

# P R O J E C T M E M O R A N D U M

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## 2004-2006 SF<sub>6</sub> DATA SUMMARY

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PM-2327-NEMA

June 2007

Prepared for the National Electrical Manufacturers Association

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INFRASTRUCTURE, SAFETY, AND ENVIRONMENT

June 25, 2007

## Memorandum

To: Sponsors

From: Debra Knopman and Katie Smythe

**Subject: 2004-2006 SF<sub>6</sub> Data Summary**

The attached tables and graphs summarize the data received from manufacturers of sulfur hexafluoride (SF<sub>6</sub>) for the period 2004-2006. The purpose of the survey is to provide the scientific community with data on the production and use of sulfur hexafluoride.

The initial request for data was sent to the six SF<sub>6</sub> producers who have participated in the data collection exercise since its inception in 1996. However, only four companies responded to this data request despite multiple efforts on RAND's part to secure responses from all six of the producers as had happened in the past. This report provides a compilation of the last three years of data from these four companies.

To summarize, the companies were requested to provide data on total actual sales by end-use applications for 2004, 2005 and 2006, and provide an additional breakdown of the data. Reported data include only the SF<sub>6</sub> sold by the company *directly* into the marketplace, including any amount purchased from co-producers for re-sale to customers. All information provided to RAND was treated as commercially confidential business information, was not divulged to any other individuals or organizations, and remains secure. Only aggregated data are reported, consistent with the agreement in place between RAND and sponsors.

The RAND survey questionnaire was organized according to the primary end-use markets:

- electric utilities
- original equipment manufacturers (for electric power systems)
- magnesium industry
- electronics industry (with an estimate of sales to semiconductor manufacturers and LCD/flat panel display manufacturers)
- use of SF<sub>6</sub> for adiabatic / shock absorbing properties (e.g., tires, athletic footwear)
- all other uses

Attached to this memorandum is a data summary table covering the period 1961-2006 along with plots and graphics depicting the results of this most recent survey. In previous years, the results have been presented at the "SF<sub>6</sub> and Environment Conference."

If you have any questions about the SF<sub>6</sub> data, please contact Debra Knopman (Tel: 703-413-1100 ext. 5667; Fax: 703-413-8111; email: knopman@rand.org).



# SF6 Data Collection Exercise

RAND Corporation

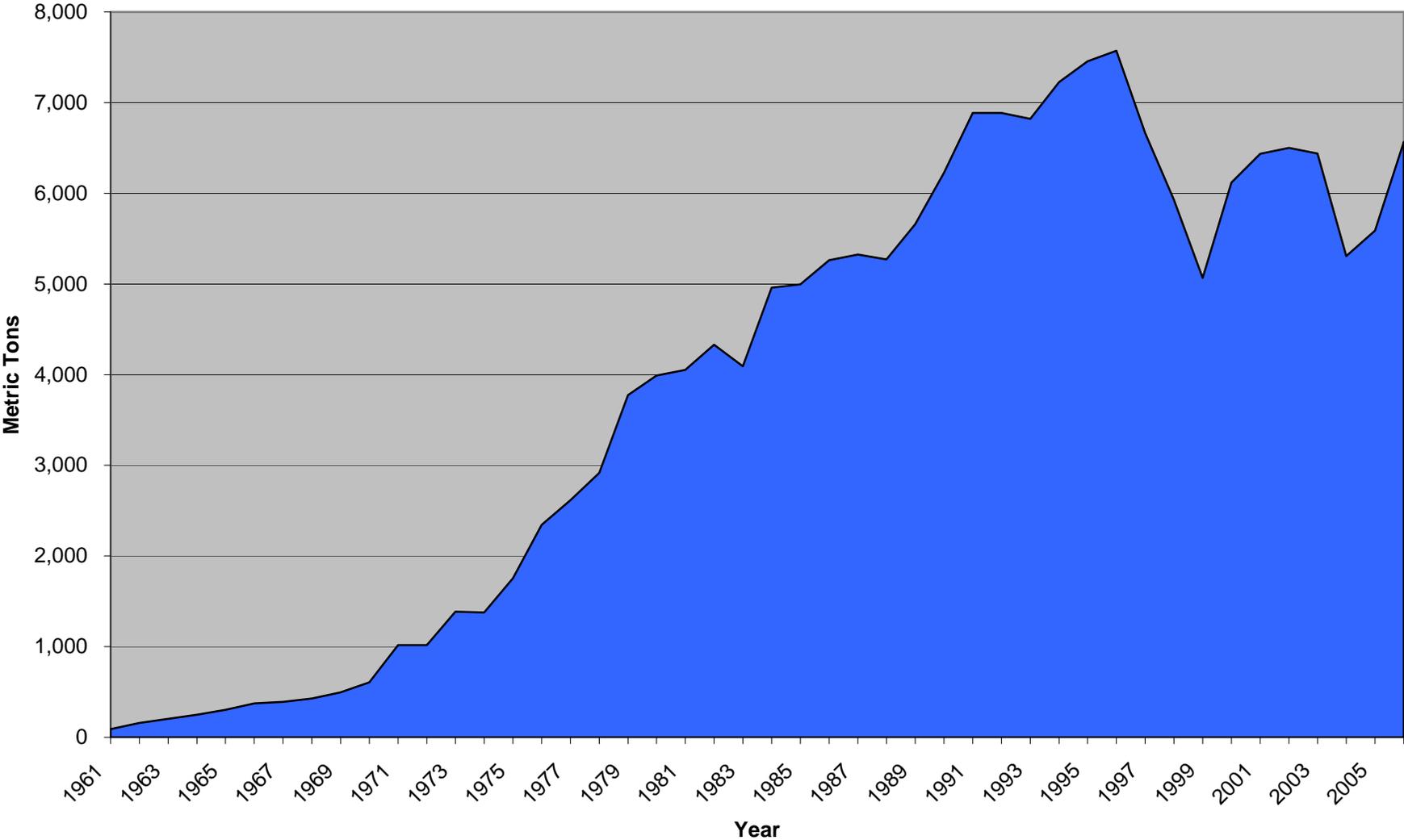
## SUMMARY REPORT

June 2007

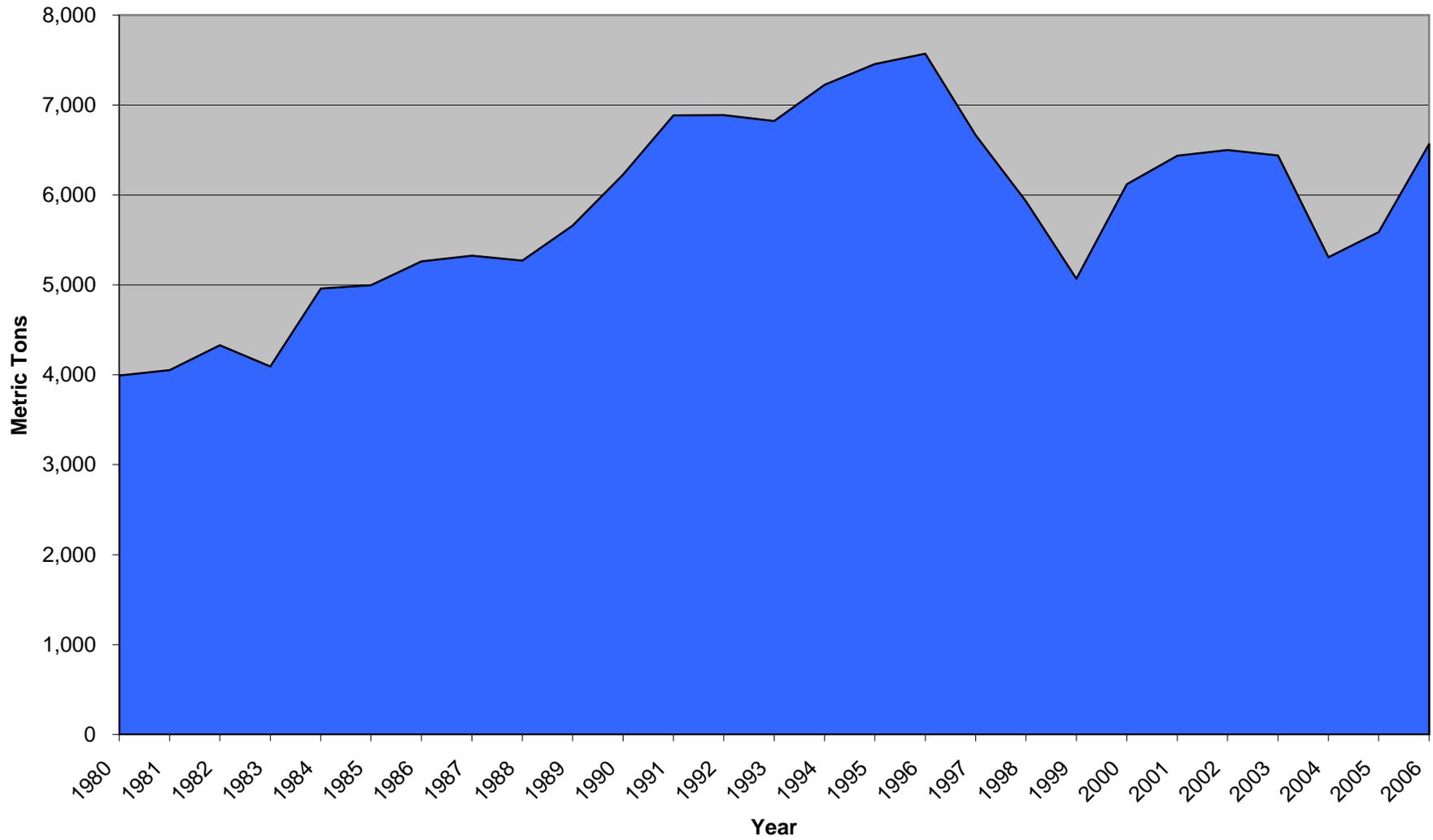
YEAR	SF6 Sales by End-Use Applications						TOTAL
	Electric Utilities	Original Equip. Manufacturers	Magnesium Industry	Electronics Industry	Adiabatic Prop. Usage	All Other Uses (listed below)	
<i>(units in metric tons)</i>							
1961	0	91	0	0	0	0	91
1962	14	145	0	0	0	0	159
1963	14	181	0	0	0	9	204
1964	18	204	14	0	0	14	250
1965	32	231	23	0	0	18	304
1966	61	233	27	2	5	23	374
1967	63	239	32	5	9	27	392
1968	63	256	36	5	14	32	428
1969	84	269	41	7	14	36	496
1970	134	283	44	9	14	44	606
1971	391	366	71	10	14	72	1,018
1972	355	423	63	11	14	64	1,017
1973	469	586	83	11	14	84	1,385
1974	449	617	46	12	14	72	1,378
1975	587	909	120	13	14	111	1,754
1976	810	1,186	195	13	14	126	2,344
1977	812	1,411	214	13	14	151	2,615
1978	729	1,763	256	13	20	134	2,915
1979	797	2,432	312	15	32	188	3,776
1980	837	2,566	321	16	35	216	3,991
1981	1,002	2,450	320	17	54	210	4,053
1982	1,005	2,641	360	18	59	246	4,329
1983	941	2,446	374	17	80	233	4,091
1984	1,043	3,164	397	16	108	232	4,960
1985	1,152	3,022	437	20	111	254	4,996
1986	1,367	3,016	431	38	110	300	5,262
1987	1,264	3,161	415	73	146	265	5,324
1988	1,393	2,910	398	100	162	307	5,270
1989	1,507	3,078	363	117	270	323	5,658
1990	1,574	3,471	385	140	220	435	6,225
1991	1,496	3,940	357	151	260	682	6,886
1992	1,295	4,190	266	201	290	645	6,887
1993	1,513	3,857	274	229	290	658	6,821
1994	1,342	4,355	354	262	325	587	7,225
1995	1,024	4,761	399	300	356	617	7,457
1996	1,163	4,771	544	307	344	442	7,571
1997	1,021	4,347	178	361	393	366	6,665
1998	741	4,140	148	373	175	351	5,929
1999	669	3,208	165	474	134	417	5,067
2000	1,128	3,915	153	604	108	211	6,119
2001	1,132	4,236	211	541	63	252	6,435
2002	1,512	3,658	311	662	29	328	6,501
2003	1,552	3,424	246	856	9	351	6,438
2004	1,323	3,093	216	465	2	208	5,307
2005	1,302	3,287	206	580	2	210	5,588
2006	1,387	3,452	266	1,247	2	212	6,566
<b>TOTAL</b>	<b>38,567</b>	<b>106,384</b>	<b>10,072</b>	<b>8,325</b>	<b>4,343</b>	<b>10,763</b>	<b>179,127</b>
	<b>22%</b>	<b>59%</b>	<b>6%</b>	<b>5%</b>	<b>2%</b>	<b>6%</b>	

- NOTES: 1) "All Other Uses" includes accelerators, leak detection, optical fiber production, glazing, biotechnology, lighting, medical, pharmaceutical, laboratory / university research, government sales, refining, sound proof windows
- 2) For the years 1966-1974 (\*\*), some companies could not provide a breakdown by end use. TOTAL SALES includes an additional 672 metric tons sold in these years. The sum of sales by end use does not equal total sales.
- 3) For the years 1961-1996, utilities and accelerators were reported together in the same category. Beginning with 1997, accelerators were included in the category of "All Other Uses" and "Utilities" was a stand-alone category.
- 4) In the 2000-2001 report, one company made a correction to the category distribution of their previously reported data. Sales shown previously as "Utilities" were moved to "Original Equipment Manufacturers". A similar change was made by another company in the 1999 report.
- 5) Data from Nuclear Energy Corp. of South Africa (NECSA) are included in the report beginning in 1997.
- 6) Ausimont was acquired by Solvay in Spring 2002; combined data were reported by Solvay for the 2000-2001 report.
- 7) Airgas took over Air Products US SF6 sales (except for the Electronics sector) in 2002.
- 8) The data reported in 2004-2006 reflects submissions from four companies; the request for data was sent to six companies.

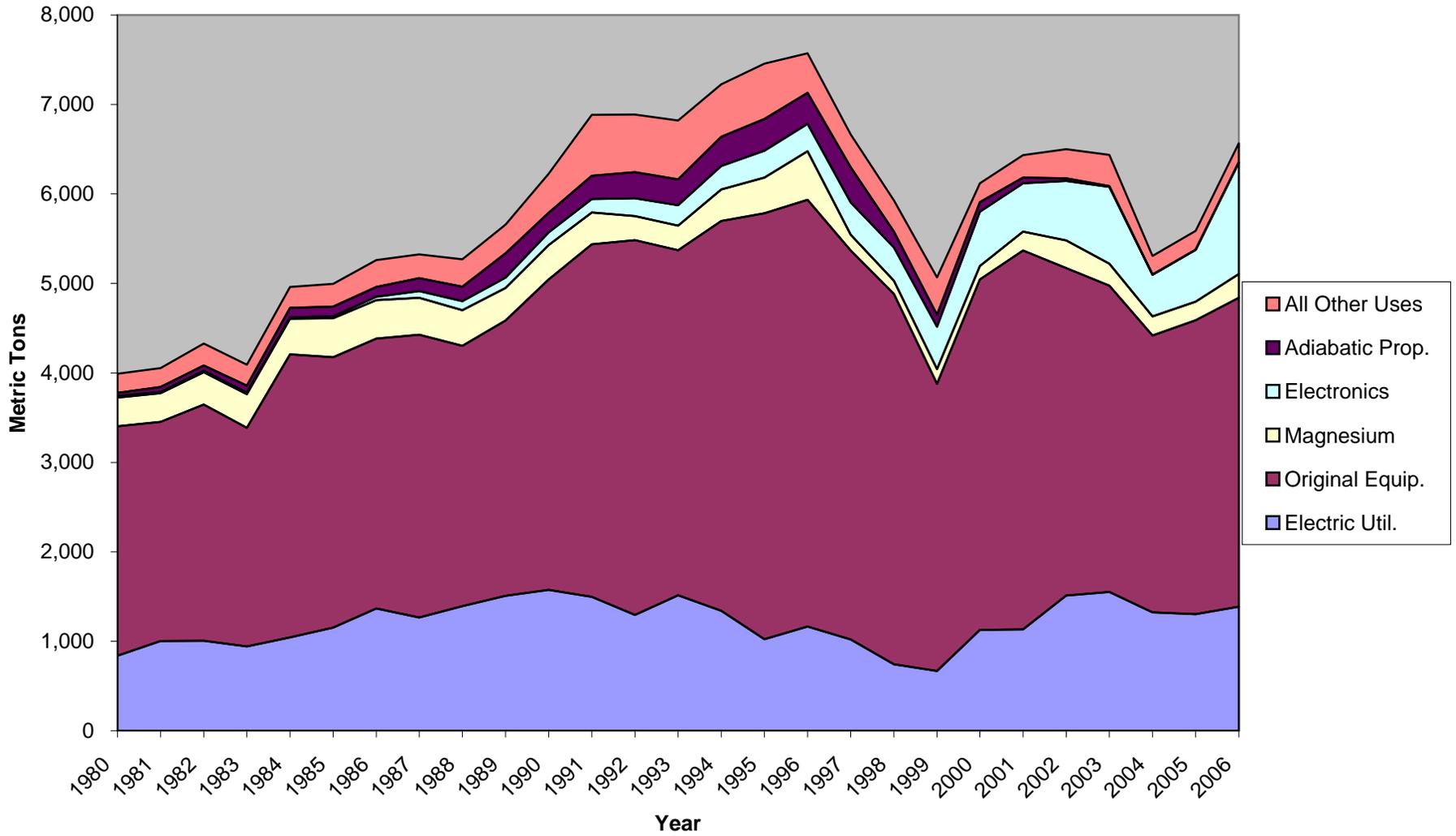
# Total Annual Sales of SF<sub>6</sub> (1961-2006)



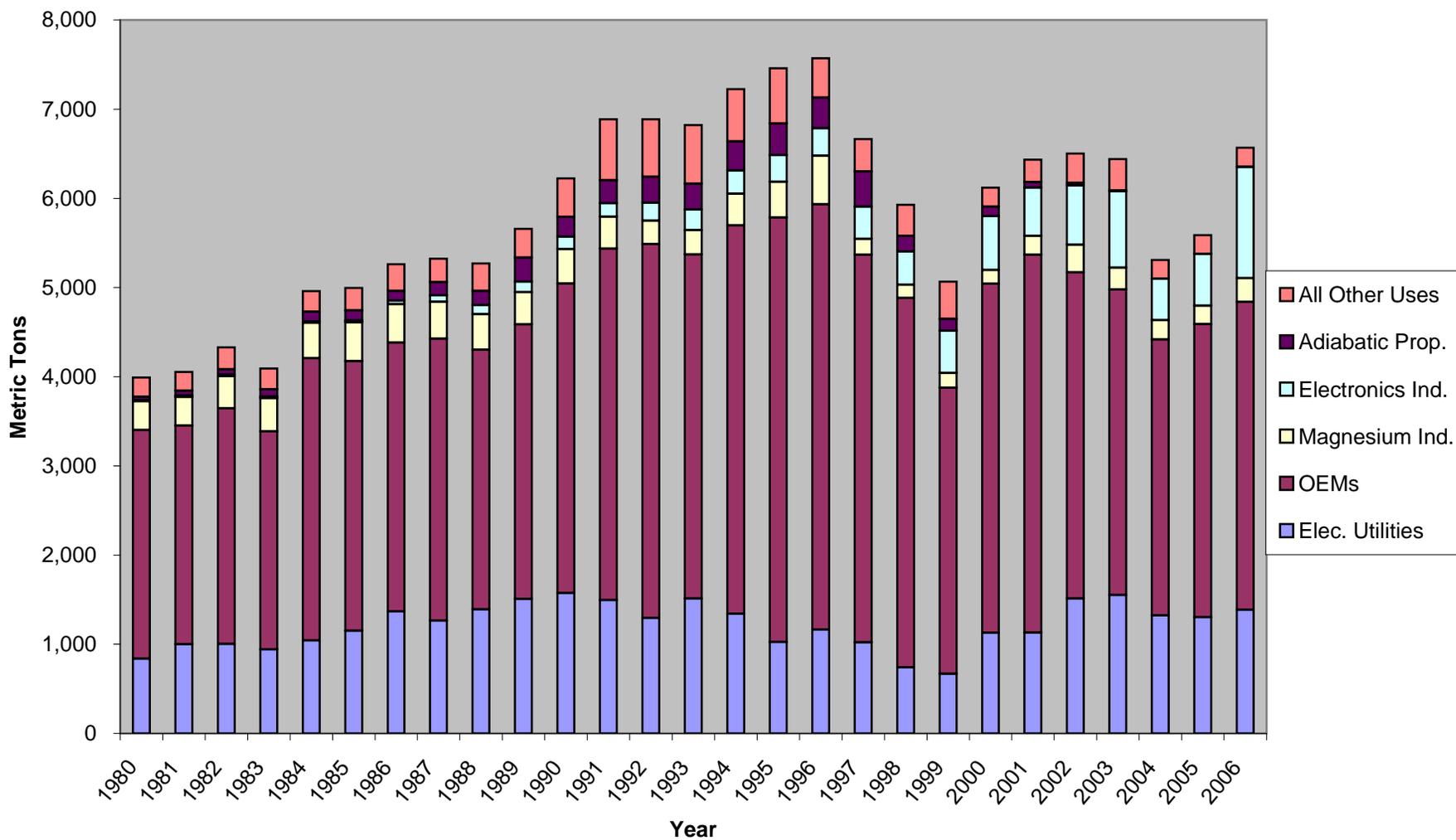
### Total Annual Sales of SF<sub>6</sub> (1980-2006)



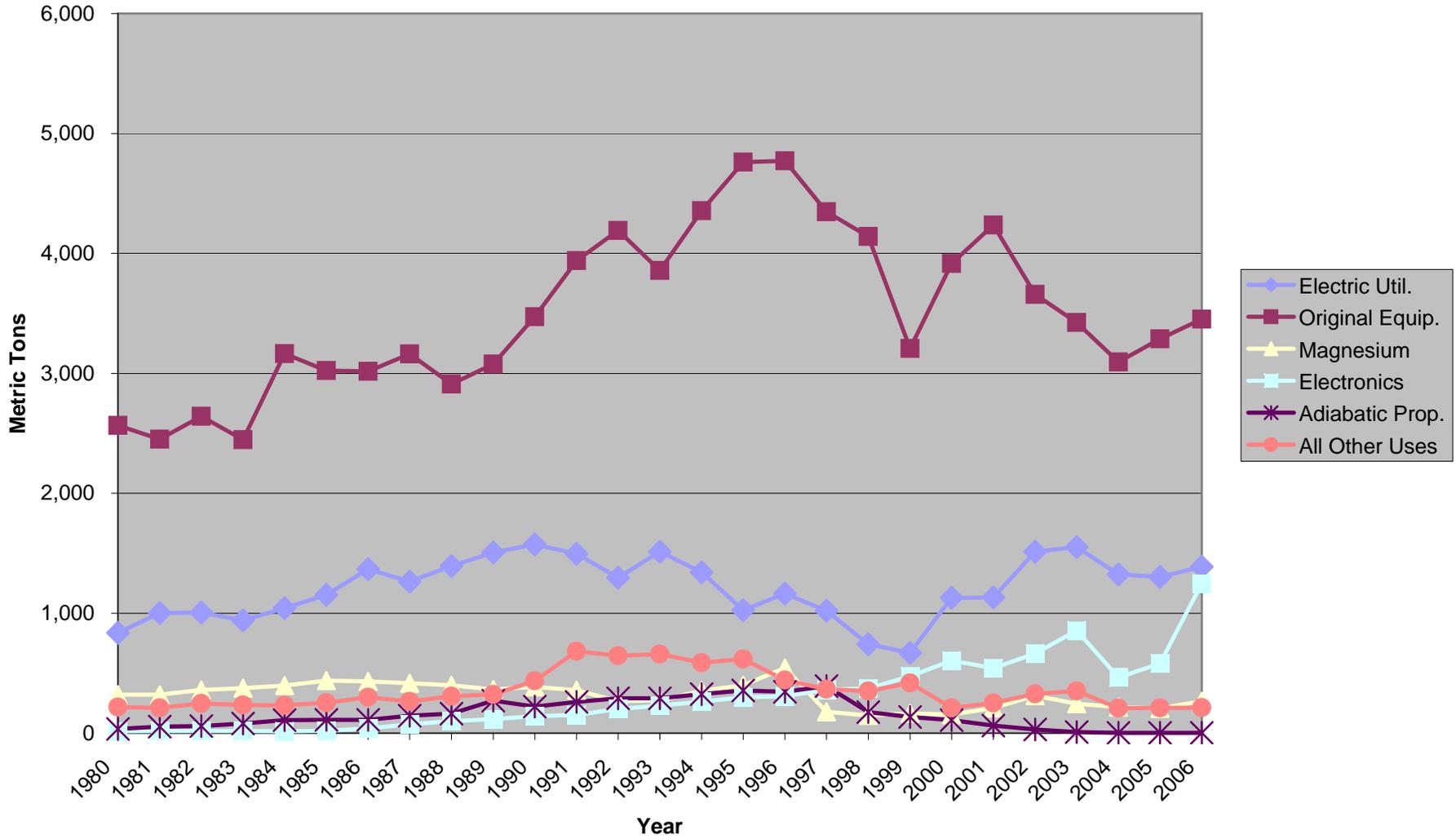
## Annual Sales of SF<sub>6</sub> by End-Use Application (1980 - 2006)



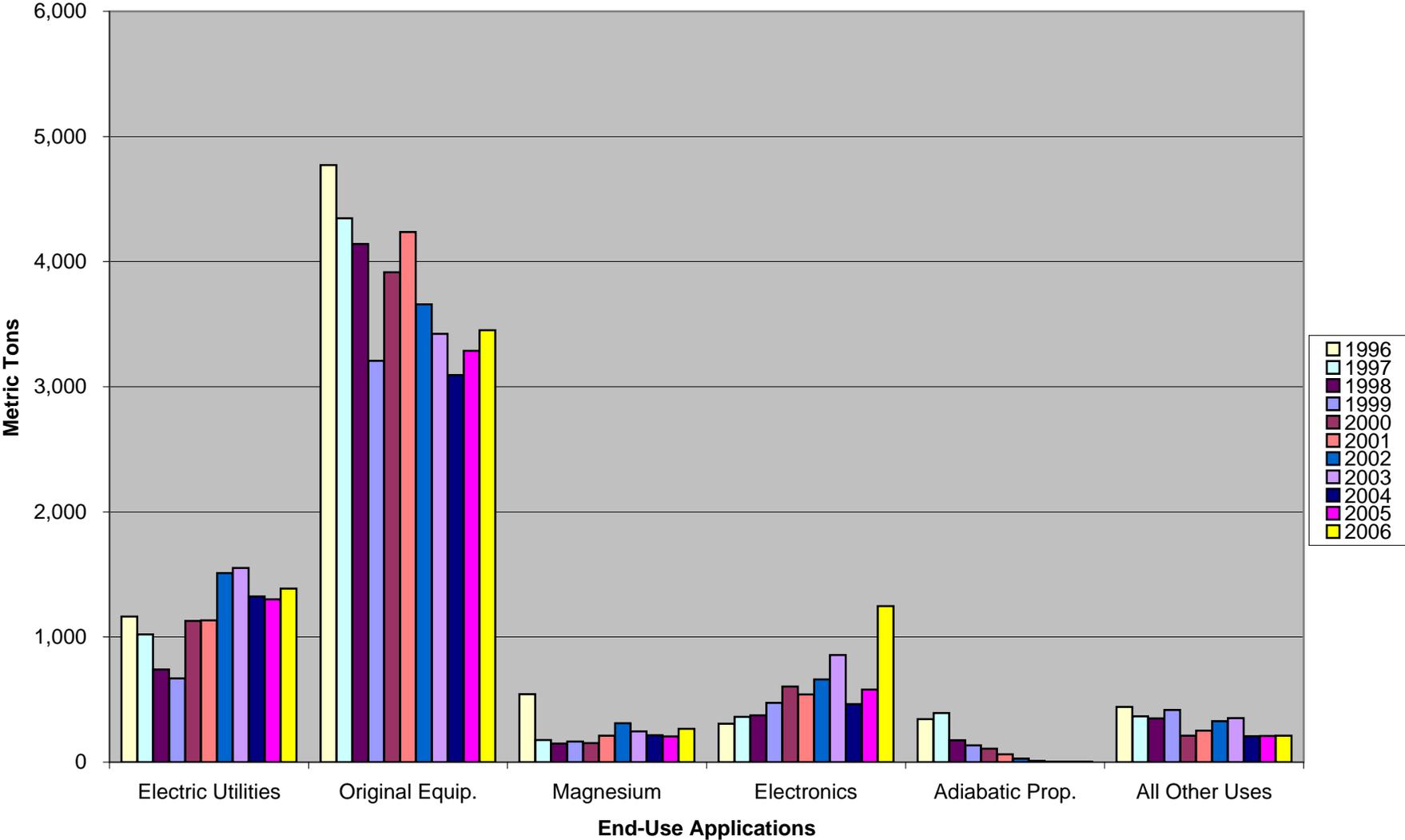
## Sales of SF<sub>6</sub> by End-Use Category (1980-2006)



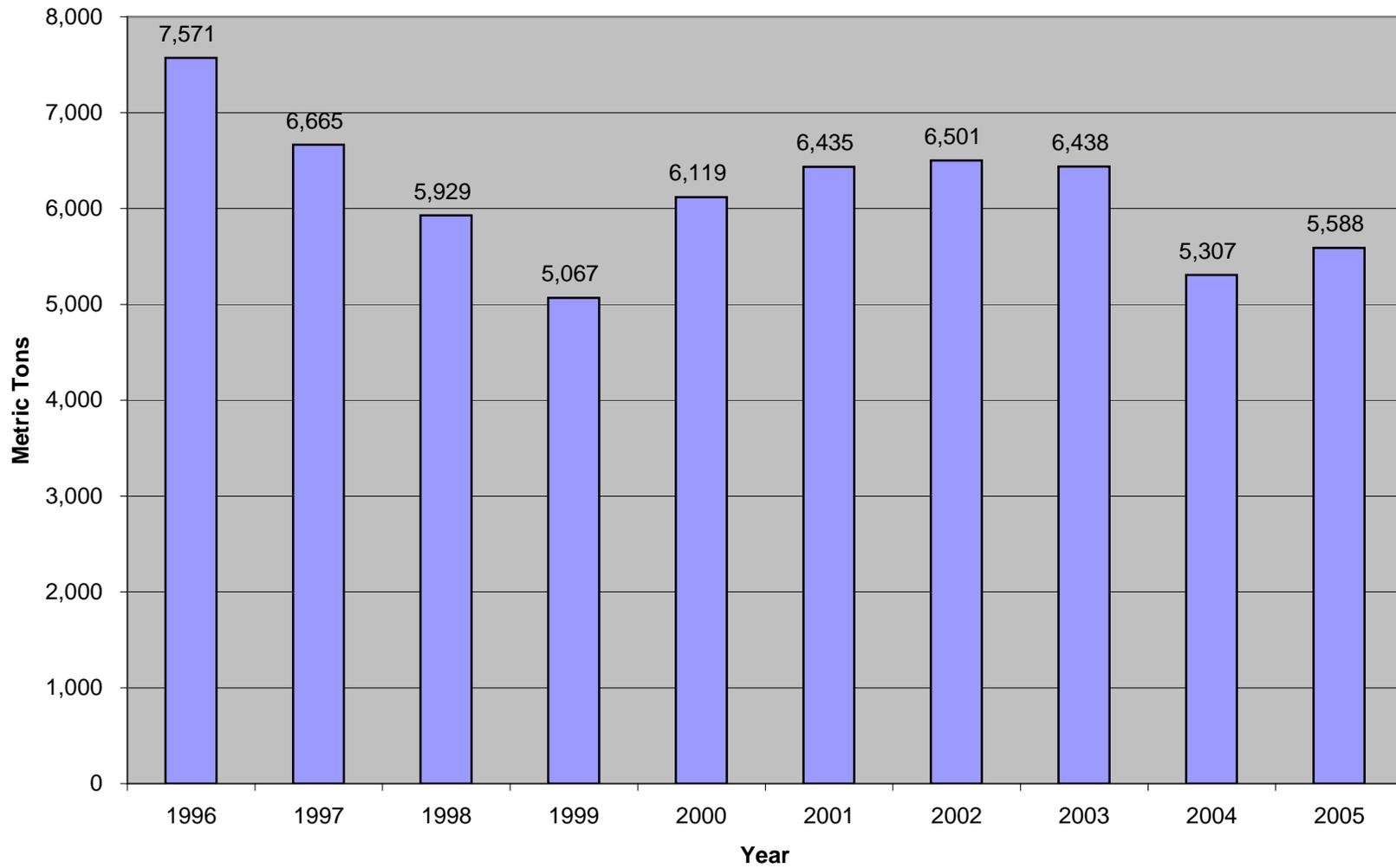
## Annual Sales of SF<sub>6</sub> by End-Use Application (1980 - 2006)



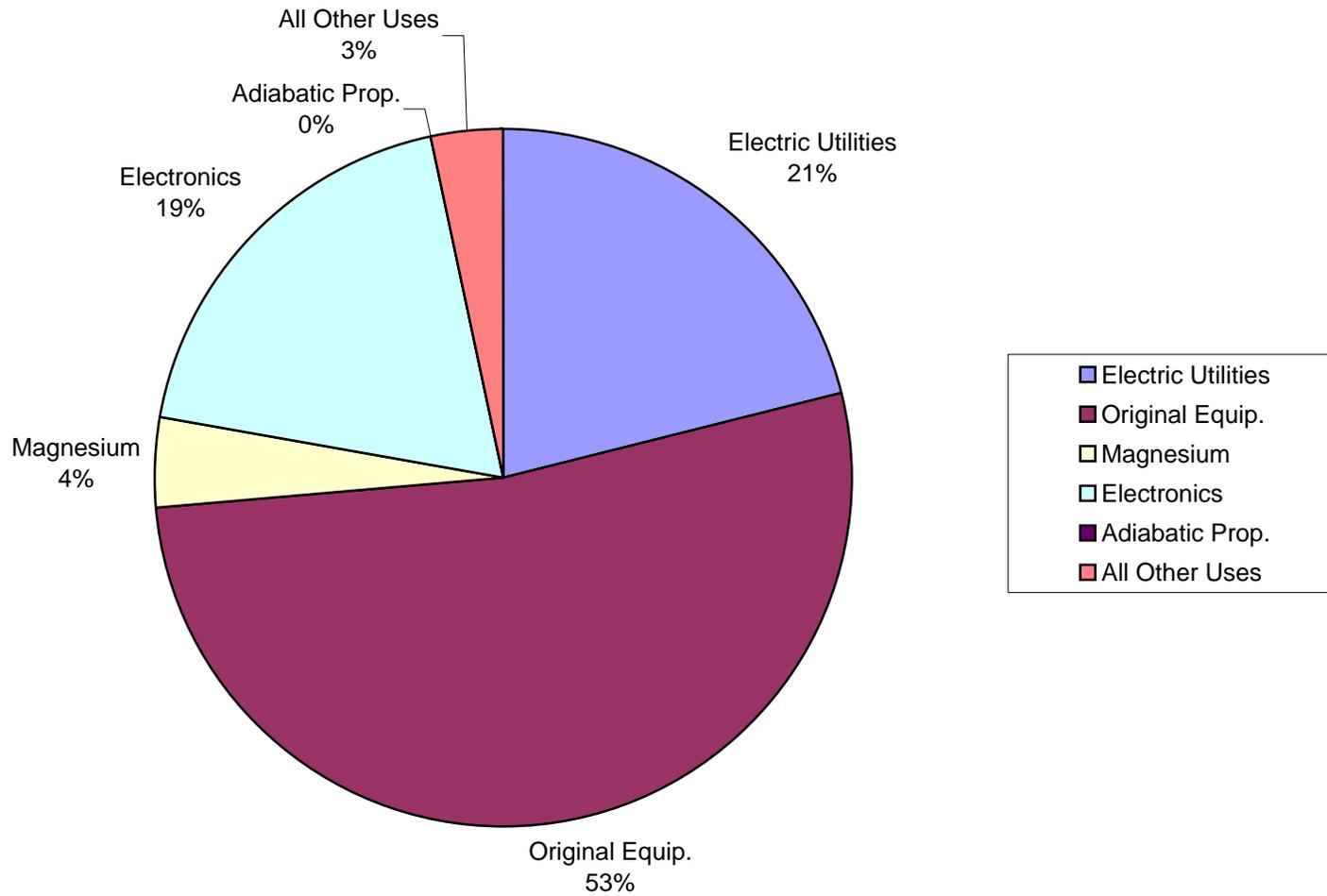
### SF6 Sales for the Period 1996-2006



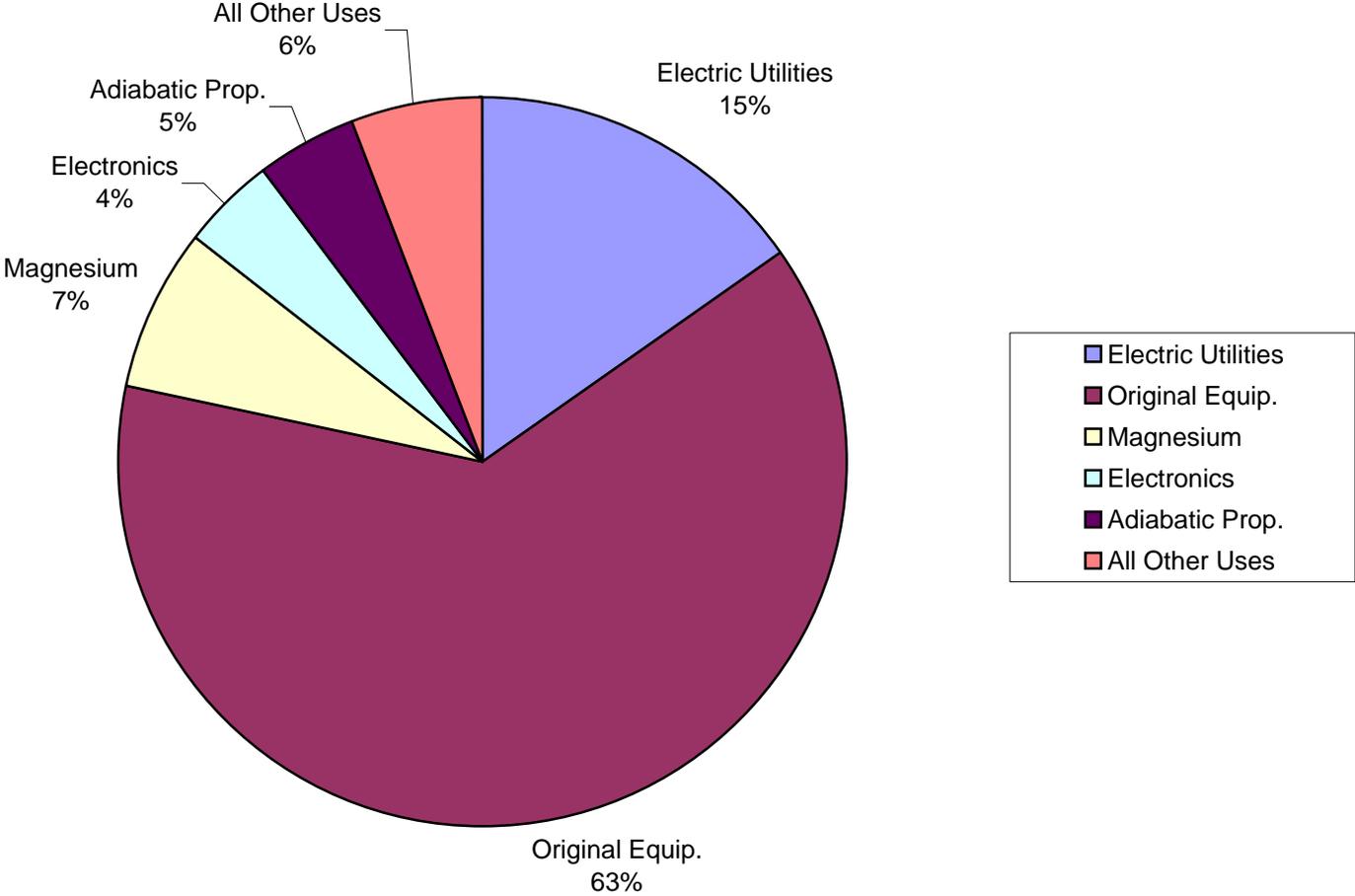
### Total Annual Sales of SF<sub>6</sub> (1996-2006)



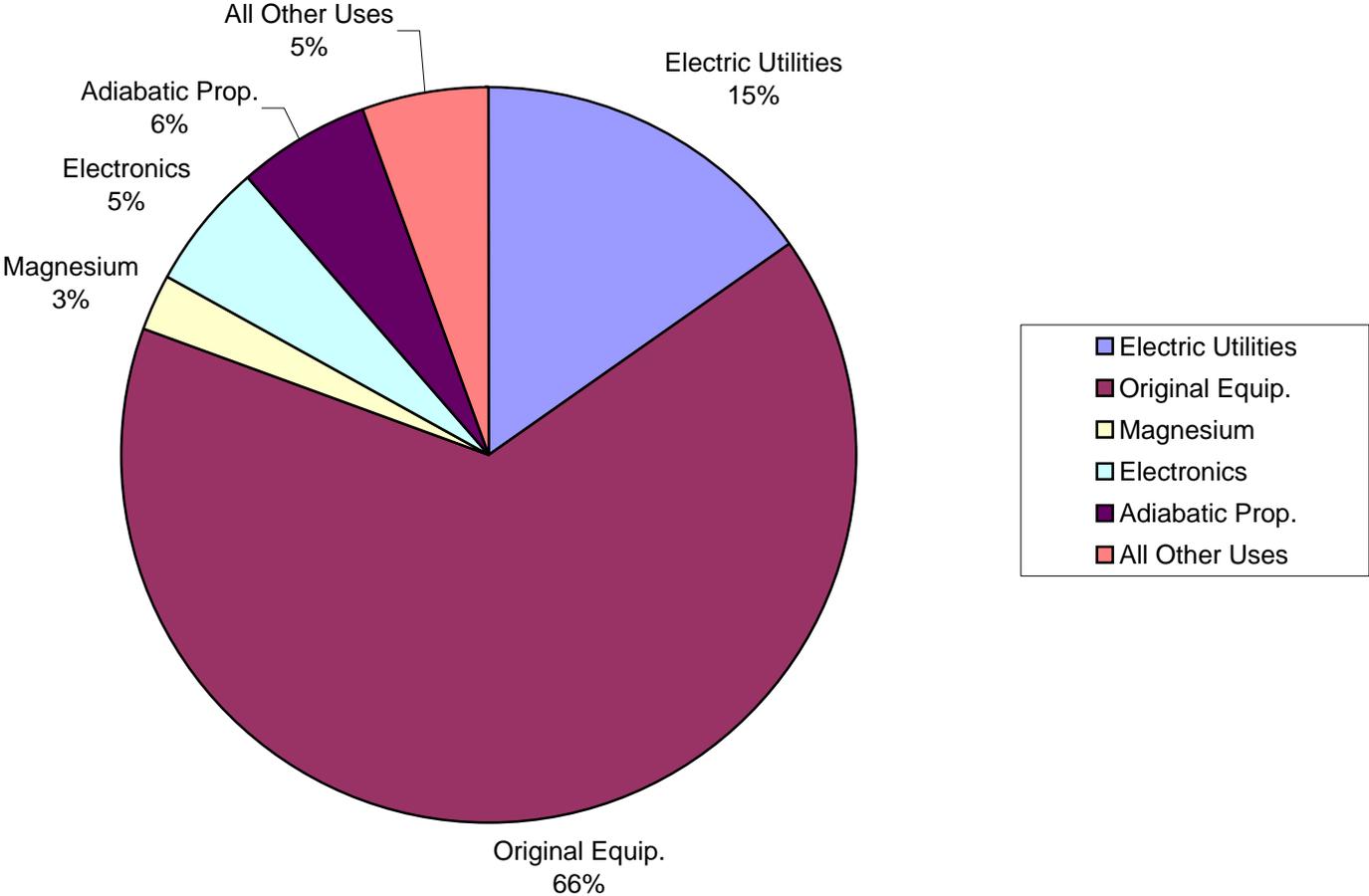
## Breakdown of Total SF<sub>6</sub> Sales: 1961-2006



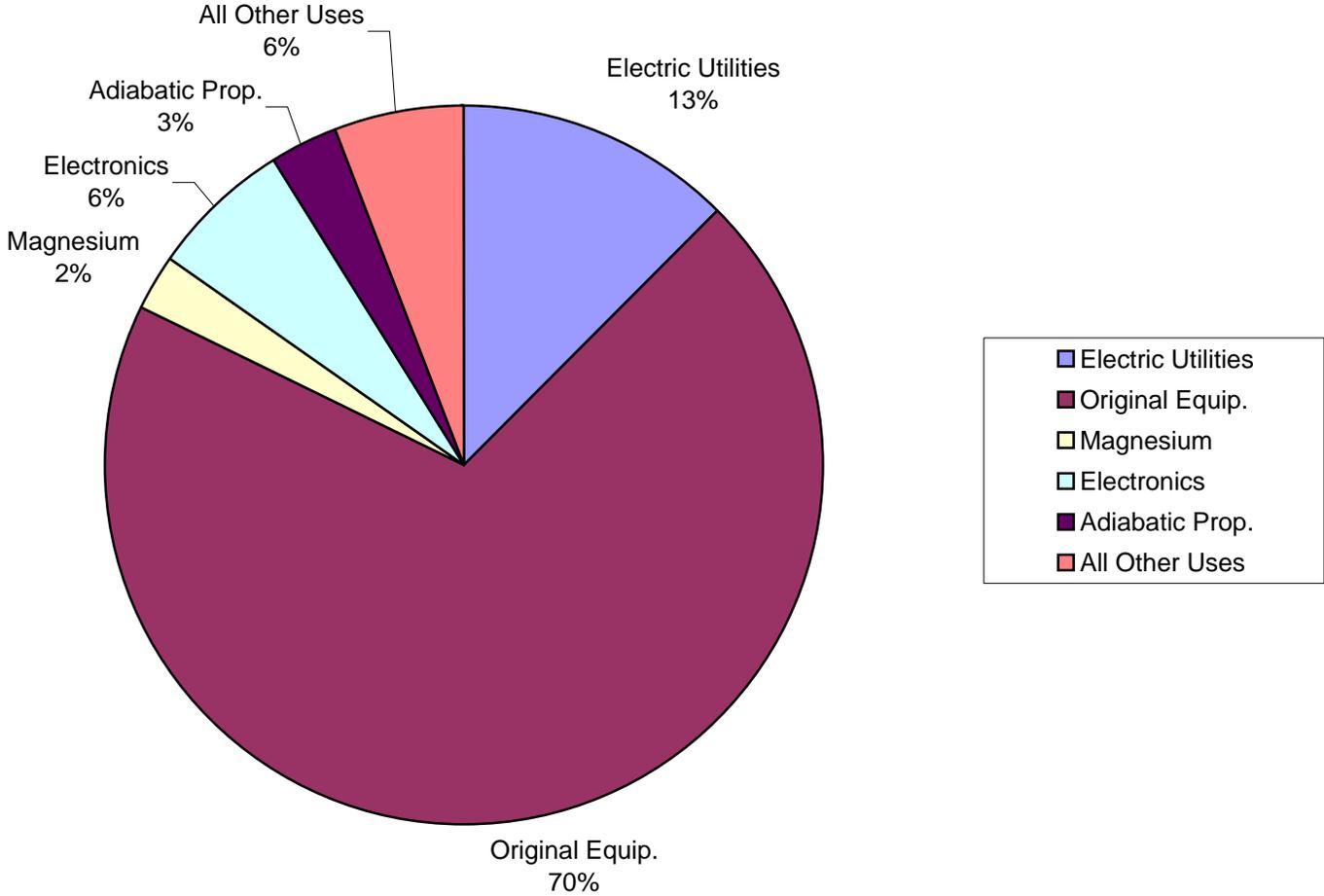
# Breakdown of Total SF<sub>6</sub> Sales: 1996



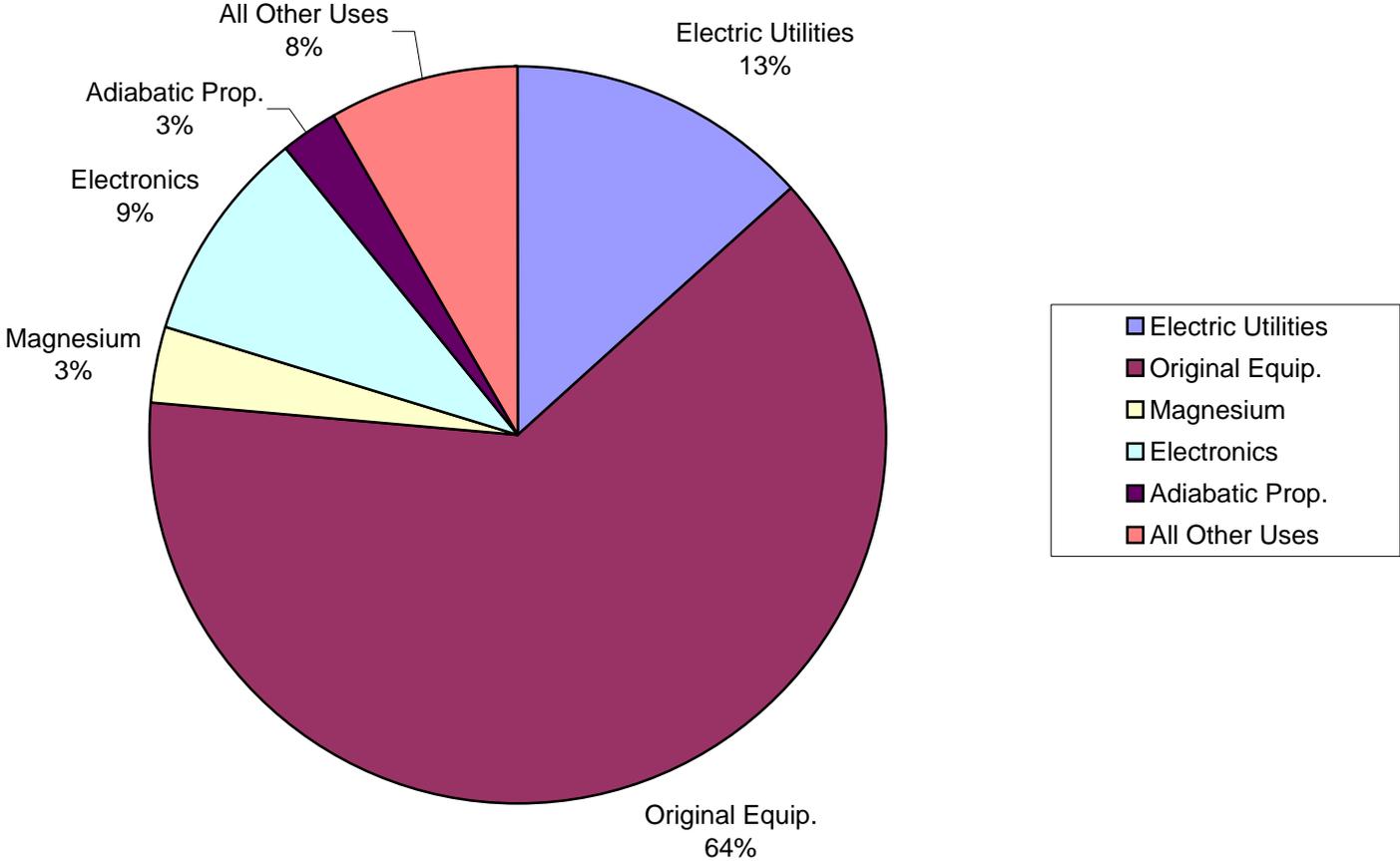
# Breakdown of Total SF<sub>6</sub> Sales: 1997



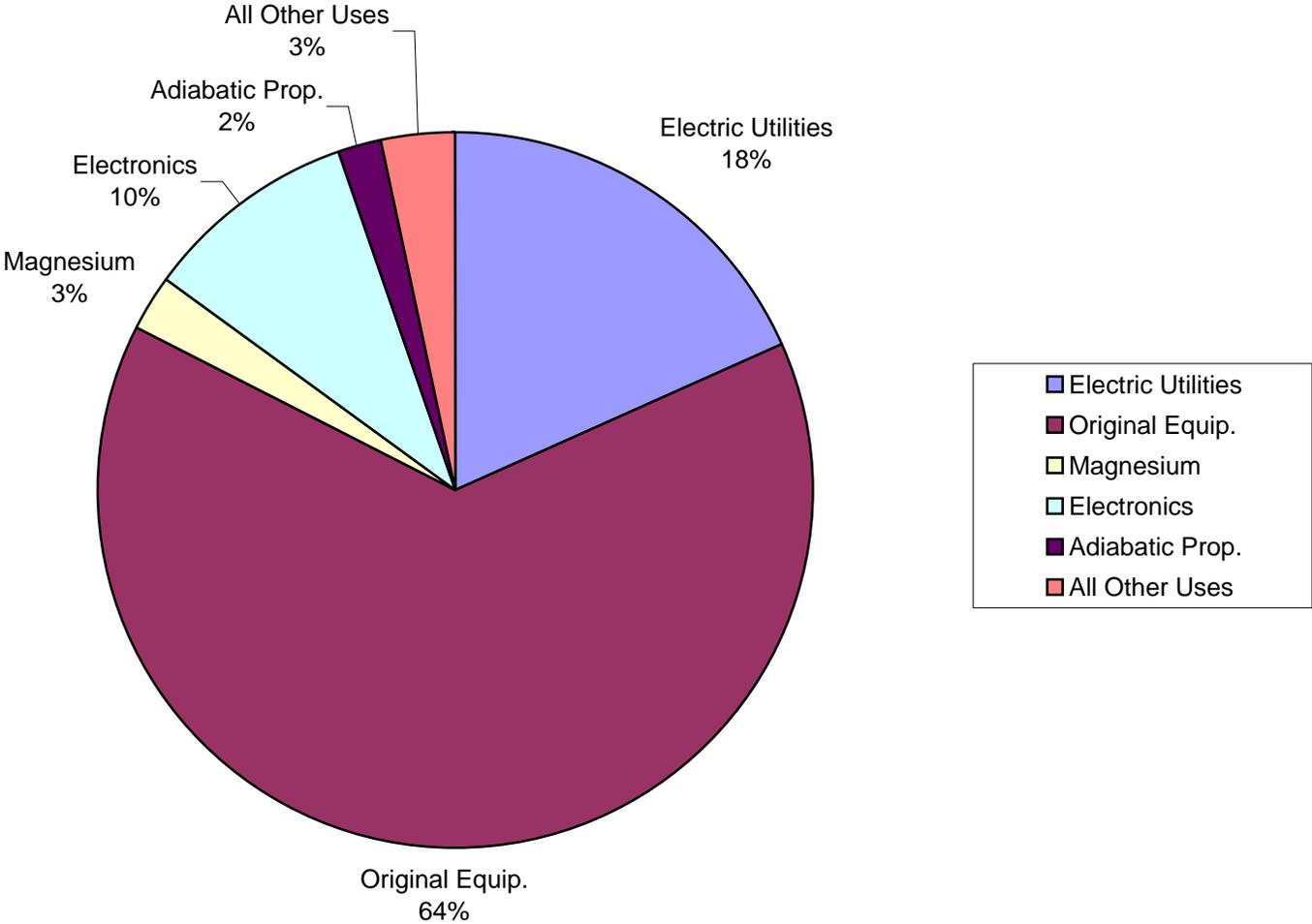
# Breakdown of Total SF<sub>6</sub> Sales: 1998



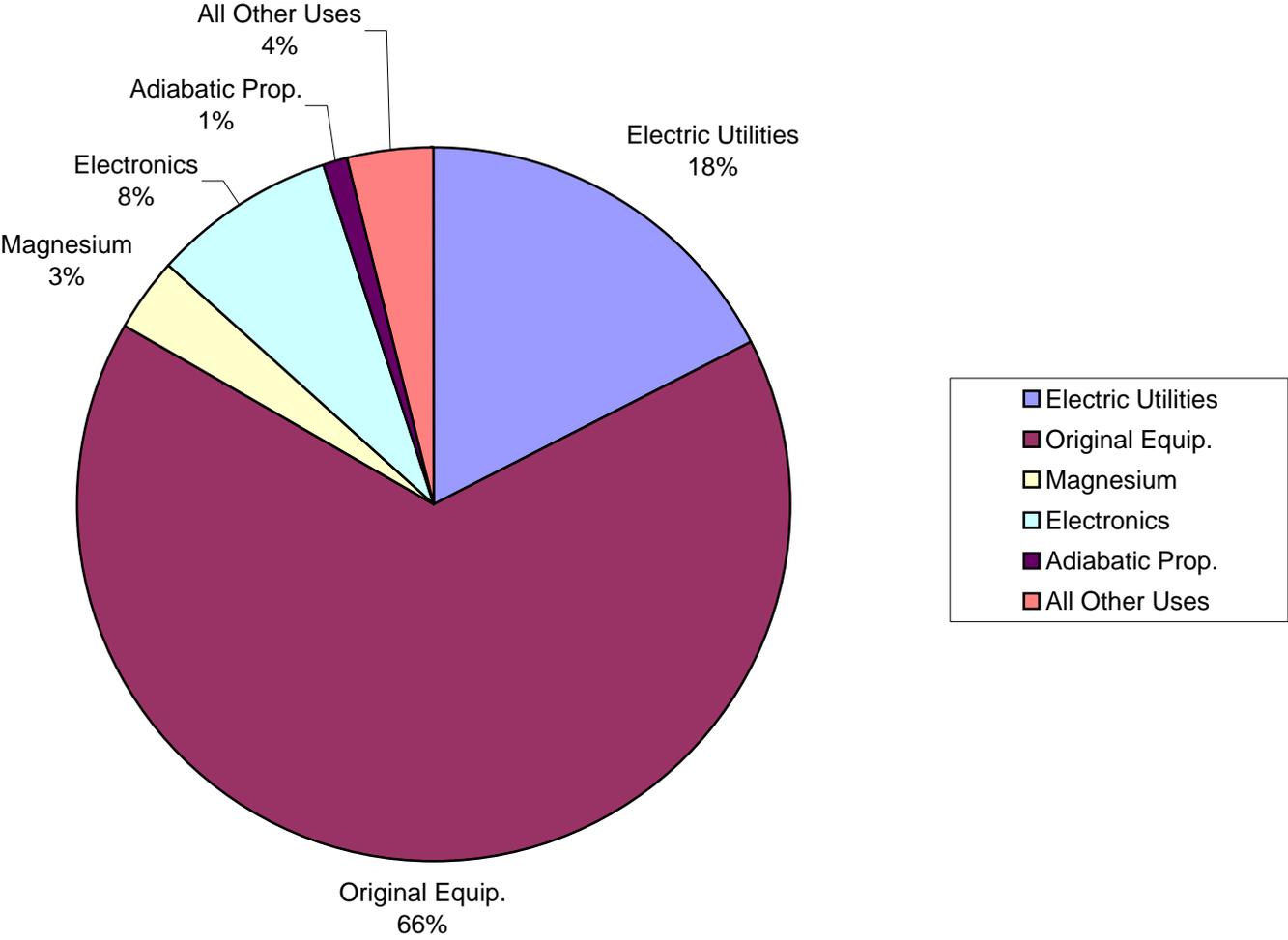
# Breakdown of Total SF<sub>6</sub> Sales: 1999



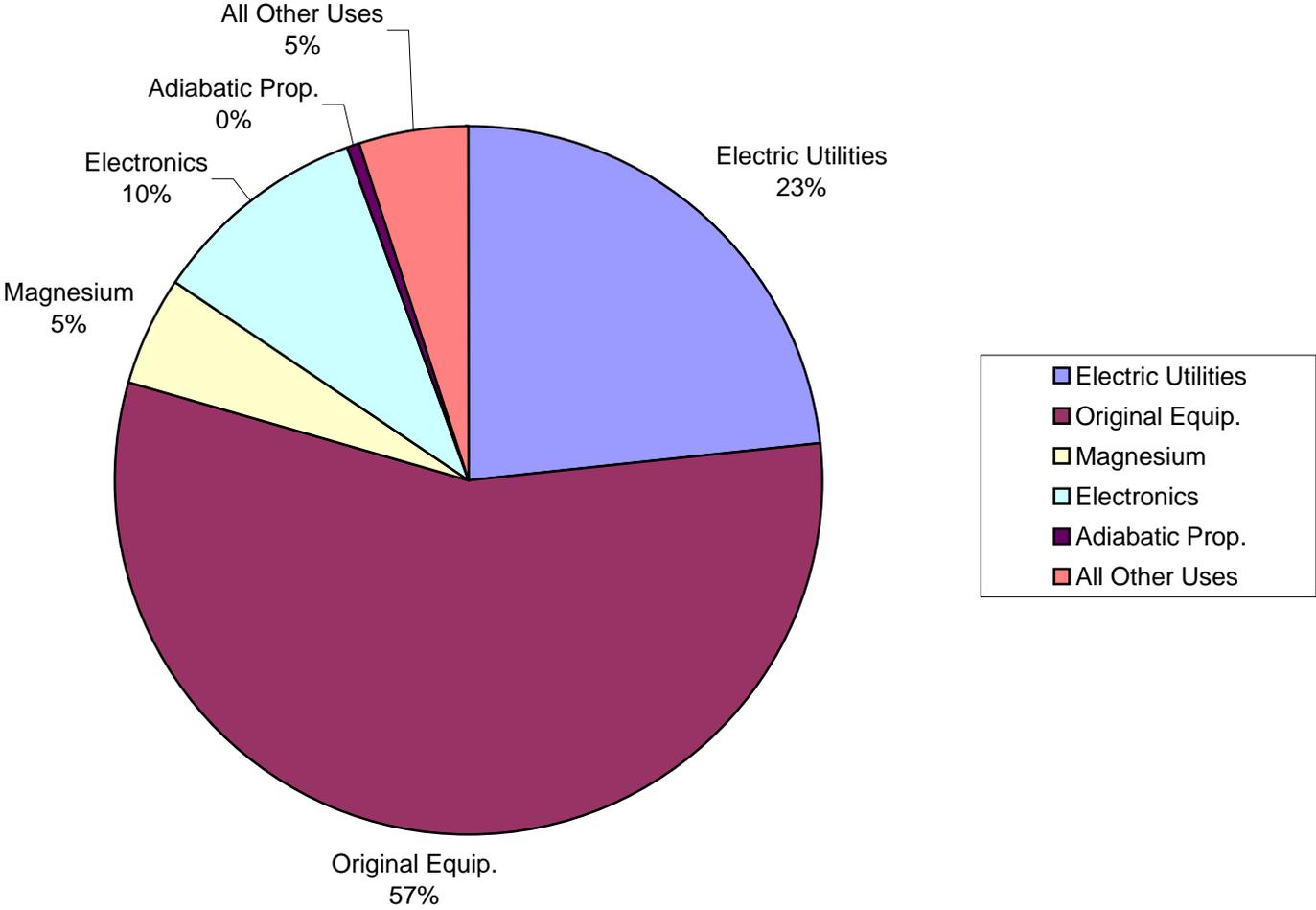
# Breakdown of Total SF<sub>6</sub> Sales: 2000



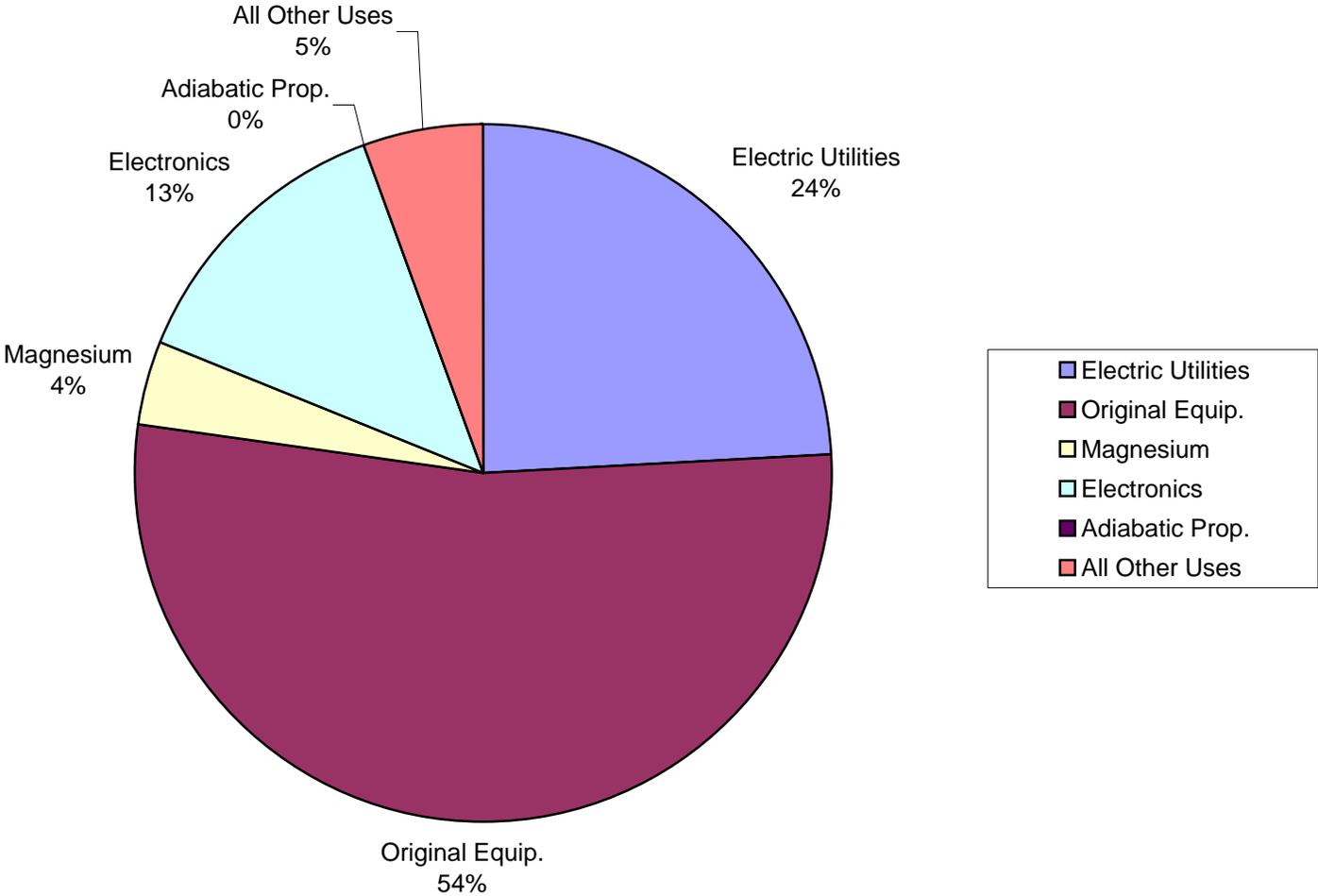
# Breakdown of Total SF<sub>6</sub> Sales: 2001



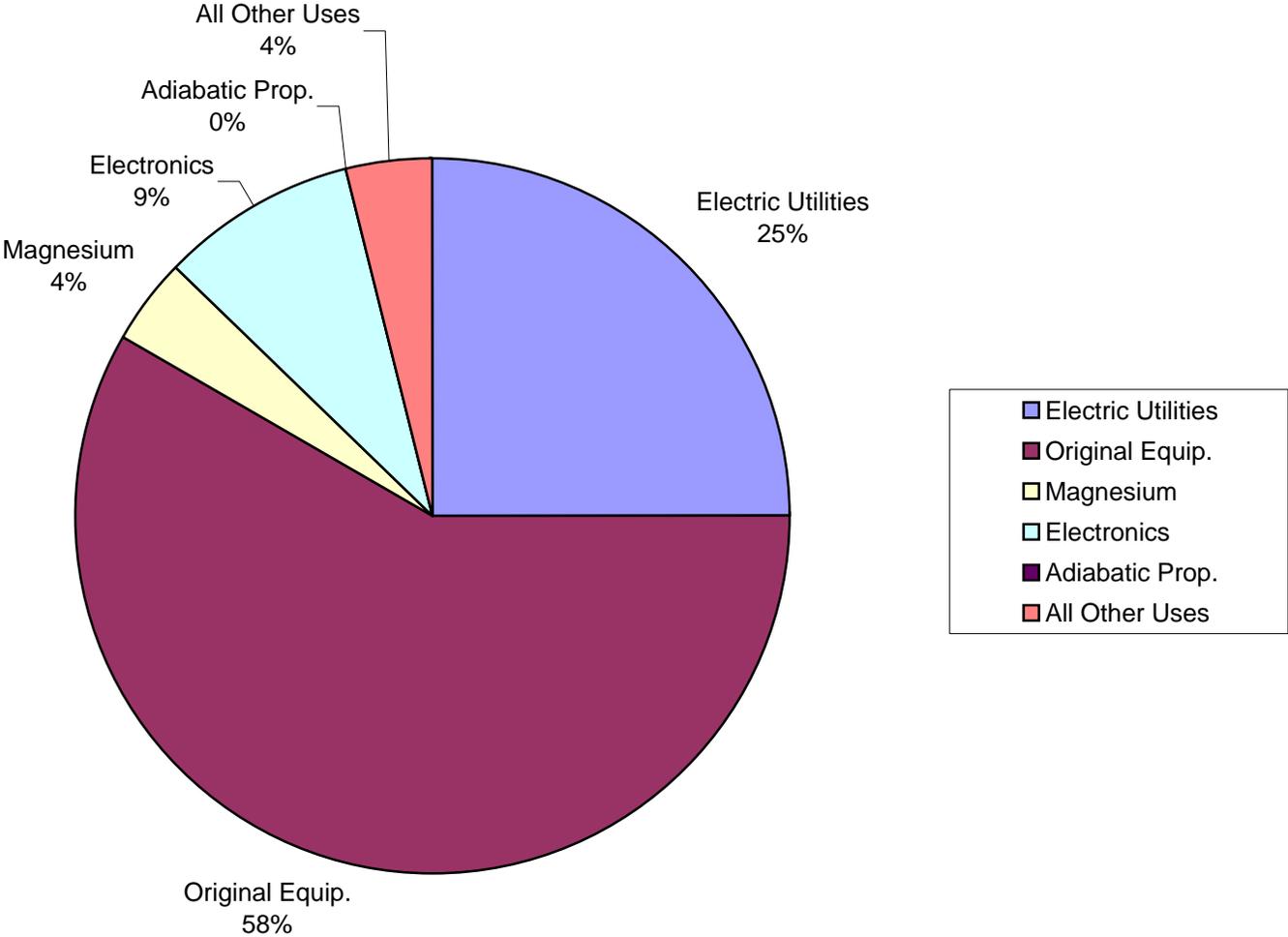
# Breakdown of Total SF<sub>6</sub> Sales: 2002



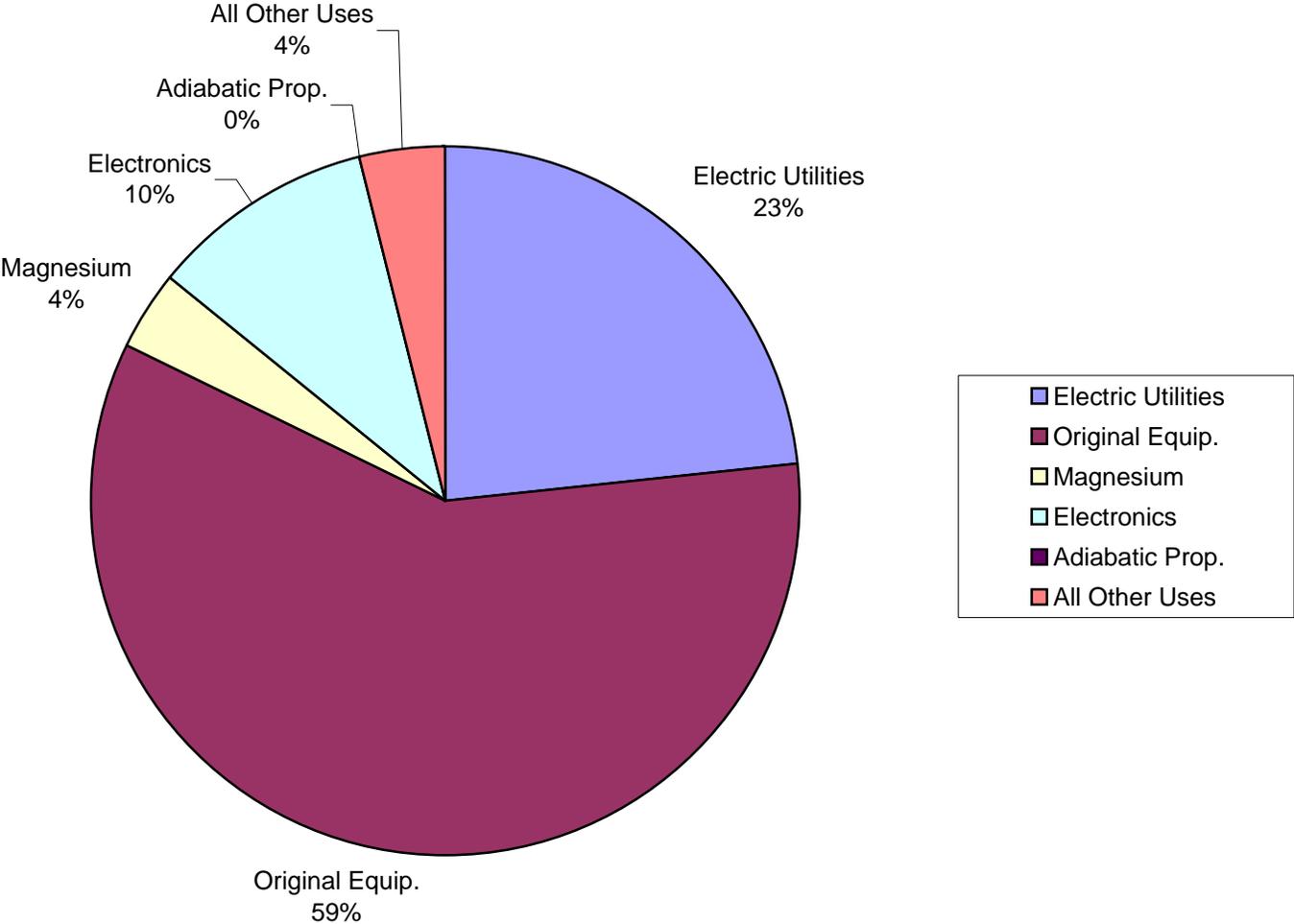
# Breakdown of Total SF<sub>6</sub> Sales: 2003



# Breakdown of Total SF<sub>6</sub> Sales: 2004



# Breakdown of Total SF<sub>6</sub> Sales: 2005



# Breakdown of Total SF<sub>6</sub> Sales: 2005

