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ANNUAL ENERGY CONSUMPTION DATA
ON APARTMENT BUILDINGS

ANALYZED

by

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A.H. Elmahdy

Division of Building Research, National Research Council of Canada

Ottawa, January 1982

ANNUAL ENERGY CONSUMPTION DATA ON APARTMENT BUILDINGS

by

A.H. Elmahdy

The Standing Committee on Energy Conservation in Buildings is attempting, on behalf of the National Research Council Associate Committee on the National Building Code, to define appropriate energy consumption targets for different classes of buildings. These are partly based on the energy consumption of existing buildings. In support of the work of the Standing Committee, this report contains data on the annual energy consumption of apartment buildings. These buildings are located in various towns and cities in Ontario and Quebec.

Table 1 provides a summary of the sample size, the average, maximum and minimum floor areas and the energy consumption for the year in which the data were recorded. Plots of the energy consumption in GJ/m²yr. versus the building area in m² are presented in Figures 1 through 7; however, no attempt has been made to correlate the annual energy consumption data with other pertinent variables. The vertical scale to the right of these plots shows the frequency of occurrence for the corresponding energy consumption bins listed on the left-hand side of each plot.

Tables 2 through 7 provide complete listings of the data presented in this report.

Although there was a slight reduction in the annual energy consumption of some of the Ontario Housing apartment buildings between 1975 and 1978, the cause of this decline in annual energy consumption was not specified. On the other hand, some of the other buildings in the same sample showed a small increase in annual energy consumption. These changes in energy consumption could be credited to one or more of the following factors:

1. weather changes;
2. degree of occupancy and vacancy within the buildings;
3. implementation of energy conservation measures in the buildings.

ACKNOWLEDGEMENT

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- a) Ontario Housing Corporation
- b) Ontario Hydro
- c) Ottawa Housing Authority
- d) CMA Chalifour Marcotte et Assoc., Consulting Engineers, Montreal

The author also wishes to thank R.W. Sintzel for his assistance in preparing the graphs and tables.

TABLE 1: SUMMARY OF APARTMENT BUILDINGS DATA

Group	Sample Size	Energy Consumption MJ/m ² yr.			Area m ²		
		Max.	Min.	Average	Max.	Min.	Average
Ontario Housing Corporation (Toronto)	50	2251	841	1437	34249	7621	20418
		2577	721	1440			
		2492	957	1477			
		2627	1004	1513			
Ontario Housing Corporation Group No. 1	47	2418	484 [?] 12.5	1033	18885	1766	8427
Ontario Hydro	52	3472	457 [?] 11.6	1151	59204	520	15808
Ottawa Housing Authority (Ottawa)	16	1135	697	900	18621	11046	14055
Apartments (Montreal Area)	51	3059	602	1493	34572	502	7425

Oct 2's
Best we have are 580 - All elec
813 - Fuel

TABLE 2: ONTARIO HOUSING CORPORATION - TORONTO REGION
(APARTMENT BUILDINGS)

No.	Area m ²	ENERGY CONSUMPTION							
		1975		1976		1977		1978	
		GJ/Unit × yr.	MJ/m ² ·yr.	GJ/Unit × yr.	MJ/m ² ·yr.	GJ/Unit × yr.	MJ/m ² ·yr.	GJ/Unit × yr.	MJ/m ² ·yr.
1	7621	158	1674	161	1709	175	1864	151	1604
2	12128	130	1445	121	1345	134	1503	139	1544
3	25190	80	1124	81	1128	85	1186	98	1376
4	25539	144	1717	143	1697	133	1589	138	1639
5	11575	143	2228	156	2422	157	2441	164	2554
6	11575	145	2251	166	2577	160	2492	169	2627
7	21529	118	1310	127	1407	111	1231	113	1252
8	29644	99	1465	101	1500	92	1369	97	1441
9	23241	124	1302	134	1403	132	1271	133	1283
10	21914	139	1403	142	1434	129	1294	132	1333
11	21966	134	1364	135	1379	120	1219	119	1209
12	16320	150	1717	156	1771	160	1825	170	1941
13	15242	117	1263	125	1345	129	1391	130	1395
14	23809	113	1356	123	1476	124	1484	126	1503
15	12706	125	1348	125	1352	117	1259	125	1345
16	16022	118	1457	129	1589	137	1697	138	1701
17	17437	145	1689	112	1306	117	1364	130	1511
18	17621	144	1670	114	1317	121	1395	135	1563
19	23314	133	1360	143	1461	145	1484	153	1560
20	18471	87	1201	99	1364	115	1589	98	1356
21	18471	78	1081	105	1453	116	1600	101	1395
22	14280	145	1678	123	1426	135	1565	187	2162
23	19728	101	1042	134	1383	128	1325	117	1213
24	26870	88	841	134	1283	131	1252	136	1306
25	18496	118	1182	126	1263	121	1205	142	1418

TABLE 2 (cont'd): ONTARIO HOUSING CORPORATION - TORONTO REGION
(APARTMENT BUILDINGS)

No.	Area m ²	ENERGY CONSUMPTION							
		1975		1976		1977		1978	
		GJ/Unit × yr.	MJ/m ² yr.	GJ/Unit × yr.	MJ/m ² yr.	GJ/Unit × yr.	MJ/m ² yr.	GJ/Unit × yr.	MJ/m ² yr.
26	24573	120	1151	120	1151	123	1186	127	1224
27	18670	101	1635	116	1872	109	1759	114	1837
28	17901	91	1100	98	1186	95	1155	99	1201
29	18954	99	1213	105	1283	104	1263	108	1314
30	33951	91	1131	93	1151	87	1085	90	1116
31	17367	130	1410	132	1434	121	1306	123	1329
32	19387	116	1174	113	1151	113	1147	116	1178
33	11561	114	1817	134	2131	126	2011	137	2182
34	17688	130	1314	138	1383	132	1333	143	1441
35	15796	149	1546	142	1476	141	1461	144	1496
36	13259	140	1352	123	1190	144	1387	148	1426
37	27685	107	1112	108	1081	124	1246	123	1240
38	27853	111	1298	119	1381	116	1360	112	1310
39	23039	136	1775	132	1728	139	1821	138	1813
40	23039	142	1856	131	1713	146	1910	142	1852
41	23039	145	1891	114	1488	157	2054	132	1724
42	18519	130	1345	82	845	136	1399	143	1469
43	23358	209	1910	153	1399	155	1410	156	1418
44	22362	123	1310	123	1317	136	1445	111	1175
45	24265	80	903	79	899	120	957	126	1004
46	22809	141	1221	83	721	111	957	156	1352
47	29048	95	1507	98	1562	99	1531	100	1554
48	23540	150	1744	149	1728	141	1627	158	1833
49	18262	108	1573	94	1372	139	1635	131	1548
50	34249	115	1403	127	1558	122	1488	114	1393

TABLE 3: ONTARIO HOUSING CORPORATION - TORONTO REGION
(APARTMENT BUILDINGS)

No.	No. of Stories	No. of Units	Area m ²	Year of Construction	No. of Units of:					
					Bachelor	1 BR	2 BR	3 BR	4 BR	5 BR
1	7	81	7621	1961	0	20	36	25	0	0
2	16	135	12128	1970	0	45	90	0	0	0
3	17	352	25190	1968	288	64	0	0	0	0
4	16	304	25539	1968	17	145	126	16	0	0
5	16	180	11575	1969	0	60	90	30	0	0
6	16	180	11575	1969	0	60	90	30	0	0
7	12	239	21529	1970	0	51	177	11	0	0
8	24	440	29644	1970	46	301	93	0	0	0
9	14	244	23241	1970	0	19	186	19	0	0
10	--	221	21914	1970	0	19	183	19	0	0
11	--	224	21966	1970	0	19	186	19	0	0
12	13	186	16320	1970	0	16	110	12	0	0
13	12	164	15242	1971	0	24	116	24	0	0
14	20	285	23809	1971	0	118	167	0	0	0
15	12	137	12706	1971	0	11	123	3	0	0
16	13	198	16022	1971	0	73	114	11	0	0
17	15	204	17437	1971	0	87	102	15	0	0
18	15	204	17621	1971	0	87	102	15	0	0
19	14	238	23314	1972	0	50	101	77	6	4
20	19	255	18471	1972	0	180	75	0	0	0
21	19	255	18471	1972	0	180	75	0	0	0
22	19	165	14280	1973	0	163	2	0	0	0
23	18	204	19728	1973	0	32	160	12	0	0
24	19	257	26870	--	0	18	237	2	0	0
25	11	185	18496	1972	0	60	111	14	0	0

TABLE 3 (cont'd): ONTARIO HOUSING CORPORATION - TORONTO REGION
(APARTMENT BUILDINGS)

No.	No. of Stories	No. of Units	Area m ²	Year of Construction	No. of Units of:					
					Bachelor	1 BR	2 BR	3 BR	4 BR	5 BR
26	11	236	24573	1972	0	84	141	11	0	0
27	16	301	18670	1973	121	179	0	1	0	0
28	16	217	17901	1972	47	107	62	1	0	0
29	17	231	18954	1972	50	114	66	1	0	0
30	18	421	33951	1972	106	210	104	1	0	0
31	15	188	17367	1971	0	58	115	15	0	0
32	12	197	19387	1971	4	80	112	1	0	0
33	12	184	11561	1971	0	69	104	11	0	0
34	13	178	17688	1971	0	26	126	26	0	0
35	12	164	15796	1971	0	24	116	24	0	0
36	13	128	13259	1970	0	38	78	12	0	0
37	24	278	27685	1971	0	139	137	2	0	0
38	21	326	27853	1971	0	201	125	0	0	0
39	16	301	23039	1964	65	156	65	11	4	0
40	16	301	23039	1964	65	156	65	11	4	0
41	16	301	23039	1964	65	156	65	11	4	0
42	18	191	18519	1970	0	102	89	0	0	0
43	13	213	23358	1969	0	20	169	24	0	0
44	19	238	22362	1970	0	72	164	2	0	0
45	14	275	24265	1969	30	52	112	54	27	0
46	10	198	22809	1968	0	55	112	21	8	2
47	25	461	29048	1968	151	248	62	0	0	0
48	42	273	23540	1965	0	183	75	15	0	0
49	14	265	18262	1968	0	72	71	72	40	10
50	20	419	34249	1972	19	247	152	1	0	0

TABLE 4: ONTARIO HOUSING CORPORATION (GROUP 1)
(APARTMENT BUILDINGS)

No.	No. of Stories	No. of Units	Year of Construction	Total Area (estimated) m ²	Energy Consumption		Location
					MJ/m ² yr.	GJ/Unit × yr.	
1	2	63	1970	2993	1507	72	Cambridge
2	2	44	1970	2677	539	33	Cambridge
3	2	86	1971	5242	616	37	Cambridge
4	3	42	1967	2323	593	33	Cambridge
5	2	29	1976	1766	856	52	Dundas
6	-	245	1975	14926	953	58	Hamilton
7	-	200	1972	12184	1182	72	Hamilton
8	10	110	1972	7732	2290	161	Hamilton
9	10	110	1972	7732	2418	170	Hamilton
10	11	200	1971	12119	1209	73	Hamilton
11	11	107	1974	6524	1069	65	North Bay
12	8	134	1973	8169	1031	63	North Bay
13	5	42	1974	2630	1519	95	Stoney Creek
14	7	103	1973	6283	1038	63	Timmins
15	2	51	1971	3104	759	46	Timmins
16	2	51	1973	3113	1093	67	Timmins
17	6	60	1975	3662	1193	73	Timmins
18	2	30	1972	1831	589	36	S.S. Marie
19	5	41	1975	2500	1104	67	S.S. Marie
20	2	61	1972	3727	554	34	S.S. Marie
21	2	61	1973	3727	484	30	S.S. Marie
22	3	67	1970	4080	1577	96	S.S. Marie
23	15	133	1975	8104	996	60	S.S. Marie
24	2	30	1969	1831	643	39	Thunder Bay
25	7	60	1973	3662	1112	68	Thunder Bay

TABLE 4 (cont'd): ONTARIO HOUSING CORPORATION (GROUP 1)
(APARTMENT BUILDINGS)

No.	No. of Stories	No. of Units	Year of Construction	Total Area (estimated) m ²	Energy Consumption		Location
					MJ/m ² yr.	GJ/Unit × yr.	
26	6	101	1975	6162	849	52	Thunder Bay
27	4	102	1976	6217	1255	76	Thunder Bay
28	7	121	1975	7379	883	54	Thunder Bay
29	6	121	1973	7379	1058	64	Thunder Bay
30	5	310	1974	18885	860	52	Ottawa
31	17	259	1973	15771	581	35	Ottawa
32	18	250	1975	15232	907	55	Ottawa
33	22	250	1972	14861	798	48	Ottawa
34	22	250	1972	14861	942	56	Ottawa
35	17	249	1974	15167	771	47	Ottawa
36	14	244	1973	14861	798	49	Ottawa
37	-	241	1972	14684	856	52	Ottawa
38	21	240	1974	14257	969	58	Ottawa
39	17	139	1971	14554	1492	156	Ottawa
40	17	230	1974	15827	1058	73	Ottawa
41	15	216	1975	13160	903	55	Ottawa
42	12	207	1973	12612	841	51	Ottawa
43	13	198	1973	10232	887	46	Ottawa
44	11	192	1971	11701	643	39	Ottawa
45	12	177	1974	10781	945	58	Ottawa
46	15	115	1971	7007	1577	96	Ottawa
47	3	30	1972	1831	1751	107	Ottawa

TABLE 5: ONTARIO HYDRO STUDY
(APARTMENT BUILDINGS)*

No.	No. of Stories	No. of Units	Year of Construction	Area m ²	Energy Consumption
					MJ/m ² yr.
1	21	162	1973	18217	784
2	16	262	1973	20161	1521
3	27	555	1974	24139	910
4	9	123	1966	18061	1221
5	16	193	1970	16627	1758
6	25	262	1969	32360	1024
7	30	483	1974	40893	1161
8	23	452	1970	35328	887
9	6	61	1960	6020	1558
10	6	77	1961	7399	1694
11	20	380	1967	35775	1836
12	25	474	1968	44140	1821
13	20	400	1968	35651	1729
14	10	248	1967	25215	797
15	2	61	1973	3367	670
16	6	410	1965	30483	1487
17	13	410	1971	36008	3472
18	6	107	1971	8045	1605
19	30	416	1974	51691	1244
20	14	280	1968	20818	1575
21	6	71	1962	6552	1469
22	30	719	1972	59204	750
23	24	380	1969	28994	847
24	16	186	1967	13622	1538
25	14	173	1973	20033	1474
26	4	51	1959	4967	833
27	5	60	1959	6212	824
28	20	279	1971	24763	1839
29	11	107	1973	9944	1121
30	18	287	1970	30194	1425
31	12	140	1964	9355	2470
32	12	106	1964	8147	2111
33	5	120	1964	11922	868
34	12	147	1966	12487	854
35	4	35	1964	3864	638

* These buildings are located in Ottawa, Belleville, Oshawa, Toronto, London, Windsor and Sault St. Marie.

TABLE 5 (cont'd): ONTARIO HYDRO STUDY
(APARTMENT BUILDINGS)*

No.	No. of Stories	No. of Units	Year of Construction	Area m ²	Energy Consumption
					MJ/m ² yr.
36	7	65	1965	7811	739
37	2	34	1972	1710	680
38	8	103	1970	11985	511
39	2	34	1973	1710	730
40	2	37	1969	1970	749
41	3	21	1966	1757	640
42	3	24	1975	2059	555
43	2	13	1972	925	1006
44	2	12	1970	822	968
45	2	5	1972	520	550
46	2	14	1969	1041	637
47	2	12	1972	669	709
48	2	32	1972	2974	581
49	2	30	1970	1737	778
50	2	45	1971	4140	457
51	11	108	1973	9596	676
52	11	107	1974	9944	1084

* These buildings are located in Ottawa, Belleville, Oshawa, Toronto, London, Windsor and Sault St. Marie.

TABLE 6: OTTAWA HOUSING AUTHORITY
(APARTMENT BUILDINGS)

No.	Area m ²	Year of Construction	No. of Stories	No. of Units	Energy Consumption	
					MJ/m ² yr.	GJ/Unit × yr.
1	11046	1971	11	192	697	40
2	14575	1972	22	250	839	49
3	14575	1972	22	250	1004	59
4	17050	1972	20	241	769	54
5	11969	1974	12	207	752	43
6	14314	1974	21	240	813	48
7	11244	1973	13	200	802	45
8	13139	1973	14	244	899	48
9	18621	1974	17	229	963	78
10	11885	1975	6	155	1095	84
11	12321	1974	12	177	991	69
12	14911	1974	17	249	788	47
13	12165	1975	14	216	1101	62
14	17732	1974	5	310	1135	65
15	14501	1974	14	243	876	52
16	14830	1975	18	250	877	52

TABLE 7: APARTMENTS - MONTREAL AREA

No.	No. of Units	Area m ²	Energy Consumption	
			MJ/m ² yr.	GJ/Unit × yr.
1	10	502	1566	79
2	24	1464	1550	95
3	24	1738	1207	87
4	26	1450	1600	89
5	32	3026	1044	99
6	34	1766	1564	81
7	35	1719	1681	83
8	35	1719	1427	70
9	43	1896	1287	57
10	45	3388	939	71
11	47	1775	2051	77
12	48	2605	1806	98
13	51	6348	602	75
14	51	3643	1275	91
15	53	2732	1323	68
16	56	2379	1887	80
17	56	2797	1091	54
18	57	2365	1659	69
19	57	6968	1395	170
20	59	4600	939	73
21	60	6087	1620	164
22	67	7807	1269	148
23	69	3033	1986	87
24	75	3301	1243	55
25	86	10874	1452	183
26	96	4470	1781	83
27	96	3625	2198	83
28	98	5163	2331	123
29	99	5855	2060	122
30	103	11152	2452	265
31	106	6366	1368	82
32	112	11710	1632	171
33	113	7900	1457	102
34	115	5621	3059	149
35	116	9164	1823	144
36	120	13383	1561	174
37	128	7844	1398	86
38	131	9689	1517	112

TABLE 7 (cont'd): APARTMENTS - MONTREAL AREA

No.	No. of Units	Area m ²	Energy Consumption	
			MJ/m ² yr.	GJ/Unit × yr.
39	135	15760	1503	175
40	142	14126	1829	182
41	163	7993	1482	73
42	180	20446	1419	161
43	181	20911	2315	267
44	220	34572	1504	236
45	90	8127	700	63
46	38	1398	1495	55
47	137	14126	616	64
48	122	8783	775	56
49	143	11401	935	75
50	151	16856	717	80
51	205	16264	746	59

FIGURE 1 ONTARIO HOUSING CORPORATION
(TORONTO) - 1975

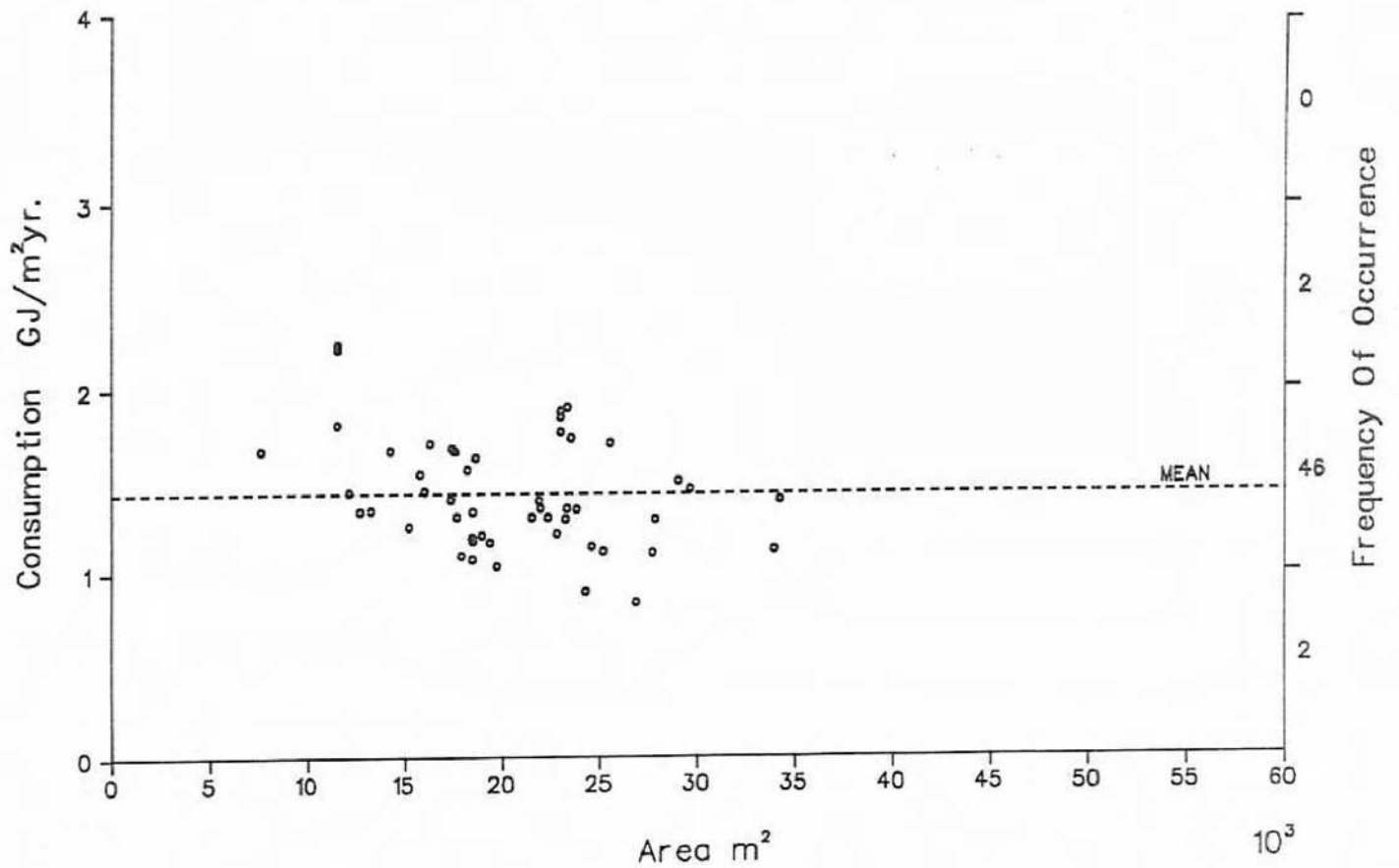


FIGURE 2 ONTARIO HOUSING CORPORATION
(TORONTO) - 1976

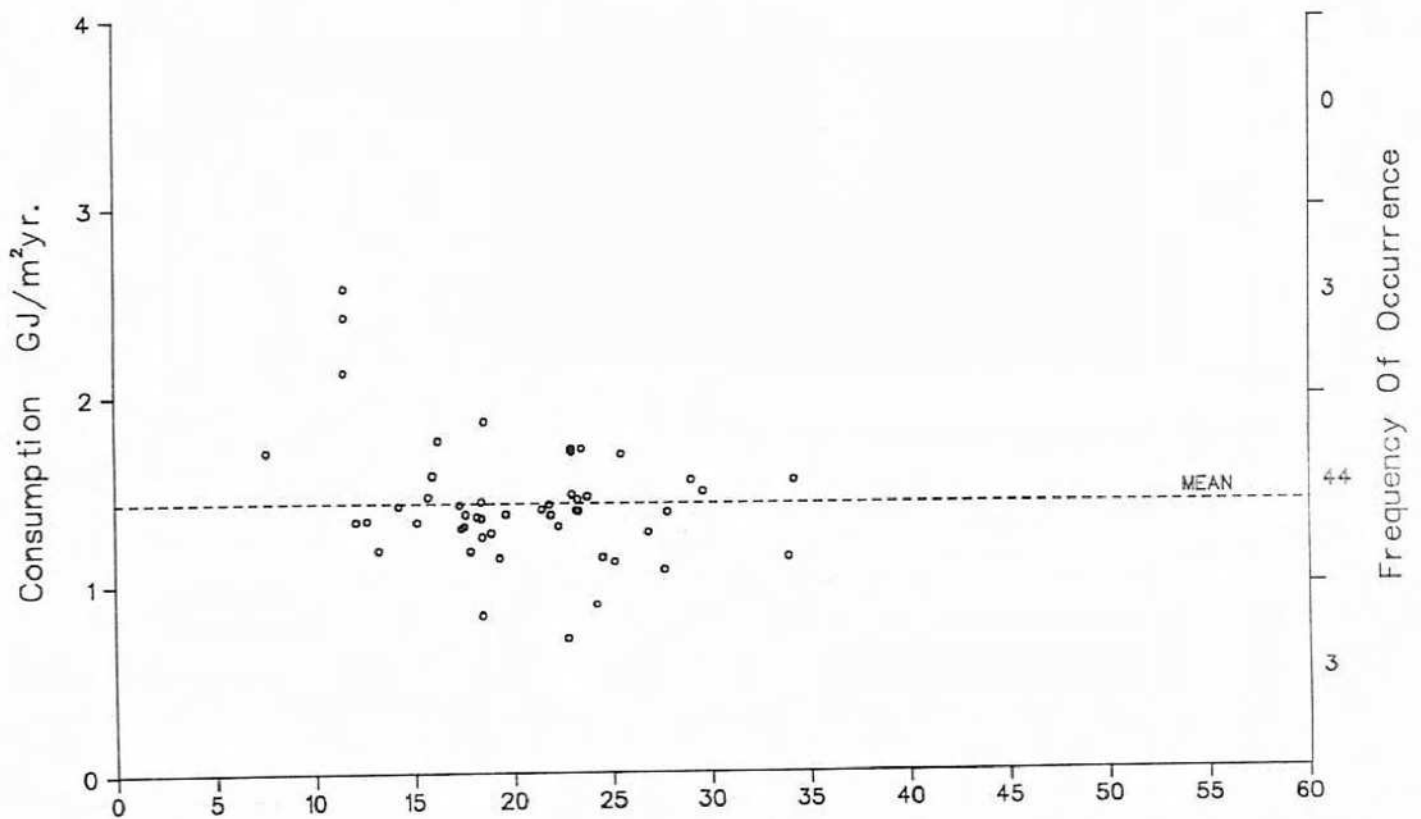


FIGURE 3 ONTARIO HOUSING CORPORATION
(TORONTO) - 1977

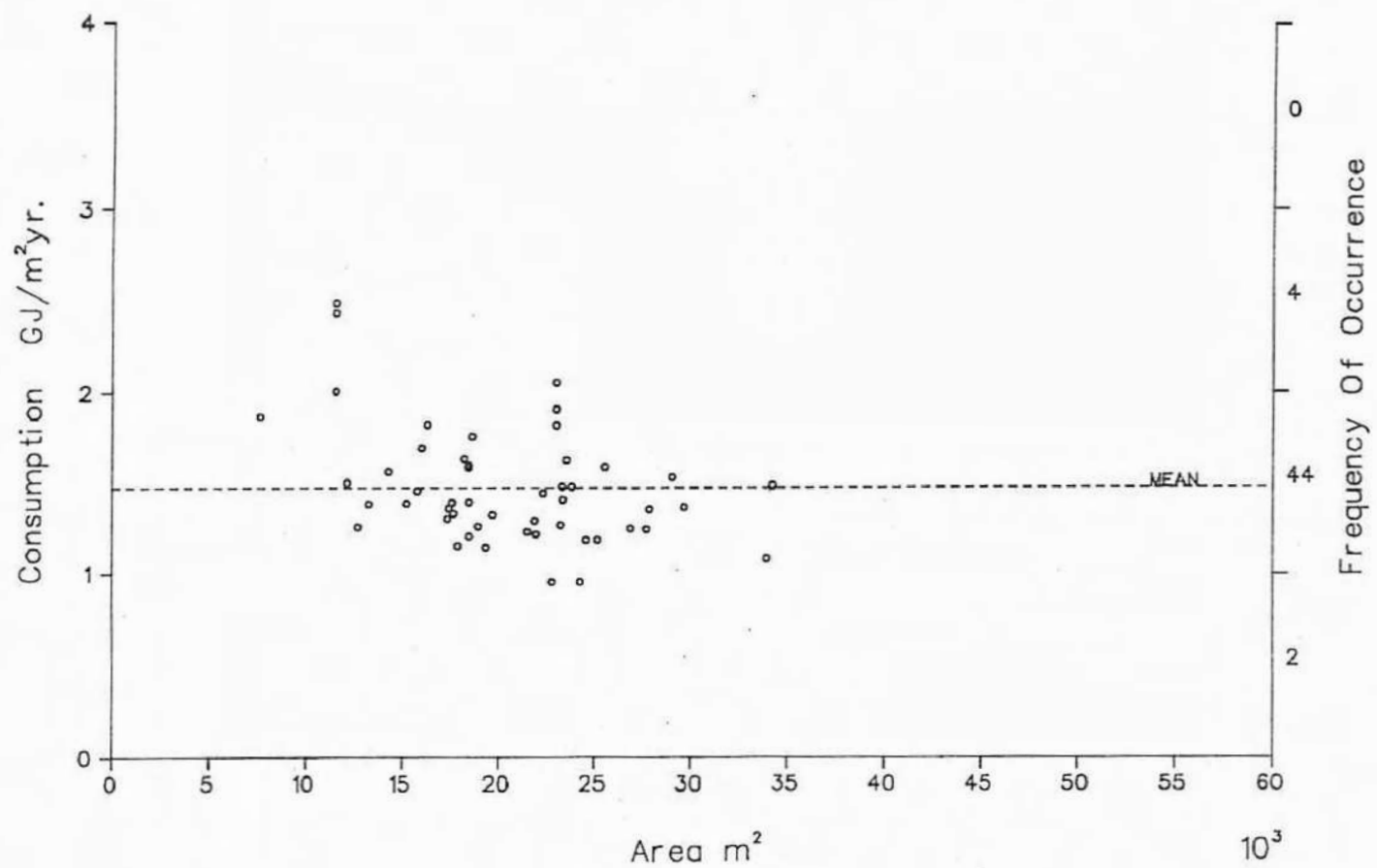


FIGURE 4 ONTARIO HOUSING CORPORATION
(TORONTO) - 1978

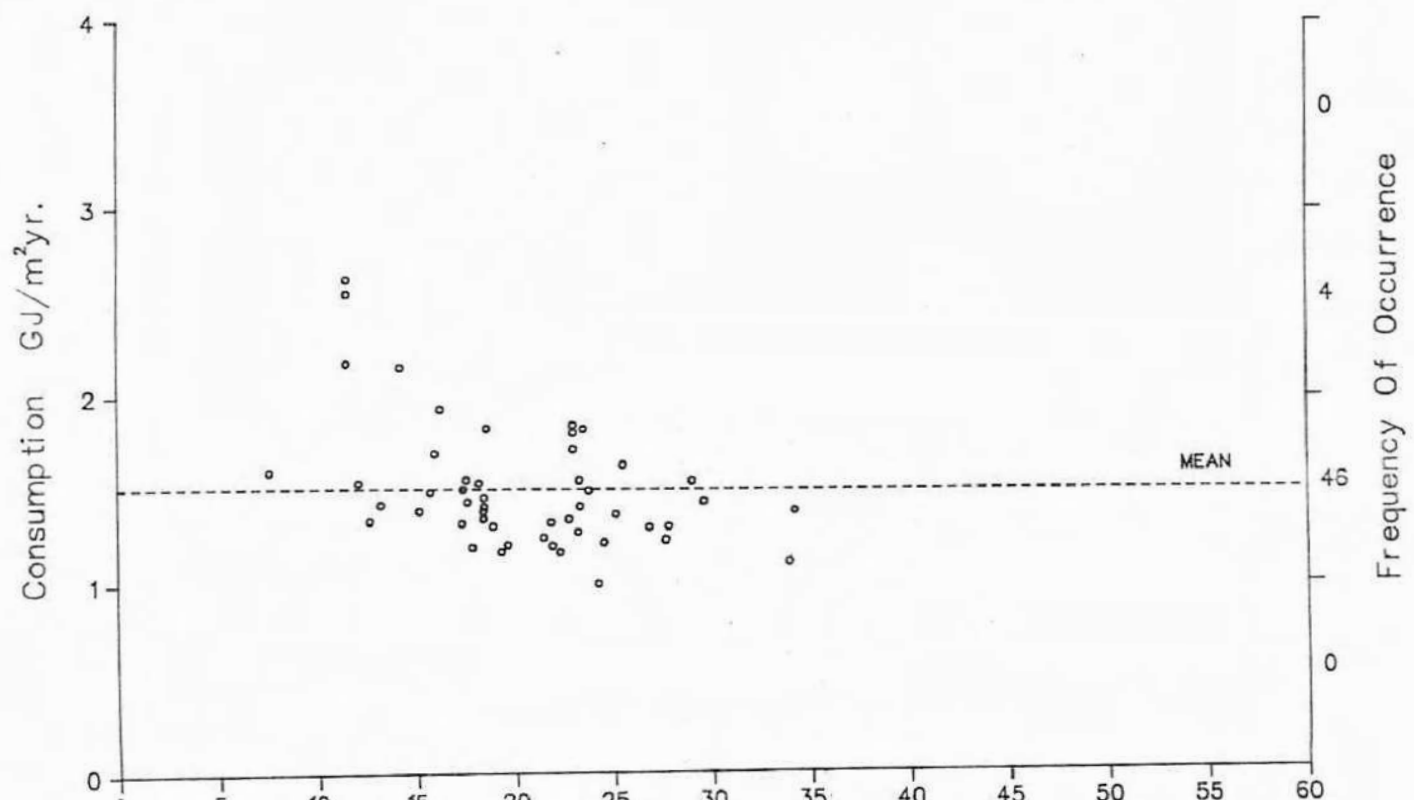


FIGURE 5 ONTARIO HOUSING CORPORATION
GROUP 1 - 1977

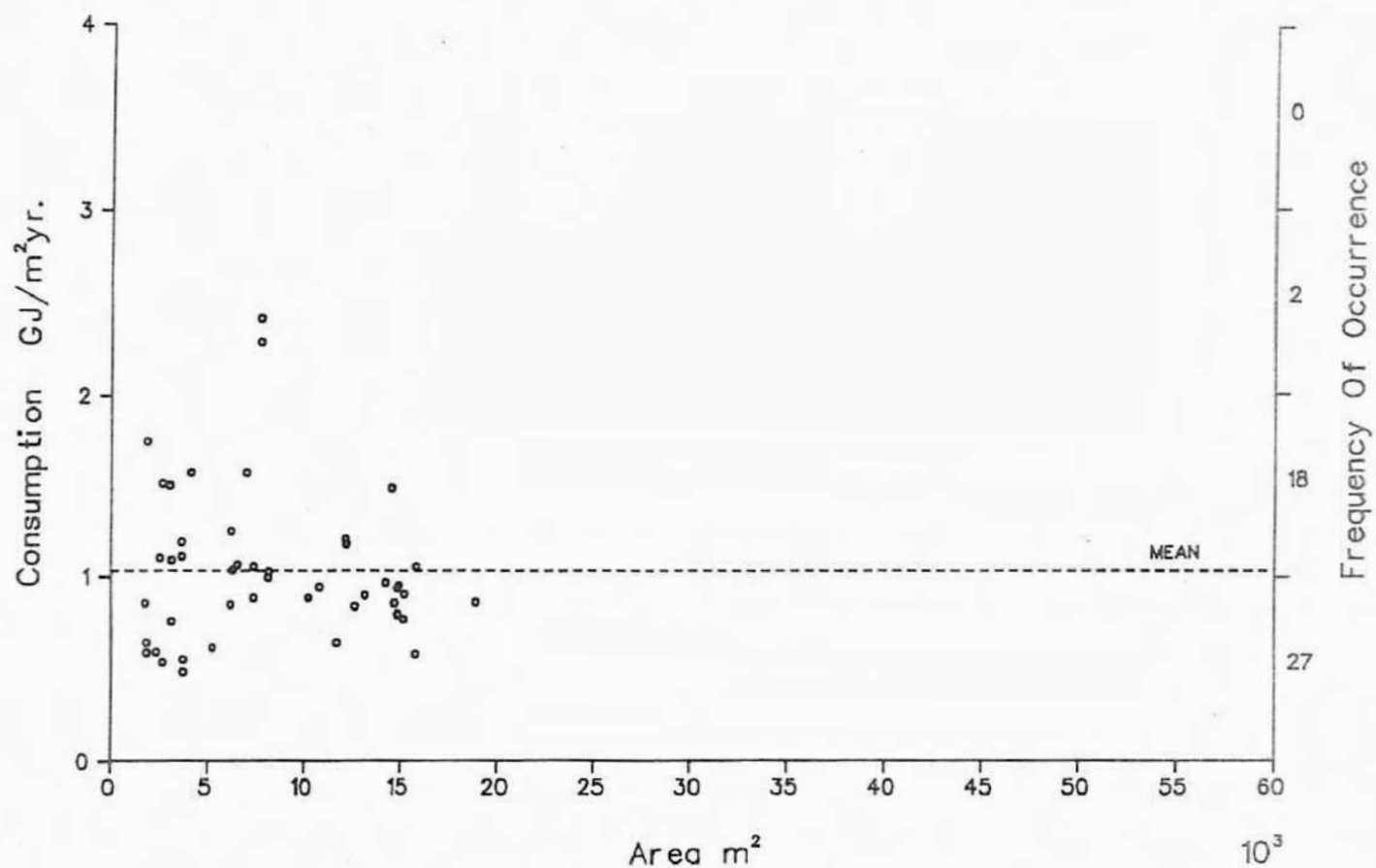


FIGURE 6 ONTARIO HYDRO
APARTMENT BUILDINGS

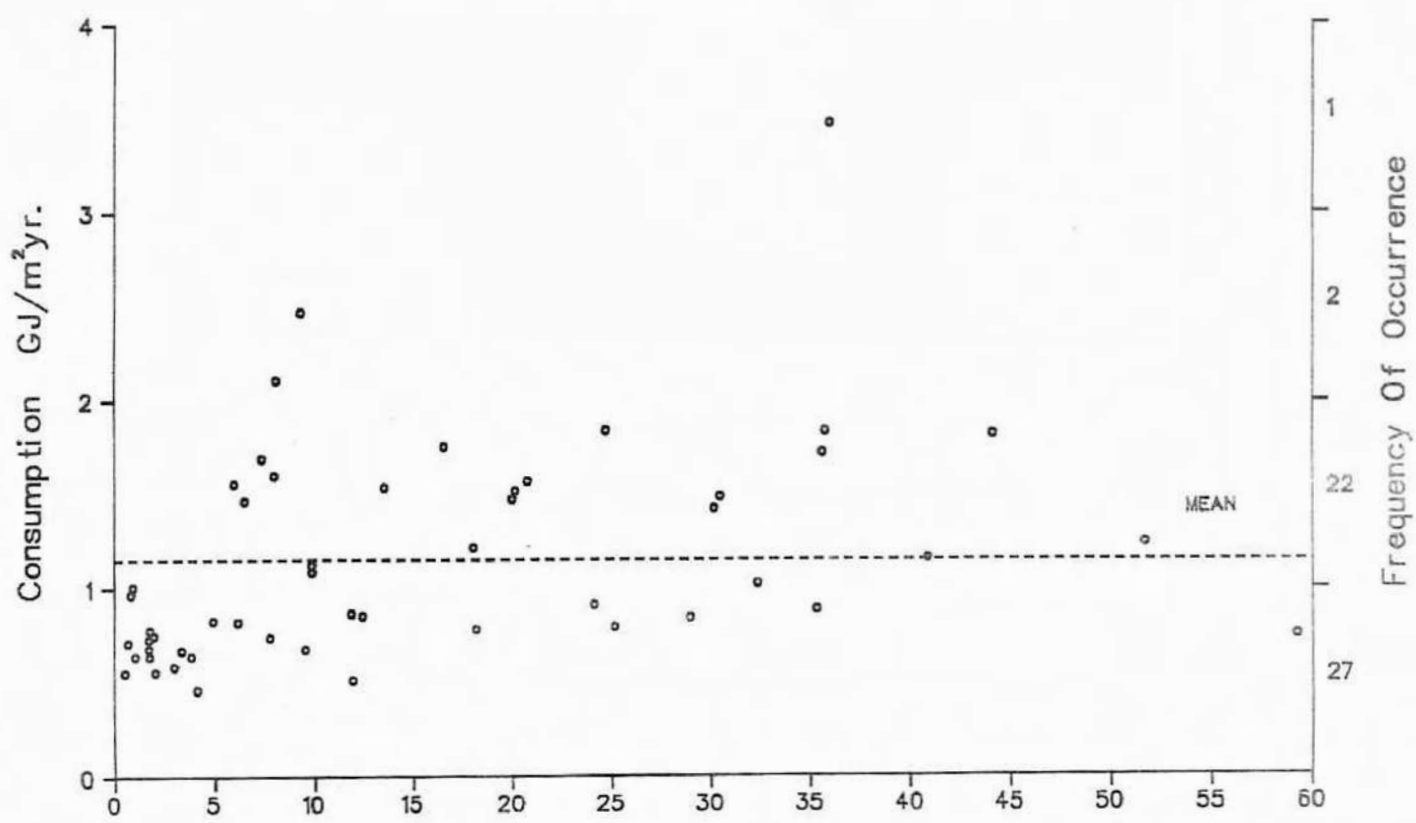


FIGURE 7 APARTMENTS (MONTREAL AREA)

