system	Backup consumed solar/conservation	w/ Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	32.5	23.3	28.4
Fuel consumed onsite (MMBtu/unit)	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup>	79.	57.	28.4
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			27.3

**Table IV-25.—Albuquerque: Solar Hot Water and Heating System—Single family House Using Flat-Plate Collectors (1977 Prices), Low-Temperature Thermal Storage; Building Equipped With SF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Heat pump.....	1.85 tons	800 \$/ton	\$1,480	\$50	10
2. Ductwork.....	—	—	425	0	30
3. Collectors and associated costs.....	25 m <sup>2</sup>	143 \$/m <sup>2</sup>	1,787	0	15
—Collectors @ 95 \$/m <sup>2</sup>			● 1,787	0	30
—Installation @ 16 \$/m <sup>2</sup>					
—Transportation @ 3 \$/m <sup>2</sup>					
—25% overhead and profit					
4. 3/4" insulated steel pipe.....	125 ft	\$4.1	513	0	30
5. Storage (without plumbing).....	200 kWh	\$2.05/kWh	410	0	30
6. Pump, controls, and heat exchanger.....	—	\$650	650	0	10
<b>TOTAL.....</b>			<b>\$7,052</b>	<b>\$50</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-2)

	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
<b>a. Costs using solar (conservation) system:</b>			
Total with no incentives.....	171. (206.)	191. (226.)	273. (308.)
Total with 20% ITC.....	163. (199.)	183. (219.)	265. (301.)
Total with full incentives.....	152. (177.)	172. (197.)	254. (279.)
<b>b. Costs using conventional reference system.....</b>	<b>157.</b>	<b>187.</b>	<b>310.</b>
<b>2. 1985 Startup<sup>d</sup></b>			
<b>a. Costs using solar (conservation) system:</b>			
(capital related costs).....	85. (121.)	85. (121.)	85. (121.)
(operation & maintenance costs).....	7. (7.)	7. (7.)	7. (7.)
(fuel bill).....	0. (0.)	0. (0.)	0. (0.)
(electric bill).....	78. (78.)	109. (109.)	0. (0.)
Total with no incentives.....	171. (206.)	202. (237.)	237. (237.)
Total with 20% ITC.....	163. (199.)	194. (230.)	321. (365.)
Total with full incentives.....	152. (177.)	184. (208.)	311. (358.)
<b>b. Costs using conventional reference system.....</b>	<b>157.</b>	<b>204.</b>	<b>395.</b>

**c. EFFECTIVE COST OF ENERGY TO CONSUMER**

[Conventional reference system is SF-2]

Levelized cost of solar energy or 'conservation' energy <sup>a</sup>	Type of incentives given		
	No incentive	20% ITC	Full incentives
\$/MMBtu primary fuel.....	4.49 (7.48)	3.82 (6.91)	2.94 (5.01)
¢/kWh electricity.....	5.29 (8.81)	4.50 (8.13)	3.46 (5.89)
	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>Levelized price paid for conventional energy<sup>b,*</sup></b>			
\$/MMBtu primary fuel.....	3.66	4.61	8.47
¢/kWh electricity.....	4.31	5.42	9.97

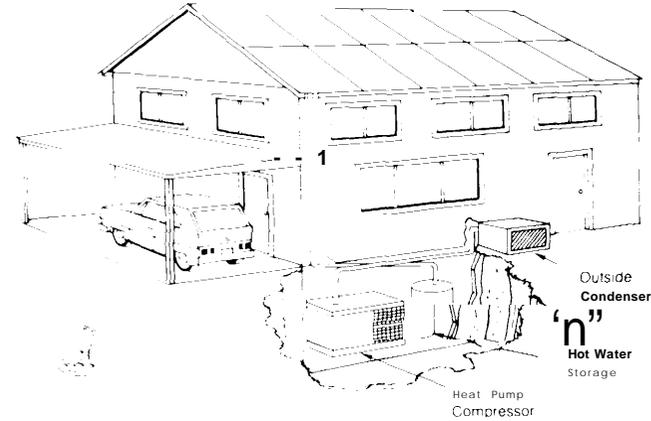
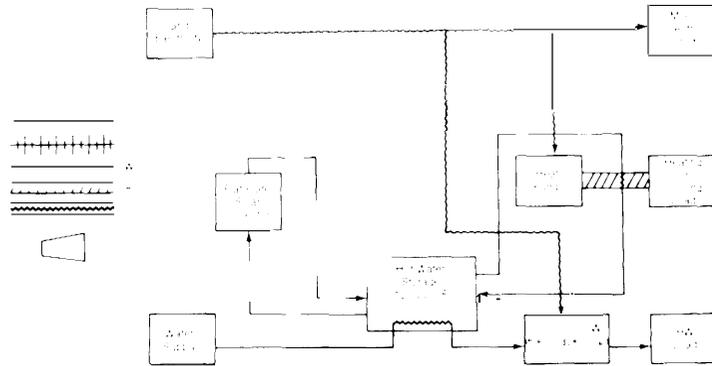
\* 24 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs.

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-21)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit).....	32.5	20.5	37.0
Fuel consumed onsite (MMBtu/unit).....	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup> .....	79.	50.	37.0
Electricity sold to grid annually (MWh, entire building).....			0.
Annual peak electricity demand (kW, entire building).....			25.6

**Table IV-26.—Albuquerque: Solar Hot Water and Heating System—Single Family House Using Flat-Plate Collectors (1977 Prices); Building Equipped With SF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs)
1 Heat pump	1.85 tons	800 \$/ton	\$1,480	\$50	10
2 Ductwork	—	—	425	0	30
3 Collectors and associated costs	30 m <sup>2</sup>	143 \$/m <sup>2</sup>	* 2,145	0	30
—Collector! @ 95 \$/m <sup>2</sup>			" 2,145	0	15
—Installation @ 16 \$/m <sup>2</sup>					
—Transportation @ 3 \$/m <sup>2</sup>					
—25% overhead and profit					
4. 1. insulated steel pipe	125 ft	4.1 \$/ft	513	0	30
5 Storage (without plumbing)	200 kWh	205 \$/kWh	410	0	30
6 Pumps, controls, and heat exchanger	—	—	650	0	10
<b>TOTAL FOR BUILDING</b>			<b>\$7,768</b>	<b>\$50</b>	
<b>TOTAL PER UNIT</b>			<b>\$7,768</b>	<b>\$50</b>	

\* 1. installed collector cost assumed replaced in 15 yrs with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-2)

	Energy consumed by ref. system	Backup consumed solar/conservation	Energy saved (% of total)
Net Electricity (bought/sold)(MWh/unit).....	32.5	19.0	41.4
Fuel consumed onsite(MMBtu/unit).....	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup> ..	79.	47.	41.4
Electricity sold to grid(annually)(MWh, entire building).....			0.
Annual peak electricity demand(kW, entire building).....			25.6

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>bc</sup>**

(Conventional reference system is SF-2)

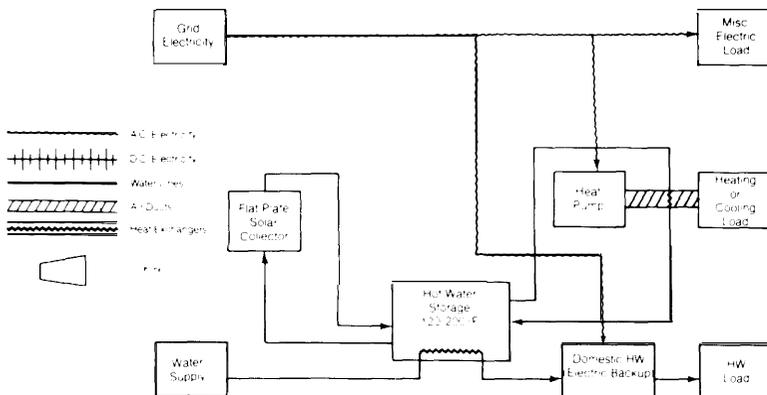
	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
<b>a. Costs using solar (conservation) system:</b>			
Total with no incentives .....	172.	(212.)	191.
Total with 20% ITC.....	163.	(204.)	182.
Total with full incentives .....	143.	(179.)	162.
<b>b. Costs using conventional reference system .....</b>	156.	186.	310.
<b>2. 1985 Startup<sup>a</sup></b>			
<b>a. Costs using solar (conservation) system:</b>			
(capital related costs) .....	92.	(132.)	92.
(operation & maintenance costs) .....	7.	(7.)	7.
(fuel bill) .....	0.	(0.)	0.
(electric bill) .....	73.	(73.)	103.
Total with no incentives .....	172.	(212.)	202.
Total with 20% ITC.....	163.	(204.)	193.
Total with full incentives .....	143.	(179.)	172.
<b>b. Costs using conventional reference system .....</b>	156.	203.	395.

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-2)

Levelized cost of solar energy or 'conservation' energy <sup>c</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel.....	4.52 (7.53)	3.83 (6.94)	2.27 (4.99)
¢/kWh electricity.....	5.32 (8.86)	4.51 (8.17)	2.68 (5.88)
<b>Levelized price paid for conventional energy<sup>b</sup>.</b>			
\$/MMBtu primary fuel.....	3.66	4.61	8.47
¢/kWh electricity.....	4.31	5.42	9.97

**Table IV-27.—Albuquerque: Solar Hot Water and Heating System—Single Family House Using Flat Plate Collectors (1977 Prices), Low-Temperature Thermal Storage; Building Equipped With SF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

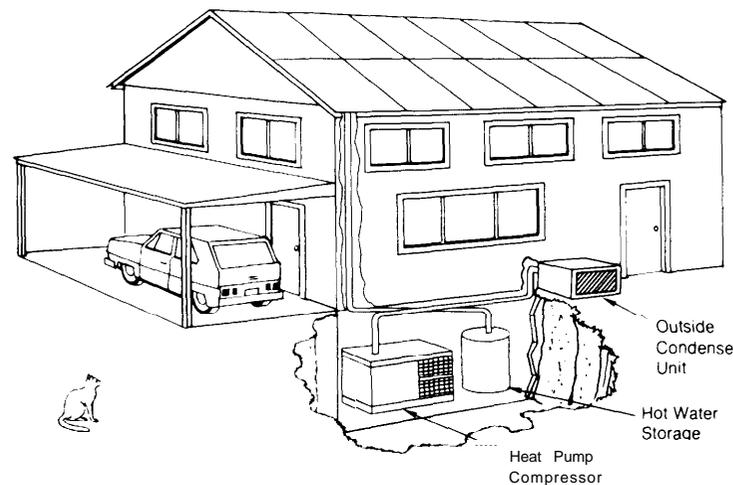
Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Heat pump	1.85 ton	800 \$/ton	\$1,480	\$50	10
2. Ductwork	—	—	425	0	30
3. Collectors and associated costs	45 m <sup>2</sup>	143 \$/m <sup>2</sup>	3,217	0	15
—Collector @ 95 \$/m <sup>2</sup>			● 3,217	0	30
—Installation @ 16 \$/m <sup>2</sup>					
—Transportation @ 3 \$/m <sup>2</sup>					
—25% overhead and profit					
4. Insulated steel pipe	125 ft	\$4.1	513	0	30
5. Storage (without plumbing)	200 kWh	\$2.05/kWh	410	0	30
6. Pump, controls, and heat exchanger	—	\$650	650	0	10
<b>TOTAL</b>			<b>\$9,912</b>	<b>\$50</b>	

• 1/2 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-2)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	32.5	16.8	48.4
Fuel consumed onsite (MMBtu/unit)	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup>	79.	41.	48.4
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			25.6



**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-2)

	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
<b>a. Costs using solar (conservation) system:</b>			
Total with no incentives	188. (237.)	205. (254.)	274. (323.)
Total with 20% ITC	176. (226.)	193. (243.)	262. (313.)
Total with full incentives	159. (191.)	176. (208.)	245. (277.)
<b>b. Costs using conventional reference system</b>	157.	187.	310.
<b>2. 1985 Startup<sup>d</sup></b>			
<b>a. Costs using solar (conservation) system:</b>			
(capitol related costs)	115. (164.)	115. (164.)	115. (164.)
(operation & maintenance costs)	7. (7.)	7. (7.)	7. (7.)
(fuel bill)	0. (0.)	0. (0.)	0. (0.)
(electric bill)	66. (66.)	92. (92.)	200. (200.)
Total with no incentives	188. (237.)	215. (263.)	322. (371.)
Total with 20% ITC	176. (226.)	202. (253.)	310. (361.)
Total with full incentives	159. (191.)	186. (217.)	293. (325.)
<b>b. Costs using conventional reference system</b>	157.	204.	395.

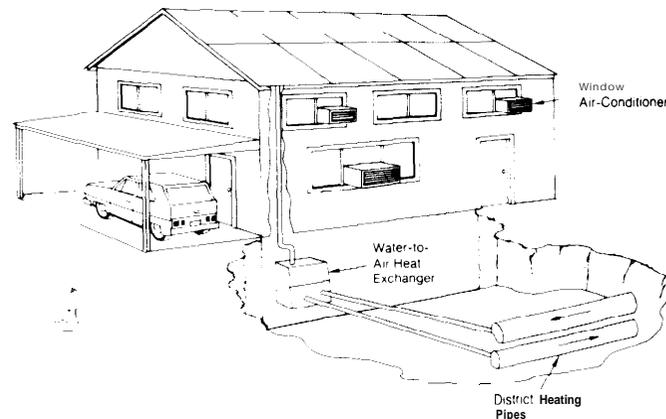
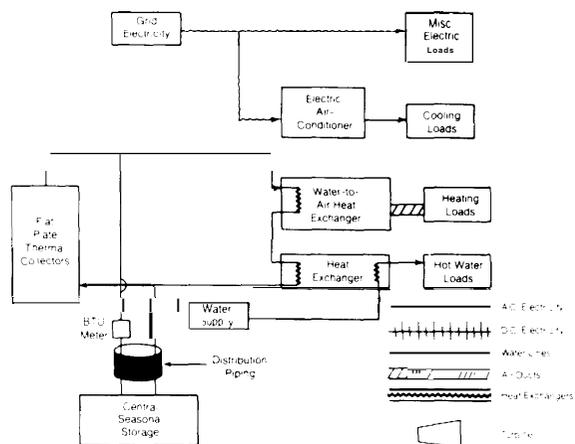
**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-2)

Levelized cost of solar energy or 'conservation' energy <sup>e</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	5.35 (8.52)	4.54 (7.82)	3.48 (5.52)
¢/kWh electricity	6.30 (10.02)	5.35 (9.21)	4.09 (6. XI)
	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>Levelized price paid for conventional energy<sup>b,d</sup></b>			
\$/MMBtu primary fuel	3.66	4.61	8.47
¢/kWh electricity	4.31	5.42	9.97



**Table IV-29.—Albuquerque: 100-Percent Solar Hot Water and Heating System—Single Family House Using Flat Plate Collectors (Possible Future Price), Community Seasonal Storage; Building Equipped With SF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Fan coil unit	.132 kW	13 \$/kW	\$170		0 15
2. Ductwork	—	—	425		0 30
3. Control electric etc.	—	—	796	\$30 10	0 15
4. Hot water tank w/heat exch.	30 ga	225 \$/ton	225		0 15
5. Collectors and associated cth.	40 m <sup>2</sup>	86 \$/m <sup>2</sup>	1,720		0 15
—Collectors @ 50 \$/m <sup>2</sup>			1,720		0 30
—Installation @ 16 \$/m <sup>2</sup>			—		—
—Transportation @ 3 \$/m <sup>2</sup>			—		—
—25% overhead and profit			—		—
6. Controls	—	—	100		0 15
7. 1" insulated steel pipe	100 ft	\$4.1/ft	410		0 30
8. Storage (aquifer part)	—	—	1,700		0 30
9. Distribution piping	—	—	3,000		90 30
<b>TOTAL FOR BUILDING</b>			<b>\$10,266</b>	<b>\$120</b>	
<b>TOTAL PER UNIT</b>			<b>\$10,266</b>	<b>\$120</b>	

1/2 installed collector cost assumed replaced in 15 yrs with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-2)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MMWh/unit)	32.5	11.3	65.4
Fuel consumed on site (MMBtu/unit)	0.	0.	0.
Total energy requirement (bbl crude equiv.)	79.	28.	65.4
Electricity sold to grid annually (MMWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			5.2

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b, c</sup>**

(Conventional reference system is SF-2)

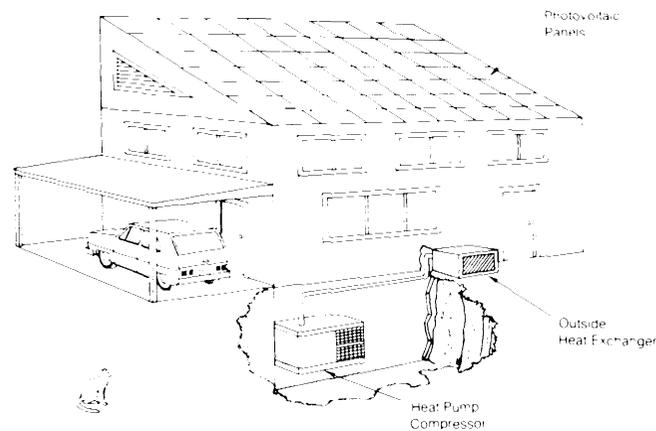
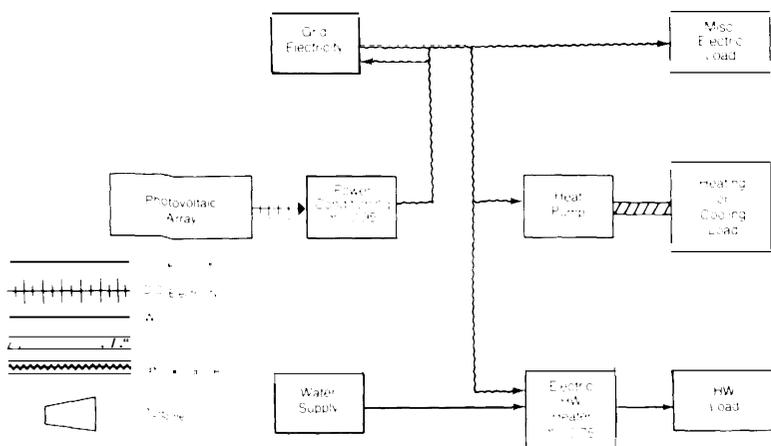
	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
<b>a. Costs using solar (conservation) system:</b>						
Total with no incentives	166.	(21 1.)	178.	(224.)	229.	(274.)
Total with 20% IT	153.	(200.)	165.	(212.)	216.	(263.)
Total with full incentives	136.	(163.)	148.	(175.)	199.	[226.]
<b>b. Costs using conventional reference system</b>	157.		187.		310.	
<b>2. 1985 Startup<sup>a</sup></b>						
<b>a. Costs using solar (conservation) system:</b>						
(capital related costs)	100.	(146.)	100.	(146.)	100.	(146.)
(operation & maintenance costs)	18.	(18.)	18.	(18.)	18.	(18.)
(fuel bill)	0.	(0.)	0.	[0.]	0.	(0.)
(electric bill)	48.	(48.)	67.	(67.)	146.	[146.]
Total with no incentives	166.	(21 1.)	185.	(231.)	264.	[309.]
Total with 20% IT	153.	(200.)	172.	(219.)	251.	(298.)
Total with full incentives	136.	(163.)	155.	(182.)	233.	[261.]
<b>b. Costs using conventional reference system</b>	157.		204.		3 9 5 .	

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-2)

Levelized cost of solar energy or 'conservation' energy <sup>a</sup>	Type of incentives given					
	No incentives		20% ITC		Full incentives	
\$/MMBtu primary fuel	3.75	(5.93)	3.13	(5.39)	2.30	(3.61)
¢/kWh electricity	4.42	(6.98)	3.68	(6.35)	2.71	(4.25)
	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
Levelized price paid for conventional energy <sup>b, c</sup>	3.66		4.61		8.47	
\$/MMBtu primary fuel	4.31		5.42		9.97	
¢/kWh electricity						

**Table IV-30. — Albuquerque: Solar Photovoltaic System— Single Family House Using Flat-Plate Air-Cooled Silicon Arrays (\$0.50/Watt); Building Equipped With SF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Heat pump.....	1.85 tons	800 \$/ton	\$1,480	\$50	10
2. Ductwork.....	—	—	425	0	30
3. Electric hot water.....	40 gal	\$225 ea.	225	0	15
4. Air-cooled silicon PV (\$500\$/kw)( $\eta = 0.12$ ).....	118 m <sup>2</sup>	88 \$/m <sup>2</sup>	\$5,190	0	30
— Silicon array @ 60 \$/m <sup>2</sup>			\$5,190	0	15
— Shipping @ 2 \$/m <sup>2</sup>					
— Installation @ 8 \$/m <sup>2</sup>					
— 25% overhead and profit					
5. Power conditioning.....	4 kW	108	1,510	15	30
6. Lightning protection.....	—	—	300	0	30
<b>TOTAL.....</b>			<b>\$14,320</b>	<b>\$65</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-2)

	Escalation of conventional energy costs			
	Constant real energy prices	Energy price escalation I	Energy price escalation II	
1. 1976 Startup				
cr. Costs using solar (conservation) system:				
Total with no incentives.....	215. (284.)	229. (297.)	283. (351.)	
Total with 20% ITC.....	196. (267.)	209. (280.)	263. (334.)	
Total with full incentives.....	170. (211.)	183. (225.)	238. (279.)	
b. Costs using conventional reference system.....	157.	187.	310.	
2. 1985 Startup <sup>d</sup>				
a. Costs using solar (conservation) system:				
(capitol related Cash.....)	154. [223.]	154. [223.]	154. (223.)	
(operation & maintenance costs).....	10. (10.)	10. (10.)	10. (10.)	
(fuel bill).....	0. (0.)	0. (0.)	0. (0.)	
(electric bill).....	51. (51.)	72. (72.)	156. [156.]	
Total with no incentives.....	215. (284.)	236. (304.)	320. [389.]	
Total with 20% ITC.....	196. (267.)	217. (288.)	301. (372.)	
Total with full incentives.....	170. (211.)	191. (232.)	275. (316.)	
b. Costs using conventional reference system.....	157.	204.	395.	

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-2)

Levelized cost of solar energy or 'conservation' energy <sup>f</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel.....	4.55 (7.05)	3.83 (6.44)	2.89 [4.40]
¢/kWh electricity.....	5.36 (8.30)	4.51 (7.58)	3.40 (5.18)
	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
Levelized price paid for conventional energy <sup>b,*</sup>			
\$/MMBtu primary fuel.....	3.66	4.61	8.47
¢/kWh A&I+.....	4.31	5.42	9.97

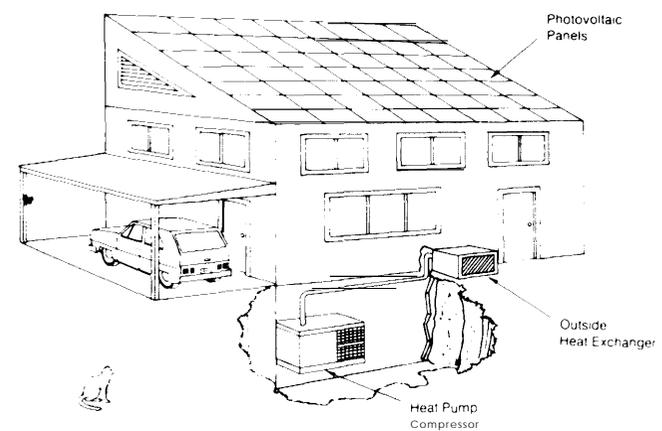
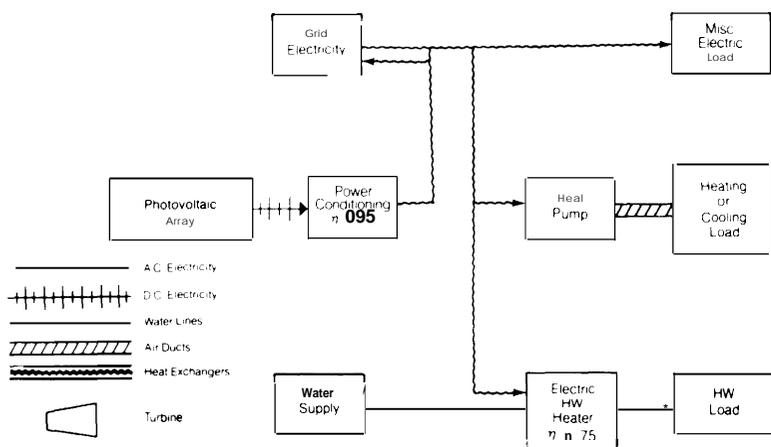
\* 1/2 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs.

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-2)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit).....	32.5	4.7	85.6
Fuel consumed on site (MMBtu/unit).....	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup> .....	79.	11.	85.6
Electricity sold to grid annually (MWh, entire building).....			15.3
Annual peak electricity demand (kW, entire building).....			23.5

**Table IV-31 .—Albuquerque: Solar Photovoltaic System—Single Family House Using Flat-Plate Air-Cooled Thin-Film Arrays (\$0.10/Watt); Building Equipped With SF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs)
1. Heat pump.....	.185 tons	\$800/ton	\$1,480	\$50	10
2. Ductwork.....	—	—	425	0	30
3. Electric hot water heater.....	40 gal	\$225 ea.	225	0	15
4. Thin film module (η = 0.094) thin film @ 100 \$/1kW.....	106 m <sup>2</sup>	25 \$/m <sup>2</sup>	*1,330	0	30
—Thin film @ 10 \$/m <sup>2</sup>					
—Installation @ 8 \$/m					
—Shipping @ 2 \$/m <sup>2</sup>					
—25% overhead and profit					
5. Power conditioning.....	10 kW	40 \$/kW	400	4	30
6. Lightning protection.....	—	—	300	0	30
<b>TOTAL</b> .....			<b>\$5,490</b>	<b>\$54</b>	

\* 1/2 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs.

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-2)

	Energy consumed by ref. system	Backup consumed solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit).....	32.5	13.0	59.9
Fuel consumed onsite (MMBtu/unit).....	0.	0.	0.
<b>Total energy requirement (bbl crude equiv.)<sup>a</sup></b> .....	<b>79.</b>	<b>32.</b>	<b>59.9</b>
Electricity sold to grid annually (MWh, entire building).....			9.1
Annual peak electricity demand (kW, entire building).....			24.1

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-2)

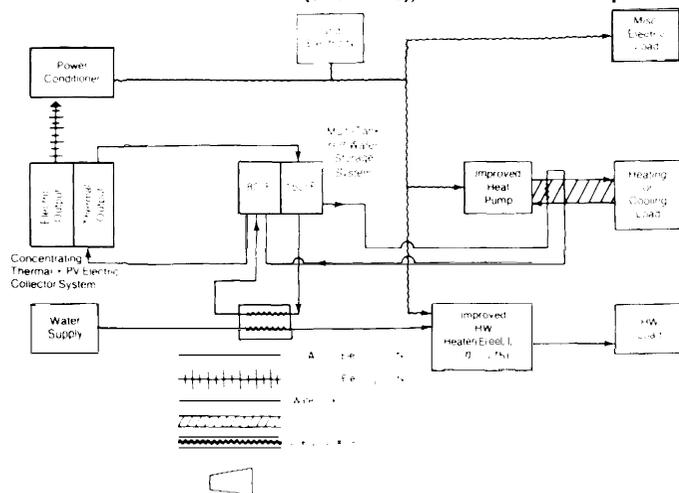
	Escalation of conventional energy costs			
	Constant real energy prices	Energy @ CO escalation I	Energy price escalation II	Scabtim II
<b>1. 1976 Startup</b>				
<b>0. Costs using solar (conservation) system:</b>				
Total with no incentives.....	142.	(169.)	160.	(187.)
Total with 20% ITC.....	137.	(165.)	154.	(182.)
Total with full incentives.....	129.	(149.)	147.	(167.)
<b>2. 1985 Startup<sup>d</sup></b>	<b>157.</b>		<b>187.</b>	<b>310.</b>
<b>a. Costs using solar (conservation) system:</b>				
(capital related costs).....	66.	(93.)	66.	(93.)
(operation & maintenance costs).....	8.	(8.)	8.	(8.)
(fuel bill).....	0.	(0.)	0.	(0.)
(electric bill).....	68.	(68.)	96.	(96.)
Total with no incentives.....	142.	(169.)	170.	(197.)
Total with 20% ITC.....	137.	(165.)	164.	(192.)
Total with full incentives.....	129.	(149.)	157.	(177.)
<b>b. Costs using conventional reference system.....</b>	<b>157.</b>		<b>20.4.</b>	<b>395.</b>

**c. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-2)

Levelized cost of solar energy or 'conservation' energy <sup>e</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel.....	1.77 (3.20)	1.48 (2.96)	1.11 (2.16)
¢/kWh electricity.....	2.08 (3.77)	1.75 (3.48)	1.31 (2.54)
<b>Levelized price paid for conventional energy<sup>b,a</sup></b>			
\$/MMBtu primary fuel.....	3.6d	4.61	8.47
¢/kWh electricity.....	4.31	5.42	9.97

**Table IV-32.—Albuquerque: Solar Photovoltaic Cogeneration System—Single Family House Using One-Axis Concentrator With Si Cells (\$15/Cells), Multitank Low-Temperature Thermal Storage; Building Equipped With SF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

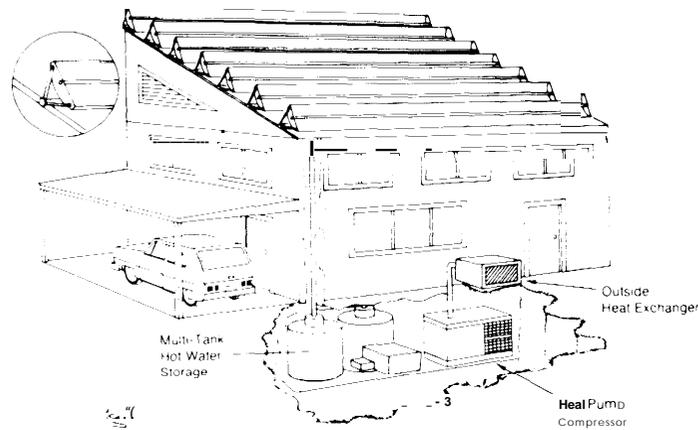
Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Electric heat pump.....	1.85 tons	800 \$/ton	\$1,480	\$50	10
2. Ductwork.....	—	425	0	0	30
3. Multitank electric hot water and storage.....	200 kWh	3 \$/kWh	600	0	30
4. Insulated steel pipe.....	125 ft	4.1 \$/ft	\$513	0	30
5. 1-axis tracking silicon module (cells cost \$15,000/kW) (η = 0.099)	74 m <sup>2</sup>	293 \$/m <sup>2</sup>	● 10,840	0	30
—Tracking collector @ 130 \$/m <sup>2</sup>			● 10,840	0	15
—Silicon concentrator cells @ 62 \$/m <sup>2</sup>					
—Shipping @ 2 \$/m <sup>2</sup>					
—Installation @ 40 \$/m <sup>2</sup>					
—Overhead and profit @ 25%					
6 Pumps, controls and hot exchanger and miscellaneous equipment.....	—	—	500	0	10
7 Thermal only collector area.....	18 m <sup>2</sup>	215 \$/m <sup>2</sup>	.1 935	0	30
8. Power conditioning.....	7 kW	222 \$/kW	1,550	16	30
9. Lightning protection.....	—	—	300	0	30
<b>TOTAL.....</b>			<b>\$30,918</b>	<b>\$66</b>	

● ½ installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs.

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-2)

	Energy consumed by ref. system	Backup consumed solar/conservation	w / (% of total)	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit).....	32.5	2.4	92.7	0.
Fuel consumed onsite (MMBtu/unit).....	0.	0.	0.	92.7
Total energy requirement (bbl crude equiv.).....	79.	8		
Electricity sold to grid annually (MWh, entire building).....				5.7
Annual peak electricity demand (kW, entire building).....				25.6



**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-2)

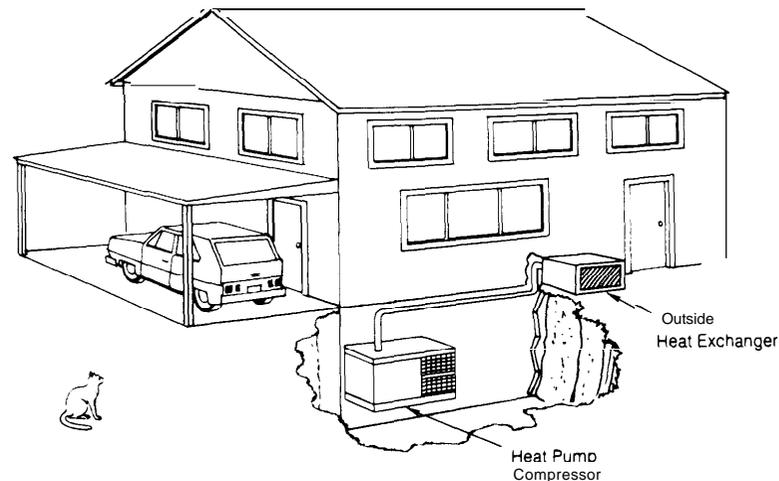
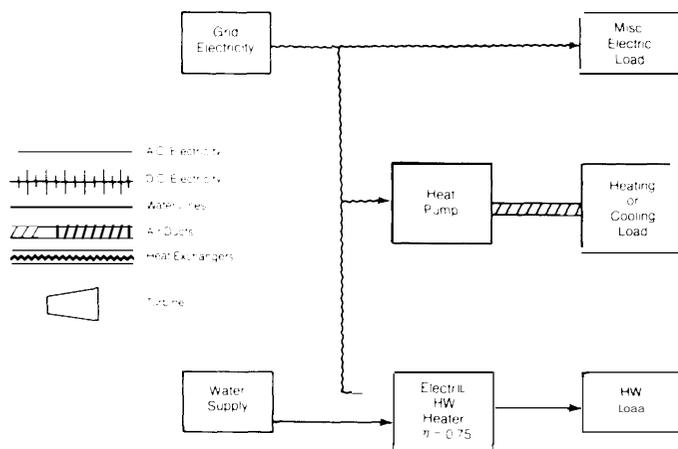
	Escalation of conventional energy costs			
	Constant real noFY prices	Energy price escalation I	Energy price escalation II	
<b>1. 1976 Startup</b>				
0. Costs using solar (conservation) system:				
Total with no incentives.....	362.	(508.)	369.	(515.)
Total with 20% IT.....	316.	(469.)	322.	(475.)
Total with full incentives.....	255.	(337.)	261.	(344.)
<b>b. Costs using conventional reference system.....</b>	157.	187.	310.	
<b>2. 1985 Startup<sup>d</sup></b>				
a. Costs using solar (conservation) system:				
(capital related costs).....	327.	(473.)	327.	(473.)
(operation & maintenance costs).....	10.	(10.)	10.	(10.)
(fuel bill).....	0.	(0.)	0.	(0.)
(electric bill).....	25.	(25.)	36.	(36.)
Total with no incentives.....	362.	(508.)	372.	(519.)
Total with 20% IT.....	316.	(469.)	326.	(479.)
Total with full incentives.....	255.	(337.)	265.	(348.)
<b>b. Costs using conventional reference system.....</b>	157.	204.	395.	

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is SF-2)

Levelized cost of solar energy or 'conservation' energy <sup>a</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel.....	10.04 (14.98)	8.47 (13.65)	6.41 (9.20)
¢/kWh electricity.....	11.81 (17.64)	9.97 [16.06]	7.55 (10.83)
<b>Levelized price paid for conventional energy<sup>b,*</sup></b>			
	Constant real energy prices	Energy price escalation I	Energy price escalation II
\$/MMBtu primary fuel.....	3.66	4.61	8.47
¢/kWh electricity.....	4.31	5.42	9.97

**Table IV-33.—Albuquerque: Conventional System—Insulated Single Family All Electric House With Heat Pump Heating (IF-2)**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	Life (yrs)
1. Heat pump	1.3 tons	800 \$/ton	\$1,040	\$50	10
2. Ductwork	—	—	425	0	30
3. Electric water heater	40 gal	225 ea.	225	0	15
4. Extra insulation, storm doors and windows	—	—	981	0	30
<b>TOTAL</b>			<b>\$2,671</b>	<b>\$50</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is IF-2)

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
Total with no incentives	142.	(155.)	168.	(181.)	275.	(289.)
Total with 20% ITC	142.	(155.)	168.	(181.)	275.	(289.)
Total with full incentives	142.	(155.)	168.	(181.)	275.	(289.)
<b>2. 1985 Startup<sup>d</sup></b>						
(capital related costs)	32.	(46.)	32.	(46.)	32.	(46.)
(operation & maintenance costs)	7.	(7.)	7.	(7.)	7.	(7.)
fuel bill	0.	(0.)	0.	(0.)	0.	(0.)
electric bill	102.	(102.)	143.	(143.)	311.	(311.)
Total with no incentives	142.	(155.)	183.	(196.)	350.	(364.)
Total with 20% ITC	142.	(155.)	183.	(196.)	350.	(364.)
Total with full incentive	142.	(155.)	183.	(196.)	350.	(364.)

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

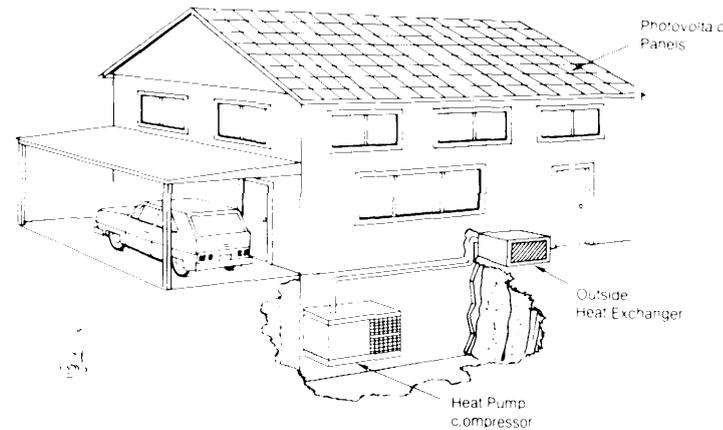
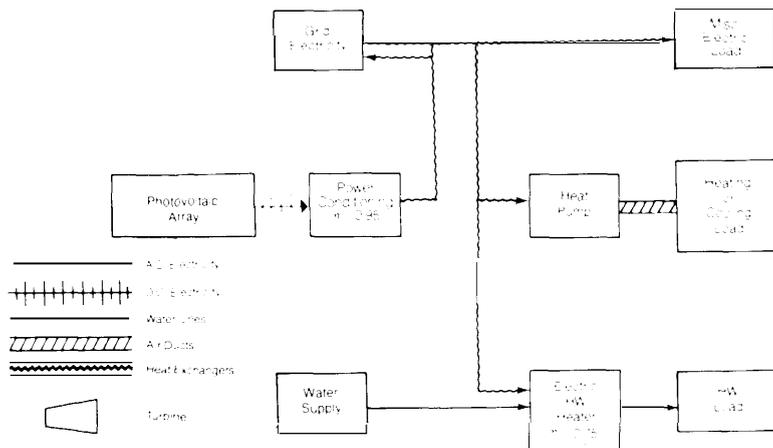
(Conventional reference system is IF-2)

**ANNUAL ENERGY FLOWS (Conventional reference system is IF-2)**

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	28.0	28.0	0.
Fuel consumed onsite (MMBtu/unit)	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup>	68.	68.	0.
Electricity sold to grid annually (MWh, entire kiting)			0.
Annual peak electricity demand (kW, entire building)			22.1

Levelized cost of solar energy or 'conservation' energy <sup>a</sup>	Type of incentives given					
	No incentives		20% ITC		Full incentives	
\$/MMBtu primary fuel	N/A	(N/A)	N/A	(N/A)	N/A	(N/A)
¢/kWh electricity	N/A	(N/A)	N/A	(N/A)	N/A	(N/A)
<b>Escalation of conventional energy costs</b>						
Levelized price paid for conventional energy <sup>b,c</sup>	Constant real energy prices		Energy price escalation I		Energy price escalation II	
	\$/MMBtu primary fuel	3.72	4.68	a d o		
¢/kWh electricity	4.38	5.51	10.12			

**Table IV-34.—Albuquerque: Solar Photovoltaic System—Insulated Single Family House Using Flat-Plate Air-Cooled Silicon Arrays (\$0.50/Watt); Building Equipped With IF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M (yrs)
1. Heat pump	1.3 tons	800 \$/ton	\$1,040	\$50 10
2 Ductwork	—	—	425	0 30
3. Electric hot water	40 gal	\$225 ea.	225	0 15
4. Air-cooled silicon PV [500 \$/kW] ( $\eta = 0.12$ )	59 m <sup>2</sup>	88 \$/m <sup>2</sup>	*2,600	0 30
—Silicon array @ 60 \$/m <sup>2</sup>				0 15
—Shipping @ 2 \$/m <sup>2</sup>				
—Installation @ 8 \$/m <sup>2</sup>				
—25% overhead and profit				
5. Power conditioning	7.6 kW	113	859	9 30
6. Lightning protection	—	—	300	0 30
7. Extra insulation, storm doors and windows	—	—	981	0 30
<b>TOTAL</b>			<b>\$9,030</b>	<b>\$59</b>

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**  
(Conventional reference system is IF-2)

	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
cc. Costs using solar (conservation) system:			
Total with no incentives	172. (214.)	189. (231.)	258. (301.)
Total with 20% IT	161. (206.)	178. (223.)	248. (292.)
Total with full incentives	14a. (176.)	165. (194.)	234. (263.)
b. Costs using conventional reference system	142.	168.	276.
<b>2. 1985 Startup<sup>d</sup></b>			
CC. Costs using solar (conservation) system:			
(capital related Cash)	97. (140.)	97. (140.)	97. (140.)
(operation & maintenance costs)	9. (9.)	9. (9.)	9. (9.)
(fuel bill)	0. (0.)	0. (0.)	0. (0.)
(electric bill)	66. (66.)	92. (92.)	200. (200.)
Total with no incentives	172. (214.)	198. (241.)	306. (349.)
Total with 20% IT	161. (206.)	188. (232.)	296. (340.)
Total with full incentives	148. (176.)	174. (203.)	282. (311.)
b. Costs using conventional reference system	142.	183.	350.

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**  
(Conventional reference system is IF-2)

Levelized cost of solar energy or 'conservation' energy <sup>a</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	4.62 (7.62)	3.91 (7.01)	2.96 (4.97)
¢/kWh electricity	5.44 (8.97)	4.60 (8.25)	3.49 (5.85)
<b>Levelized price paid for conventional energy<sup>b,*</sup></b>			
\$/MMBtu primary fuel	3.72	4.68	8.60
¢/kWh electricity	4.38	5.51	10.12

<sup>a</sup> 1/2 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS**  
(Conventional reference system is IF-2)

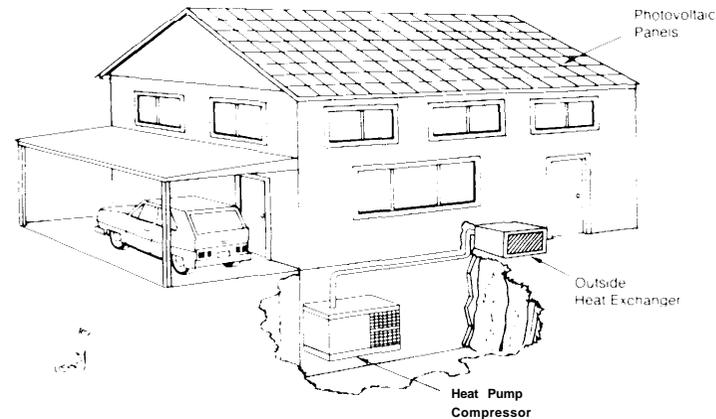
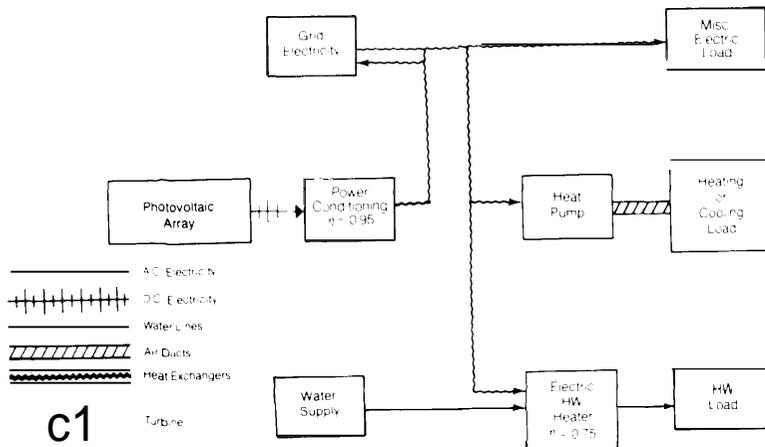
	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought/sold) (MWh/unit)	28.0	13.4	51.9
Fuel consumed onsite (MMBtu/unit)	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup>	68.	33.	51.9
Electricity sold to grid annually (MWh, entire building)			6.7
Annual peak electricity demand (kW, entire building)			19.6







**Table V-38.—Albuquerque: Solar Photovoltaic System—Insulated Single Family House Using Flat-Plate Air-Cooled Thin-Film Arrays (\$0.10/Watt); Building Equipped With IF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs.)
1. Electric heat pump.....	1.3 tons	\$800	\$1,040	\$50	10
2. Ductwork .....	—	—	425	0	30
3. Electric water heater .....	40 gal	225 ea	225	0	15
4. Thin film module (η = 0.94) 100\$/kW .....	53 mm'	25	663	0	30
—Thin film (61 10 \$/m <sup>2</sup> ) .....	—	—	663	0	15
—insulation @ 8 \$/m <sup>2</sup> .....	—	—	—	—	—
—Shipping 22 \$/m <sup>2</sup> .....	—	—	—	—	—
—25% overhead and profit .....	—	—	—	—	—
5. power conditioning .....	5.5 kW	40	220	2	30
6. Lighting protection .....	—	—	300	0	30
7. Extra insulation, storm doors and windows .....	—	—	981	0	30

1. installed collector cost assumed replaced in 15 yrs with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS**

(Conventional reference system is IF-2)

	Energy consumed by ref. system	Backup consumed w/ u+Or/consolation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit).....	28.0	17.5	37.5
Fuel consumed on site (MMBtu/unit).....	0.	0.	—
Total energy requirement (bbl crude equiv.) <sup>a</sup> .....	68.	43.	37.5
Electricity sold to grid annually (MWh, entire building) .....	—	—	3.9
Annual peak electricity demand (kW, entire building) .....	—	—	19.9

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is IF-2)

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1 1976 Startup</b>						
<b>a. Costs using solar (conservation) system:</b>						
Total with no incentives .....	132.	(154.)	152.	(173.)	23a	(251.)
Total with 20% IT .....	129.	(151.)	149.	(170.)	227.	(249.)
Total with full incentives .....	125.	(143.)	145.	(162.)	223.	(24a)
<b>b. Costs using conventional reference system .....</b>	142.		168.		276.	
<b>2 1985 Startup<sup>d</sup></b>						
<b>a. Costs using solar (conservation) system:</b>						
(capital related Cost) .....	50.	(72.)	50.	(72.)	50.	(72.)
(operation & maintenance costs) .....	8.	(8.)	8.	(8.)	8.	(8.)
(fuel bill) .....	0.	(0.)	0.	(0.)	0.	(0.)
(electric bill) .....	74.	(74.)	104.	(104.)	226.	(226.)
Total with no incentives .....	132.	(154.)	162.	(184.)	284.	(306.)
Total with 20% IT .....	129.	(151.)	159.	(181.)	281.	(303.)
Total with full incentives .....	125.	(143.)	155.	(173.)	277.	(295.)
<b>b. Costs using conventional reference system .....</b>	142.		183.		330.	

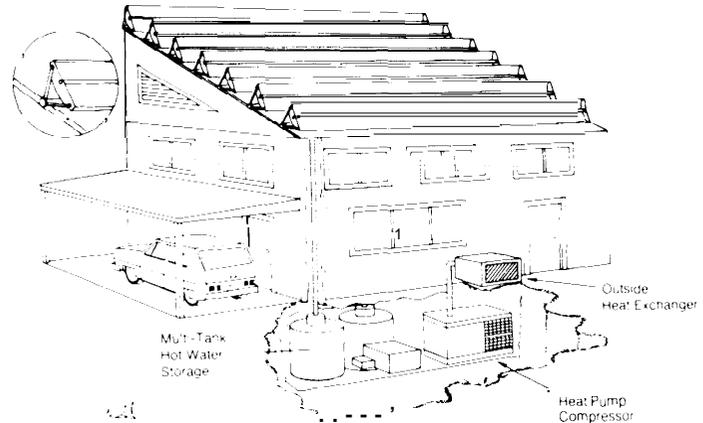
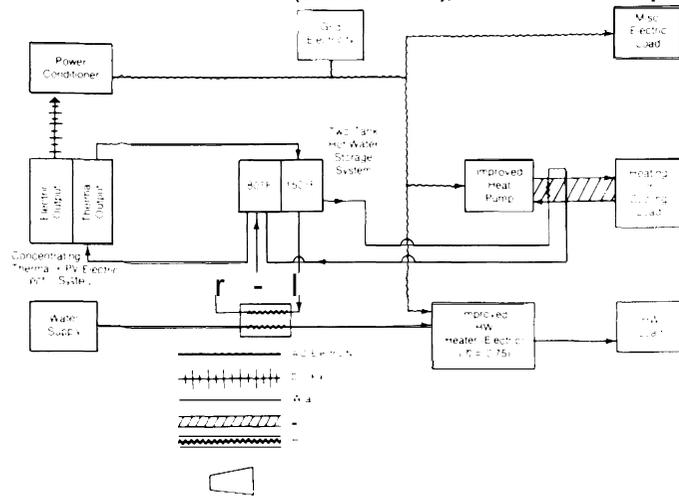
**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is IF-2)

Levelized cost of solar energy or 'conservation' energy <sup>e</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel .....	1.77 (3.85)	1.48 (3.61)	1.10 (2.79)
¢/kWh electricity .....	2.08 [4.53]	1.74 [4.24]	1.30 [3.28]
<b>Escalation of conventional energy costs</b>			
<b>Levelized price paid for conventional energy<sup>b,*</sup></b>	Constant real energy prices	Energy price escalation I	Energy price escalation II
	3.72	4.68	8.60
¢/kWh electricity .....	4.38	5.51	10.12



**Table IV-40.—Albuquerque: Solar Photovoltaic Cogeneration System—Insulated Single Family House Using One-Axis Concentrator With Si Cells (\$15/Watt cells), Multitank Low-Temperature Thermal Storage; Building Equipped With IF-2 Space. Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual Life O&M (yin)
1. Electric heat pump...	1.3 ton	964 \$/ton	\$1,250	\$50 10
2. Ductwork.....			425	0 30
3. Multitank electric hot water and storage.....	200 kWh	3 \$/kWh	600	0 30
4 Insulated steel pipe ..	125 ft	4.1 \$/ft	513	0 30
5 1-axis tracking silicon module (cells cost \$15,000/kW) (η = 0.09).	37	293 \$/m²	*54,201	0 30
— Tracking collector @ 130 \$/m²				0 15
— Silicon concentrator cells 62 \$/m²				0 15
— Shipping @ 2\$, m²				0 15
— install iron @ 40 \$/m²				0 15
— Overhead and profit @ 25%.				0 15
6. Pumps, controls and heat exchanger and miscellaneous equipment			500	0 10
7. Thermal only collector area.....	9	215 \$/m²	.968	0 30
8. Power conditioning.....	4 kW	233 \$/kW	932	9 30
9. Lightning protection.....			300	0 30
10. Extra insulation, storm doors and windows			981	0 30
<b>TOTAL.....</b>			<b>\$115,839</b>	<b>\$59</b>

\*1/2 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs.

**ANNUAL ENERGY FLOWS (Conventional reference system is IF-2)**

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought/sold) (MWh/unit).....	28.0	6.5	76.7
Fuel consumed on site (MMBtu/unit).....	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup> ...	68.	16.	76.7
Electricity sold to grid annually (MWh, entire building).....			2.0
Annual peak electricity demand (kW, entire building).....			17.7

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is IF-2)

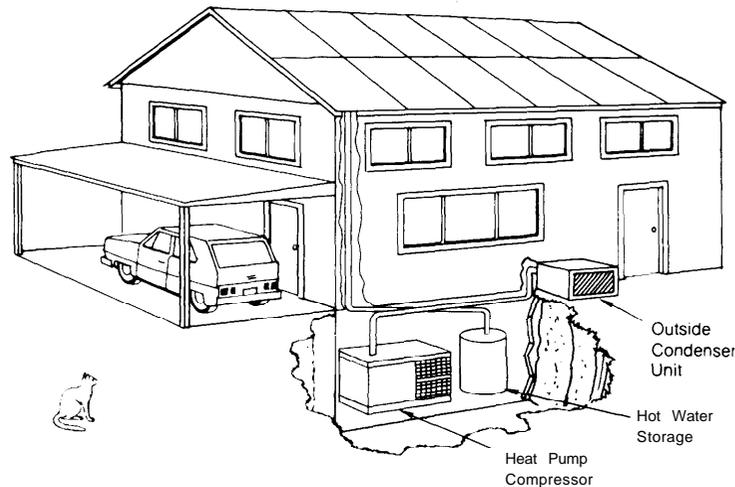
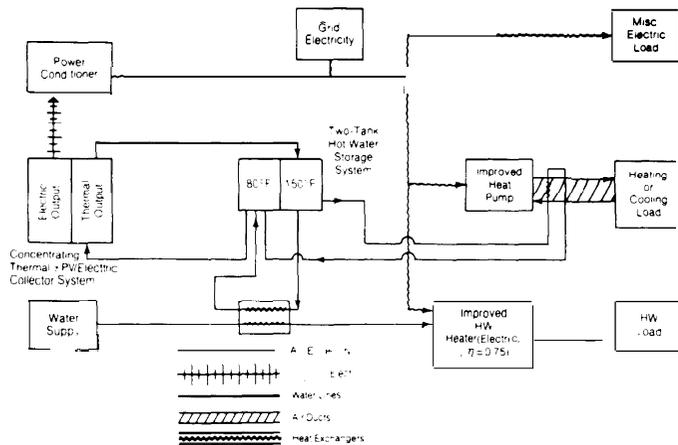
	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
<b>a. Costs using solar (conservation) system:</b>			
Total with no incentives.....	235. (323.)	244. (332.)	281. (370.)
Total with 20% IT.....	210. [302.]	219. (311.)	256. (348.)
Total with full incentives.....	153. (230.)	162. (240.)	199. (277.)
<b>b. Costs using conventional reference system.....</b>	<b>142</b>	<b>142.</b>	<b>275.</b>
<b>2. 1985 Startup<sup>d</sup></b>			
<b>a. Costs using solar (conservation) system:</b>			
(capital related costs).....	191. (279.)	191. (279.)	191. [279.]
(operation & maintenance costs).....	9. (9.)	9. (9.)	9. (9.)
(fuel bill).....	0. (0.)	0. (0.)	0. (0.)
(electric bill).....	35. (35.)	50. (50.)	108. (108.)
Total with no incentives.....	235. (323.)	249. (337.)	307. (395.)
Total with 20% IT.....	210. (302.)	224. (316.)	282. (374.)
Total with full incentives.....	153. (230.)	167. (245.)	225. (303.)
<b>b. Costs using conventional reference system.....</b>	<b>142.</b>	<b>142.</b>	<b>350.</b>

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is IF-2)

	Type of incentives given		
	No incentives	20% ITC	Full incentives
<b>Levelized cost of solar or 'conservation' energy<sup>a</sup></b>			
\$/MMBtu primary fuel.....	7.60 (11.80)	6.41 (10.78)	3.71 (7.40)
¢/kWh electricity.....	8.95 [13.89]	7.55 (12.69)	4.36 [8.70]
<b>Levelized price paid for conventional energy<sup>b,c</sup></b>			
\$/MMBtu primary fuel.....	3.72	4.68	8.60
¢/kWh electricity.....	4.38	5.51	10.12

**Table IV-41.—Albuquerque: Solar Photovoltaic Cogeneration System—insulated Single Family House Using Plastic Dye Photovoltaic Concentrator Multitank Low Temperature Storage; Building Equipped With IF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs)
1. Electric heat pump	1.3 tons	800 \$/ton	\$1,040		<b>\$50 10</b>
2. Ductwork			425		0 30
3. Electric hot water and multitank low temperature storage	200 kWh	3 \$/kWh	600		0 30
4. Insulated steel pipe	125 ft	4.1 \$/ft	513		0 30
5. Nontracking 100X plastic concentrator with 30% efficient cells	38 m <sup>2</sup>	103 \$/m <sup>2</sup>	•1,960		0 30
—Plexiglass and dyes @ 45 \$/m <sup>2</sup>					0 15
—Cells @ 15 \$/m <sup>2</sup>					
—Shipping @ 2 \$/m <sup>2</sup>					
—Installation @ 20 \$/m <sup>2</sup>					
—25% overhead and profit					
6. Pumps, controls, and heat exchanger			500		0 10
7. Power conditioning	8.5 kW	53 \$/kW	450		7 30
8. Lightning protection			300		0 30
9. Extra insulation, storm doors and windows			981		0 30
<b>TOTAL</b>			<b>\$8,729</b>		<b>\$57</b>

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**  
(Conventional reference system is IF-2)

	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
<b>a. Costs using solar (conservation) system:</b>			
Total with no incentives	124. (166.)	129. (171.)	153. (195.)
Total with 20% IT	114. (157.)	120. (163.)	143. (187.)
Total with full incentives	92. (130.)	98. (135.)	121. (159.)
<b>b. Costs using conventional reference system</b>	142.	168.	275.
<b>2. 1985 Startup<sup>d</sup></b>			
<b>a. Costs using solar (conservation) system:</b>			
(capital related Cash)	93. (135.)	93. (135.)	93. (135.)
(operation & maintenance costs)	8. (8.)	8. (8.)	8. (8.)
(fuel bill)	0. (0.)	0. (0.)	0. (0.)
(electric bill)	22. (22.)	31. (31.)	68. (68.)
Total with no incentives	124. (166.)	133. (175.)	170. (211.)
Total with 20% IT	114. (157.)	123. (166.)	160. (203.)
Total with full incentives	92. (130.)	101. (139.)	138. (175.)
<b>b. Costs using conventional reference system</b>	142.	163.	350.

**c. EFFECTIVE COST OF ENERGY TO CONSUMER**  
(Conventional reference system is IF-2)

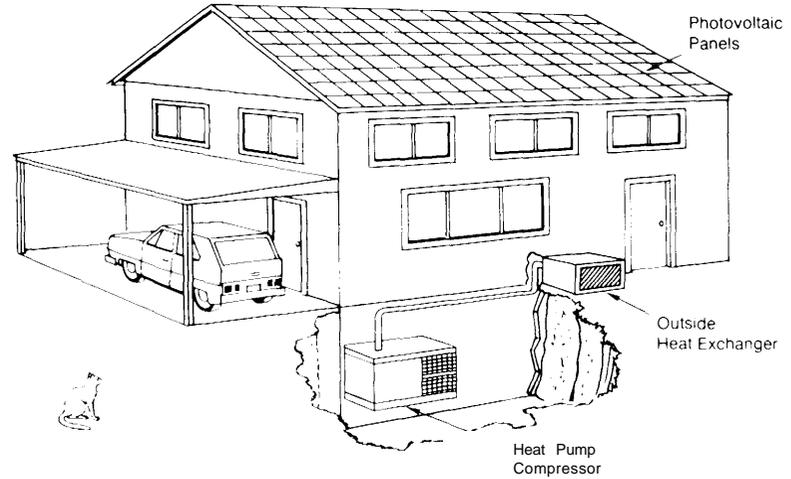
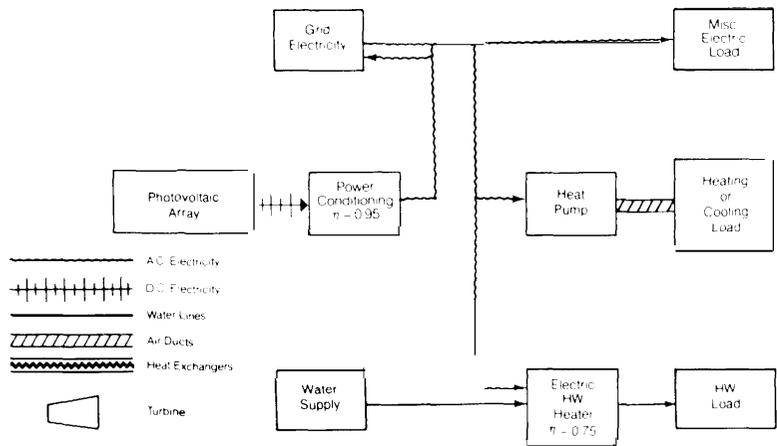
Levelized cost of solar energy or "conservation" energy <sup>a</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel	2.23 (3.75)	1.88 (3.45)	1.08 (2.45)
¢/kWh electricity	2.63 (4.41)	2.21 (4.05)	1.27 (2.88)
<b>Levelized price paid for conventional energy<sup>b,c</sup></b>			
\$/MMBtu primary fuel	3.72	4.68	8.60
¢/kWh electricity	4.38	5.51	10.12

<sup>a</sup> 1/2 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs.

**ANNUAL ENERGY FLOWS (Conventional reference system is IF-2)**

	Energy consumed by ref. system	Backup consumed solar/conservation	Energy saved (% of total)
Net Electricity (bought/sold) (MWh/unit)	28.0	-2	100.8
Fuel consumed onsite (MMBtu/unit)	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>a</sup>	68.	-1.	100.8
Electricity sold to grid annually (MWh, entire building)			9.5
Annual peak electricity demand (kW, entire building)			19.8

**Table IV-42.—Albuquerque: Solar Photovoltaic System—Insulated Single Family House Using Plastic Dye Photovoltaic Concentrator With Passive Cooling; Building Equipped With IF-2 Space-Conditioning**



**ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M	Life (yrs.)
1. Electric heat Wimp.....	1.3 tons	800 \$/ton	\$1,040	\$50	10
2. Ductwork.....	—	—	425	0	30
3. Electric water heater.....	40 gals	225 ea.	225	0	15
5. Nontracking 100x plastic concentrator with 30% efficient cells.	39 m <sup>2</sup>	103 \$/m <sup>2</sup>	2,010	0	30
— Plexiglass and dyes @ 45 \$/m <sup>2</sup>			2,010	0	15
— Cells @ 15 \$/m <sup>2</sup>					
— Shipping @ 2 \$/m <sup>2</sup>					
— Installation @ 20 \$/m <sup>2</sup>					
— 25% overhead and profit					
7. Power conditioning.....	13.1	53 \$/kw	690	4	30
& Lightning protection.....	—	—	300	0	30
9. Extra insulation, storm doors and windows.....	—	—	981	0	30
<b>TOTAL</b>			<b>\$11,381</b>	<b>\$54</b>	

\* 1, installed collector cost assumed replaced in 5 yrs with total replacement in 30 yrs

**ANNUAL ENERGY FLOWS**  
[Conventional reference system is IF-2]

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit).....	28.0	2.8	90.0
Fuel consumed on site (MMBtu/unit).....	0.	0.	0.
<b>Total energy requirement (bbl crude equiv.)<sup>a</sup></b>	<b>6s.</b>	<b>7.</b>	<b>90.0</b>
Electricity sold to grid annually (MWh, entire billing).....			14.4
Annual peak electricity demand (kW, entire building).....			19.0

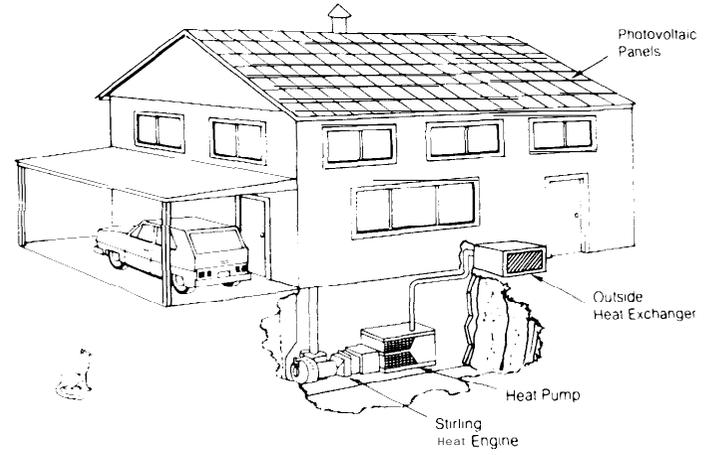
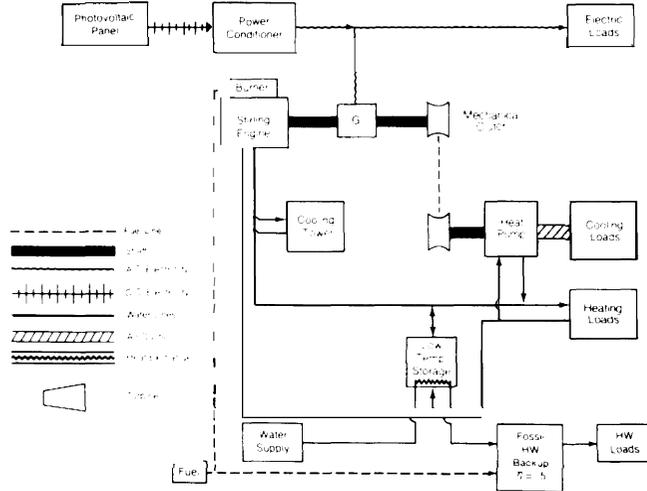
**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**  
[Conventional reference system is IF-2]

	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
<b>a. Costs using solar (conservation) system:</b>			
Total with no incentives.....	133. (170.)	144. (181.)	190. (227.)
Total with 20% ITC.....	125. (163.)	136. (174.)	182. (220.)
Total with full incentives.....	106. (140.)	118.6 (151.)	164. (198.)
<b>b. Costs using conventional reference system</b>	142.		275.
<b>2. 1985 Startup<sup>d</sup></b>			
<b>a. Costs using solar (conservation) system:</b>			
(capital related costs).....	81. (118.)	81. (118.)	81. (118.)
(operation & maintenance).....	8. (8.)	8. (8.)	8. (8.)
(fuel bill).....	0. (0.)	0. (0.)	0. (0.)
(electric bill).....	44. (44.)	61. (61.)	133. (133.)
Total with no incentives.....	133. (170.)	150. (187.)	222. (259.)
Total with 20% ITC.....	125. (163.)	142. (181.)	214. (252.)
Total with full incentives.....	106. (140.)	124. (158.)	196. (230.)
<b>b. Costs using conventional reference system</b>	142.	183.	350.

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**  
[Conventional reference system is IF-2]

Levelized cost of solar energy or conservation <sup>a</sup> per \$	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel.....	2.00 (3.50)	1.68 (3.23)	.94 (2.30)
¢/kWh electricity.....	2.36 (4.12)	1.98 (3.80)	1.10 (2.71)
	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
\$/MMBtu primary fuel.....	3.72	4.68	8.60
¢/kWh electricity.....	4.38	5.51	10.12

**Table IV-43.—Albuquerque: Solar Photovoltaic System—Insulated Single Family House Using Flat-Plate Air-Cooled Silicon Arrays (\$0.50/Watt), Low-Temperature Thermal Storage; Building Equipped With Improved IF-2 Space-Conditioning**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O&M	life (yrs)
1. Heat pump	1.3 tons	800 \$/ton	\$1,040	\$50	10
2. Ductwork	—	—	425	0	30
3. Electric hot water	40 gal	\$225 ea.	225	0	15
4. Air-cooled silicon PV (500 \$/kW) (η = 0.12)	59 m <sup>2</sup>	88 \$/m <sup>2</sup>	*2,600	0	30
—Silicon array @ 60 \$/m <sup>2</sup>			*2,600	0	15
—Shipping @ 2 \$/m <sup>2</sup>					
—Installation @ 8 \$/m <sup>2</sup>					
—25% overhead and profit					
5. Power conditioning	7 kW	114	800	8	30
6. lightning protection	—	—	300	0	30
7. Backup engine and generator	6.53 kW	225 \$/kW	1,470	53	10
8. Hot water exchange	—	33 ea.	33	0	30
9. Low temperature stly.	50 kWh	2 \$/kWh	100	0	30
10. Extra insulation, storm doors and windows	—	—	981	0	30
<b>TOTAL</b>			<b>\$10,574</b>	<b>\$111</b>	

\*1/3 installed collector cost assumed replaced in 15 yrs., with total replacement in 30 yrs.

**ANNUAL ENERGY FLOWS**

(Conventional reference system is IF-2)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% of total)
Net Electricity (bought-sold) (MWh/unit)	28.0	0.	100.0
Fuel consumed onsite (MMBtu/unit)	0.	86.	0.
<b>Total energy requirement (bbl crude equiv.)<sup>a</sup></b>	<b>68.</b>	<b>18.</b>	<b>73.9</b>
Electricity sold to grid annually (MWh, entire building)			0.
Annual peak electricity demand (kW, entire building)			0.

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**  
(Conventional reference system is IF-2)

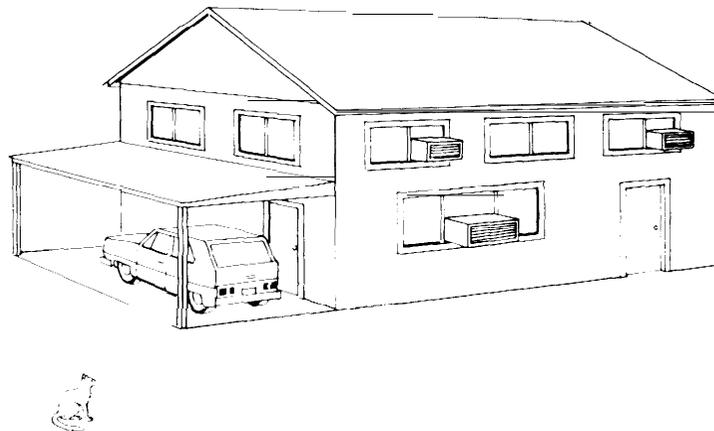
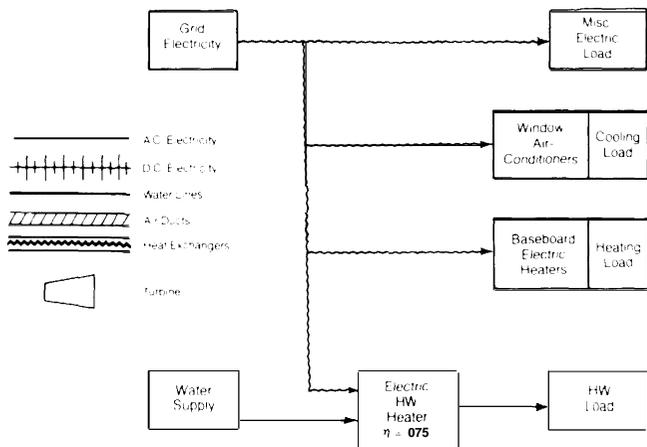
	Escalation of conventional energy costs		
	Constant real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>			
<b>a. Costs using solar (conservation) system:</b>			
Total with no incentives	159. (211.)	171. (224.)	183. (235.)
Total with 20% IT...	146. (200.)	159. (213.)	170. (224.)
Total with full incentives	129. (164.)	142. (177.)	154. (188.)
<b>b. Costs using conventional reference system</b>	142.	168.	276.
<b>2. 1985 Startup<sup>d</sup></b>			
<b>a. costs using solar (conservation) system:</b>			
(capital related costs)	124. (176.)	124. (176.)	124. (176.)
(operation & maintenance costs)	16. (16.)	16. (16.)	16. (16.)
(fuel bill)	19. (19.)	38. (38.)	57. (57.)
(electric bill)	0. (0.)	0. (0.)	0. (0.)
Total with no incentives	159. (211.)	178. (231.)	197. (249.)
Total with 20% IT...	146. (200.)	166. (220.)	184. (238.)
Total with full incentives	129. (164.)	149. (184.)	167. (202.)
<b>b. Costs using conventional reference system</b>	142.	183.	330.

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

(Conventional reference system is IF-2)

Levelized cost of solar energy or 'conservation' energy <sup>e</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary load	4.94 (7.52)	4.32 (6.98)	3.49 (5.20)
¢/kWh electricity	5.82 (8.85)	5.08 (8.22)	4.11 (6.12)
<b>Levelized price paid for conventional energy<sup>b,c</sup></b>			
		Escalation of conventional energy cash	
	Constant real energy prices	Energy price escalation I	Energy price escalation II
\$/MMBtu primary load	3.72	4.68	8.60
¢/kWh electricity	4.38	5.51	10.12

Table [V.44.—Albuquerque: Conventional System—All Electric Single Family House Using Electric Resistance Heat and Window A/C (SF-3)



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O&P)	Annual O & M (Y in)	Lif. (Y in)
1. Baseboard electric heat.....	13.1	67 \$/kW	\$878		30
2. Window electric a/c.....	1.85 tons	280 \$/ton	518	\$3:	10
3. Electric water heater.....	40 gal	\$225 ea.	225	0	15
<b>TOTAL.....</b>			<b>\$1,621</b>	<b>\$30</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**  
(Conventional reference system is SF-3)

	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>1. 1976 Startup</b>						
Total with no incentives.....	177.	(185.)	216.	(224.)	378.	(386.)
Total with 20% IT.....	177.	(185.)	216.	(224.)	378.	(386.)
Total with full incentives.....	177.	(185.)	216.	(224.)	378.	(386.)
<b>2. 1985 Startup<sup>d</sup></b>						
(capital related costs).....	19.	(27.)	19.	(27.)	19.	(27.)
(operation & maintenance costs).....	4.	(4.)	4.	(4.)	4.	(4.)
(fuel bill).....	0.	(0.)	0.	(0.)	0.	(0.)
(electric bill).....	153.	(153.)	215.	(215.)	467.	(467.)
Total with no incentives.....	177.	(185.)	239.	(246.)	490.	(498.)
Total with 20% IT.....	177.	(185.)	239.	(246.)	490.	(498.)
Total with full incentive.....	177.	(185.)	239.	(246.)	490.	(498.)

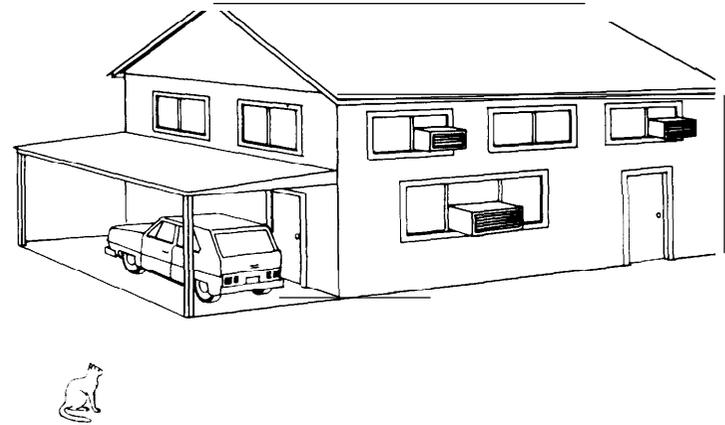
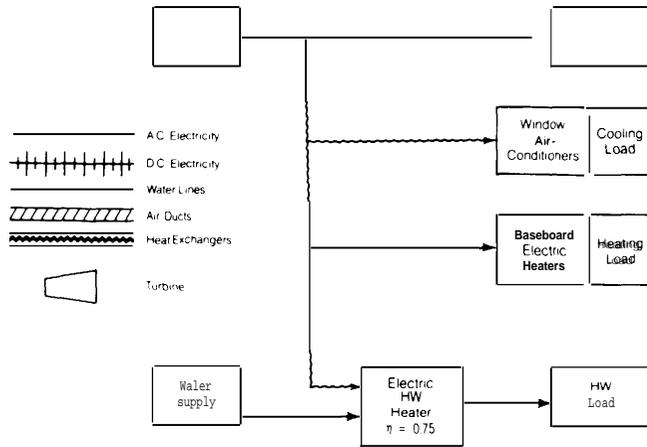
**C. EFFECTIVE COST OF ENERGY TO CONSUMER**  
(Conventional reference system is SF-3)

**ANNUAL ENERGY FLOWS**  
(Conventional reference system is SF-3)

	Energy consumed by ref. system	Backup consumed solar/conservation	Energy saved (% of total)
Net Electricity (bought/sold) (MWh/unit).....	43.8	43.8	0.
Fuel consumed on site (MMBtu/unit).....	0.	0.	0.
<b>Total energy requirement (bbl crude equiv.)<sup>a</sup></b> .....	<b>107.</b>	<b>107.</b>	<b>0.</b>
Electricity sold to grid annually (MWh, entire building).....			0.
<b>Annual peak electricity demand (kW, entire building).....</b>			<b>27.3</b>

Levelized cost of solar energy or 'conservation' energy <sup>a</sup>	Type of incentives given					
	No incentives		20% ITC		Full incentives	
\$/MMBtu primary fuel.....	N/A	(N/A)	N/A	(N/A)	N/A	(N/A)
¢/kWh electricity.....	N/A	(N/A)	N/A	(N/A)	N/A	(N/A)
	Escalation of conventional energy costs					
	Constant real energy prices		Energy price escalation I		Energy price escalation II	
<b>Levelized price paid for conventional energy<sup>b,*</sup></b>						
\$/MMBtu primary fuel.....	3.57		4.49		8.25	
¢/kWh electricity.....	4.20		5.29		9.72	

**Table IV-45. — Albuquerque: Conventional System—All Electric Single Family I-House Using Electric Resistance Heat and Window A/C, 65/85 Thermostat Settings (SF-3)**



**A. ITEMIZED COST OF COMPONENTS**

Component	Size	Unit cost	First cost (incl. O & P)	Annual O&M (yrs)	Life
1. Baseboard electric heat.....	13.1	67 \$/kW	\$878	0	30
2. Window electric a/c.....	1.85 tons	280 \$/ton	518	\$30	10
3. Electric water heater.....	40 gal	\$225 ea.	225	0	15
<b>TOTAL</b> .....			<b>\$1,621</b>	<b>\$30</b>	

**B. LEVELIZED MONTHLY COSTS PER UNIT TO CONSUMER (Dollars)<sup>b,c</sup>**

(Conventional reference system is SF-3)

	Escalation of conventional energy costs			
	constant energy prices	real energy prices	Energy price escalation I	Energy price escalation II
<b>1. 1976 Startup</b>				
<b>0. Costs using solar (conservation) system:</b>				
Total with no incentives.....	171.	(179.)	209.	(217.)
Total with 20% ITC.....	171.	(179.)	209.	(217.)
Total with full incentives.....	171.	(179.)	209.	(217.)
<b>b. Costs using conventional reference system.....</b>	<b>177.</b>		<b>216.</b>	<b>378</b>
<b>2. 1985 Startup<sup>d</sup></b>				
<b>a. Costs using solar (conservation) system:</b>				
(capital related costs).....	19.	(27.)	19.	(27.)
(operation & maintenance costs).....	4.	(4.)	4.	(4.)
(fuel bill).....	0.	(0.)	0.	(0.)
electric &.....	147.	[147.]	207.	(207.)
Total with no incentives.....	171.	(179.)	230.	(238.)
Total with 20% ITC.....	171.	(179.)	230.	(238.)
Total with full incentives.....	171.	(179.)	230.	(238.)
<b>b. Costs using conventional reference system.....</b>	<b>177.</b>		<b>239.</b>	<b>490.</b>

**C. EFFECTIVE COST OF ENERGY TO CONSUMER**

Conventional reference system is SF-3)

Levelized cost of solar energy or 'conservation' energy <sup>e</sup>	Type of incentives given		
	No incentives	20% ITC	Full incentives
\$/MMBtu primary fuel.....	-0.00 [4.36]	-0.00 (4.36)	-0.00 (4.36)
¢/kWh electricity.....	-0.00 (5.13)	-0.00 (5.13)	-0.00 (5.13)
<b>Levelized price paid for conventional energy<sup>b,a</sup></b>	<b>Escalation of conventional costs</b>		
	constant energy prices	Energy price escalation I	Energy price escalation II
\$/MMBtu primary fuel.....	3.57	4.49	8.25
¢/kWh electricity.....	4.20	5.29	9.72

**ANNUAL ENERGY FLOWS**

(Conventional reference system is SF-3)

	Energy consumed by ref. system	Backup consumed w/ solar/conservation	Energy saved (% cd total)
Net Electricity (bought-sold) (MWh/unit).....	43.8	42.0	4.2
Fuel consumed onsite (MMBtu/unit).....	0.	0.	0.
Total energy requirement (bbl crude equiv.) <sup>f</sup> .....	107.	103.	4.2
Electricity sold to grid annually (MWh, entire building).....			0.
<b>Annual peak electricity demand (kW, entire building).....</b>			<b>27.3</b>