city-gate avoided cost which is used in this analysis to evaluate benefits of natural gas savings.

Since the actual natural gas savings are not known in advance, the commonly used approach is to calculate unit avoided cost which then could be applied to the particular physical gas savings in order to evaluate resulting benefits. However, one cannot simply calculate a single avoided cost and assume that it represents the value of all potential savings for two reasons: (1) Avoided gas costs vary according to the shape and load factor of the reduction in sendout. This is to be expected since the cost of providing service varies according to the shape of the load being served and the time of year (e.g. peak day, non-peak winter day, summer day). (2) Load reductions caused by building code enhancement will have different impacts on different end uses (e.g. space and water heating) and it may vary by the type of building. As a result, building code enhancement in different buildings will result in load reductions which differ in shape and load factor.

Thus, to estimate the value of potential natural gas savings, one needs to calculate individual avoided costs for a range of different types of load reductions, i.e. various shapes and load factors. One approach to these calculations would be to address each type of load reduction separately, calculating reduction-specific avoided costs for each possible type of load decrement. However, this would be very time-consuming.

A second approach, the one used here, is to estimate avoided costs for two basic types of load reduction:

- a peak day reduction/decrement case to estimate a **peak day avoided cost**;
- a non-peak day reduction/decrement case to estimate a **non-peak avoided cost**[28].

Peak day avoided costs are based on the assumption that load is reduced on the peak day only, while off-peak avoided cost is based on the assumption that load is evenly reduced in all days of the year excluding peak day. Basic avoided costs are presented in Table III-11, on the following page.

These estimates of the Missouri avoided gas costs were prepared based on the data from one of the largest Missouri utilities - Laclede Gas Company, which is serving Northeastern part of the state, including St. Louis City and County. Information on Laclede Gas Company was obtained from the Missouri Public Service

[28] Initially, the analysis considered winter non-peak and summer non-peak avoided costs separately. The differential between them was negligible in the original analysis, and we combined them into one category of non-peak avoided costs.

Commission. This information is representative for the whole state for the following reasons:

- Laclede Gas Company and Western Resources Company, which is serving the Kansas City area, account for almost 85% of total gas supply in Missouri;
- Average cost of gas supply for Laclede Gas and for Western Resources are very close (within 1%). Due to the lack of data, we were unable to calculate avoided costs for Western Resources directly, but we expect that results would not be significantly different.

Table III-11
BASIC AVOIDED COSTS OF NATURAL GAS
(Nominal $/MMbtu)

Year	Peak Day Type: Capacity Component	Peak Day Type: Commodity Component	Peak Day Type: Total Peak	Non-peak Type: Capacity Component	Non-peak Type: Commodity Component	Non-peak Type: Total Non-peak
1995	$74.38	$2.73	$77.10	$0.00	$2.73	$2.73
1996	$74.38	$2.78	$77.16	$0.00	$2.78	$2.78
1997	$74.38	$2.84	$77.21	$0.00	$2.84	$2.84
1998	$74.38	$2.89	$77.27	$0.00	$2.89	$2.89
1999	$74.38	$2.95	$77.33	$0.00	$2.95	$2.95
2000	$74.38	$3.01	$77.39	$0.00	$3.01	$3.01
2001	$74.38	$3.14	$77.52	$0.00	$3.14	$3.14
2002	$74.38	$3.28	$77.66	$0.00	$3.28	$3.28
2003	$74.38	$3.43	$77.80	$0.00	$3.43	$3.43
2004	$74.38	$3.58	$77.96	$0.00	$3.58	$3.58
2005	$74.38	$3.75	$78.12	$0.00	$3.75	$3.75
2006	$74.38	$3.85	$78.23	$0.00	$3.85	$3.85
2007	$74.38	$3.96	$78.33	$0.00	$3.96	$3.96
2008	$74.38	$4.07	$78.45	$0.00	$4.07	$4.07
2009	$74.38	$4.18	$78.56	$0.00	$4.18	$4.18
2010	$74.38	$4.30	$78.68	$0.00	$4.30	$4.30
2011	$74.38	$4.43	$78.80	$0.00	$4.43	$4.43
2012	$74.38	$4.55	$78.93	$0.00	$4.55	$4.55
2013	$74.38	$4.68	$79.06	$0.00	$4.68	$4.68
2014	$74.38	$4.82	$79.19	$0.00	$4.82	$4.82
Levelized Values (1993$/MMbtu) @ nominal discount rate of:						6.60%
95-14	$74.38	$3.43	$77.80	$0.00	$3.43	$3.43

Environmental Benefits of Building Code Improvements

Electricity - The consumption of electricity and natural gas results in a variety of environmental impacts. These impacts are sometimes referred to as environmental externalities, because they are not generally included in the prices paid for energy. In recent years, energy planners and regulators have begun to take account of environmental impacts in energy resource decisions. Monetary values of these environmental impacts have been developed to enable planners to compare environmental impacts with direct economic impacts, using dollars as a consistent unit of measurement. In this way, it is possible to compare options that have both different direct economic costs and different environmental impacts.

A variety of techniques have been developed to estimate monetary values of environmental impacts.[29] The two most frequently used techniques for estimating environmental externalities for electricity resources are the *direct cost* approach and the *control cost* approach. The direct cost approach assigns a monetary value to environmental *goods*, such as trees, fish and recreational parks, based on the market value of those goods. The control cost approach assigns a monetary value to pollutants, such as carbon dioxide (CO_2), sulphur dioxide (SO_2) and nitrous oxides (NO_X), based on the costs required to abate those pollutants. For pollutants such as SO_2 and NO_X, control technologies, such as scrubbers and selective catalytic reduction, are often used to represent the control costs. For CO_2, control costs are based on the costs of planting trees to act as carbon sinks, thereby offsetting the effects of CO_2 emissions. Both the control cost and direct techniques have resulted in a wide range of estimates of environmental externalities.

For the purposes of this analysis, the monetary values of environmental externalities are derived using the control cost technique. This approach is preferable to the damage cost approach, because of the many uncertainties inherent in the damage cost approach at this time. The control costs for non-greenhouse gases are based on analysis of existing and/or emerging air quality regulations. The costs for greenhouse gases were derived from estimates of the cost of planting trees as a carbon sink. The monetary values used in this analysis are presented in Table III-12, on the following page. These values were adopted by the Massachusetts Department of Public Utilities for electric utility integrated resource planning (MDPU 1993).

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[29] See EIERA, *Missouri Statewide Energy Study*, Volume IV, May 1992, for an overview of environmental impacts of energy consumption and monetary values for these impacts.

Table III-12 MONETARY VALUES OF AIR EMISSIONS	
Pollutant	**Monetary Values (1992-$/ton)**
Nitrogen Oxides (NO_x)	$7,200
Sulphur Dioxide (SO_2)	$1,700
Carbon Dioxide (CO_2)	$24
Methane (CH_4)	$240
Carbon (CO)	$960
Total Suspended Particulates (TSP)	$4,400
Volatile Organic Compounds (VOC)	$5,900

The air emissions presented in Table III-13 are primarily responsible for global warming, acid rain, ground-level ozone, and other impacts that affect the environment and human health. While there are a variety of additional environmental impacts associated with energy consumption, we have not included them in our analysis here.

The environmental impacts of the building improvements have been estimated using a similar approach as the direct economic impacts. *Monetized Environmental Costs* have been estimated by first applying the monetary values presented in Table III-13 to emission factors (in tons/mmbtu) which are representative of the avoided power plants in Missouri (UCS 1992). This results in avoided environmental costs, in $/mmbtu, which are then applied to heat rates which are also representative of the avoided power plants (EEI 1993; EPRI TAG 1993). This provides avoided environmental costs, in dollars per megawatt hour of electricity ($/mwh), which can be added to the avoided energy costs.

In developing avoided energy costs, the assumption is that certain marginal generation facilities would operate less, as a result of the building code standards. The avoided environmental costs used are based on those pollutants that would be avoided as a result of lower operation of these same facilities. Therefore, from 1995 through 1999, the code improvements are assumed to displace emissions from existing coal plants, and after 1999 the emissions from the new combined cycle are assumed to be displaced. As a result, there is a significant drop in the avoided externality costs in 2000, when the avoided emissions switch from existing coal facilities to a cleaner, more efficient combined cycle plant. This decrease in environmental externality costs coincides with the increase in capital and energy costs of the combined cycle plant.

The resulting avoided environmental costs of electricity generation in Missouri are presented in Table III-13, on the following page. These costs can then be added to the avoided energy and capacity costs to determine the total "societal" avoided costs per unit of electricity generation.

Table III-13 *MONETIZED ENVIRONMENTAL COSTS* OF ELECTRICITY AND NATURAL GAS PRODUCTION IN MISSOURI		
Year	Electricity ($/mwh)	Natural Gas ($/mmbtu)
1995	59.7	2.05
1996	61.8	2.12
1997	63.9	2.20
1998	66.2	2.27
1999	68.5	2.35
2000	19.5	2.43
2001	20.2	2.52
2002	20.9	2.61
2003	21.6	2.70
2004	22.3	2.79
2005	23.1	2.89
2006	23.9	2.99
2007	24.8	3.10
2008	25.6	3.21
2009	26.5	3.32
2010	27.5	3.43
2011	28.4	3.55
2012	29.4	3.68
2013	30.4	3.81
2014	31.5	3.94

Natural Gas End-Use Consumption - Consumption of natural gas in appliances also results in environmental impacts. The primary environmental impacts are due to emissions of the same pollutants that are released from fossil-fuel power plants.

Therefore, estimated avoided environmental costs of end-use natural gas consumption based on the same pollutants and monetary values presented in Table III-12. These values in ($/ton) are applied to emission factors (in lb/mmbtu) to determine an avoided cost (in $/mmbtu). The emission factors used in our analysis are based on average emission factors of residential and commercial space and water heating gas appliances (UCS 1992).

The resulting monetized environmental costs of natural gas end-use consumption in Missouri are presented in Table III-13. These costs can then be added to the direct avoided costs of natural gas, to determine the total "societal" avoided costs per unit of gas.

Net Economic and Environmental Impact

As described above, this analysis models the impact of building efficiency improvements implemented during the six years from 1995 through 2000. In order to capture the long-term benefits of the building efficiency improvements, it is necessary to account for the energy savings which will continue to accrue after 2000, from those measures that were implemented from 1995 through 2000. Therefore, it is assumed that the energy savings achieved in 2000 will continue to occur through the remainder of the study period. A twenty-year study period was selected for this impact analysis, even though much of the energy savings will continue to occur after twenty years. We see this as a conservative assumption in the methodology. The costs of implementing these measures, however, are incurred during the 1995 through 2000 period only.

The benefits of the building efficiency improvements can be derived by simply multiplying the avoided costs by the estimated electricity and gas savings. The results are provided in Table III-14, which presents the reduction in electricity and natural gas costs, in nominal dollars, for the twenty-year study period. The environmental benefits of the building code improvements are presented separately, and then are added to the direct economic benefits to determine the total benefits in terms of dollars. Table III-14, on the following 3 pages, provides a summary of results for the EPAct Standard, Enhanced Case and Resource Case.

Table III-14
ECONOMIC AND ENVIRONMENTAL BENEFITS OF EFFICIENCY IMPROVEMENTS
EPAct Standard Case
Page 1 of 3

Amounts are $Million. Annual figures are in nominal dollars. Cumulative Present Values (CPV) are in 1993 present value dollars. Discount Rate is 6.6%.

Year	Electric					Natural Gas End-Use			Electricity & gas
	Energy	Capacity	Energy & Capacity	Exter-nality	Total Electric	Gas	Exter-nality	Total Gas	Total Benefits
1995	$0.4	$0.0	$0.4	$1.7	$2.1	$1.5	$0.8	$2.3	$4.4
1996	$0.8	$0.0	$0.8	$3.5	$4.3	$3.1	$1.6	$4.8	$9.1
1997	$1.3	$0.0	$1.3	$5.4	$6.7	$4.9	$2.5	$7.5	$14.2
1998	$1.9	$2.3	$4.1	$7.5	$11.7	$6.9	$3.5	$10.4	$22.1
1999	$2.5	$2.9	$5.4	$9.8	$15.2	$9.1	$4.5	$13.7	$28.9
2000	$5.1	$5.4	$10.5	$3.4	$13.9	$11.6	$5.7	$17.3	$31.2
2001	$5.5	$5.5	$11.0	$3.5	$14.5	$12.4	$5.9	$18.3	$32.8
2002	$6.0	$5.6	$11.6	$3.6	$15.2	$13.3	$6.1	$19.4	$34.5
2003	$6.5	$5.6	$12.1	$3.7	$15.9	$14.2	$6.3	$20.5	$36.4
2004	$7.0	$5.7	$12.7	$3.9	$16.6	$15.2	$6.5	$21.8	$38.4
2005	$7.6	$5.8	$13.4	$4.0	$17.4	$16.4	$6.7	$23.1	$40.5
2006	$8.2	$5.9	$14.1	$4.2	$18.2	$17.3	$7.0	$24.3	$42.5
2007	$8.9	$6.0	$14.8	$4.3	$19.1	$18.3	$7.2	$25.5	$44.7
2008	$9.6	$6.1	$15.7	$4.4	$20.1	$19.4	$7.5	$26.9	$47.0
2009	$10.4	$6.2	$16.5	$4.6	$21.1	$20.5	$7.7	$28.3	$49.4
2010	$11.2	$6.3	$17.5	$4.8	$22.2	$21.8	$8.0	$29.8	$52.0
2011	$12.1	$6.4	$18.5	$4.9	$23.4	$23.0	$8.3	$31.3	$54.8
2012	$13.1	$6.5	$19.6	$5.1	$24.7	$24.4	$8.6	$33.0	$57.7
2013	$14.2	$6.6	$20.8	$5.3	$26.1	$25.9	$8.9	$34.8	$60.8
2014	$15.3	$6.7	$22.1	$5.5	$27.5	$27.4	$9.2	$36.6	$64.1
CPV	$59.5	$41.2	$100.7	$47.3	$148	$130	$54.3	$184	$332.4

Table III-14

ECONOMIC AND ENVIRONMENTAL BENEFITS OF EFFICIENCY IMPROVEMENTS

Enhanced Case

Page 2 of 3

Amounts are $Million. Annual figures are in nominal dollars. Cumulative Present Values (CPV) are in 1993 present value dollars. Discount Rate is 6.6%.

Year	Electric					Natural Gas End-Use			Electricity & gas
	Energy	Capacity	Energy & Capacity	Exter-nality	Total Electric	Gas	Exter-nality	Total Gas	Total Benefits
1995	$1.5	$0.0	$1.5	$6.6	$8.1	$3.3	$1.6	$4.9	$13.0
1996	$3.2	$0.0	$3.2	$13.6	$16.8	$6.7	$3.2	$9.9	$26.7
1997	$5.0	$0.0	$5.0	$21.2	$26.2	$10.6	$4.9	$15.5	$41.7
1998	$7.3	$11.8	$19.1	$29.5	$48.6	$14.9	$6.8	$21.7	$70.3
1999	$9.7	$15.0	$24.7	$38.4	$63.1	$19.6	$8.9	$28.5	$91.6
2000	$20.1	$27.8	$47.9	$13.2	$61.1	$24.7	$11.0	$35.7	$96.8
2001	$21.7	$28.2	$49.9	$13.7	$63.6	$26.4	$11.4	$37.8	$101.4
2002	$23.4	$28.6	$52.0	$14.1	$66.1	$28.2	$11.8	$40.0	$106.1
2003	$25.3	$29.0	$54.3	$14.6	$68.9	$30.1	$12.2	$42.3	$111.2
2004	$27.4	$29.4	$56.8	$15.1	$71.9	$32.2	$12.7	$44.9	$116.8
2005	$29.6	$29.8	$59.4	$15.7	$75.1	$34.4	$13.1	$47.5	$122.6
2006	$32.0	$30.3	$62.3	$16.2	$78.5	$36.4	$13.6	$50.0	$128.5
2007	$34.6	$30.8	$65.4	$16.8	$82.2	$38.4	$14.0	$52.4	$134.6
2008	$37.4	$31.2	$68.6	$17.4	$86.0	$40.6	$14.5	$55.1	$141.1
2009	$40.5	$31.7	$72.2	$18.0	$90.2	$42.9	$15.0	$57.9	$148.1
2010	$43.8	$32.3	$76.1	$18.6	$94.7	$45.4	$15.6	$61.0	$155.7
2011	$47.4	$32.8	$80.2	$19.3	$99.5	$48.0	$16.1	$64.1	$163.6
2012	$51.2	$33.3	$84.5	$19.9	$104.4	$50.8	$16.7	$67.5	$171.9
2013	$55.4	$33.9	$89.3	$20.6	$109.9	$53.8	$17.3	$71.1	$181.0
2014	$59.9	$34.5	$94.4	$21.4	$115.8	$56.9	$17.9	$74.8	$190.6
CPV	**$232.5**	**$212.0**	**$444.5**	**$184.8**	**$629.4**	**$274.0**	**$105.6**	**$379.6**	**$1,009.0**

Table III-14
ECONOMIC AND ENVIRONMENTAL BENEFITS OF EFFICIENCY IMPROVEMENTS
Resource Case
Page 3 of 3
Amounts are $Million. Annual figures are in nominal dollars. Cumulative Present Values (CPV) are in 1993 present value dollars. Discount Rate is 6.6%.

Year	Electric					Natural Gas End-Use			Electricity & gas
	Energy	Capacity	Energy & Capacity	Exter-nality	Total Electric	Gas	Exter-nality	Total Gas	Total Benefits
1995	$2.1	$0.0	$2.1	$9.1	$11.2	$4.2	$1.9	$6.1	$17.3
1996	$4.4	$0.0	$4.4	$18.8	$23.2	$8.8	$4.0	$12.8	$36.0
1997	$6.9	$0.0	$6.9	$29.2	$36.1	$13.8	$6.1	$19.9	$56.0
1998	$10.0	$18.1	$28.1	$40.5	$68.6	$19.3	$8.5	$27.8	$96.4
1999	$13.3	$22.9	$36.2	$52.7	$88.9	$25.4	$11.0	$36.4	$125.3
2000	$27.5	$42.6	$70.1	$18.1	$88.2	$32.1	$13.7	$45.8	$134.0
2001	$29.7	$43.2	$72.9	$18.7	$91.6	$34.2	$14.2	$48.4	$140.0
2002	$32.1	$43.8	$75.9	$19.4	$95.3	$36.5	$14.7	$51.2	$146.5
2003	$34.7	$44.4	$79.1	$20.1	$99.2	$38.9	$15.2	$54.1	$153.3
2004	$37.6	$45.0	$82.6	$20.8	$103.4	$41.5	$15.8	$57.3	$160.7
2005	$40.6	$45.7	$86.3	$21.5	$107.8	$44.4	$16.3	$60.7	$168.5
2006	$43.9	$46.4	$90.3	$22.2	$112.5	$46.9	$16.9	$63.8	$176.3
2007	$47.5	$47.1	$94.6	$23.0	$117.6	$49.5	$17.5	$67.0	$184.6
2008	$51.3	$47.9	$99.2	$23.8	$123.0	$52.3	$18.1	$70.4	$193.4
2009	$55.5	$48.6	$104.1	$24.7	$128.8	$55.2	$18.7	$73.9	$202.7
2010	$60.0	$49.4	$109.4	$25.5	$134.9	$58.4	$19.4	$77.8	$212.7
2011	$64.9	$50.2	$115.1	$26.4	$141.5	$61.7	$20.1	$81.8	$223.3
2012	$70.2	$51.1	$121.3	$27.3	$148.6	$65.2	$20.8	$86.0	$234.6
2013	$76.0	$52.0	$128.0	$28.3	$156.3	$69.0	$21.5	$90.5	$246.8
2014	$82.2	$52.9	$135.1	$29.3	$164.4	$73.0	$22.2	$95.2	$259.6
CPV	$318.9	$324.9	$643.8	$253.7	$897.5	$353.6	$131.4	$485.0	$1,382.5

The costs of the building efficiency improvements that were derived in the Residential and Commercial Buildings analyses include all of the costs that are incurred by building owners to purchase and install the additional measures required by the improved codes. These costs, are presented in Table III-15 below, for the EPAct Standard, Enhanced Case and Resource Case. Both the nominal costs, and the present value in 1993 dollars are shown.

Table III-15
COST OF BUILDING EFFICIENCY IMPROVEMENTS

YEAR	EPAct ($Million)		ENHANCED ($Million)		RESOURCE ($Million)	
	Nominal	Present Value	Nominal	Present Value	Nominal	Present Value
1995	$47.5	$41.8	$93.1	$81.9	$179.7	$158.1
1996	$47.7	$39.4	$94.5	$78.0	$183.6	$151.6
1997	$49.7	$38.5	$98.8	$76.5	$192.3	$148.9
1998	$52.1	$37.9	$103.7	$75.3	$202.6	$147.2
1999	$54.7	$37.3	$109.0	$74.3	$213.5	$145.5
2000	$57.3	$36.6	$114.6	$73.2	$224.2	$143.3
Cumulative	$309	$231.5	$613.7	$459.2	$1195.9	$894.6

Table III-16 summarizes the results of our impact analysis. It presents both the benefits and the costs of the building code improvements, in cumulative present value dollars using the 3% real societal discount rate. The difference between the two gives us the net benefit, for each of the three cases examined.

Table III-16
NET BENEFITS OF BUILDING EFFICIENCY IMPROVEMENTS
In Cumulative 1993 Present Dollars

	EPAct Standard	Enhanced Case	Resource Case
Benefits (Savings):	($Millions)	($Millions)	($Millions)
Electricity	$101.7	$444.5	$643.8
Natural Gas	$130.1	$274.0	$353.6
Environmental	$101.6	$290.5	$385.1
Total	$332.4	$1,009.0	$1,382.5
Costs	($231.4)	($459.2)	$894.6
Net Benefits	$101.0	$549.8	$487.9

Table III-16 indicates that there will be significant net benefits from the building efficiency improvements. The net benefits are expected to be $101.0 million in 1993 present value dollars for the EPACT standard, and $549.8 and $487.9 million for the Enhanced and Resource Cases, respectively.

In the EPACT Case, the benefits are obtained roughly evenly from electricity, gas and environmental impacts. In the latter two cases, however, the benefits are primarily obtained from electricity impacts. **It is interesting to note that if environmental externalities are not included in the benefits, there will still be positive net benefits from the building code improvements in all three cases.**

The Resource Case has lower net benefits than the Enhanced Case because the incremental costs necessary to achieve this higher level of savings exceed the incremental benefits. This suggests that **the optimal level of building efficiency improvements lies somewhere between the Enhanced and the Resource cases.**

Macroeconomic Effects

Estimating the economic impact of cost savings of energy efficiency investments in buildings is a straightforward but multi-step process. Given estimated cost savings for natural gas and electric usage for both residential and commercial buildings as provided by the residential and commercial buildings analyses, this part of the analysis now begins the step-by-step process of calculating the economic impacts based on a number of different indicators.

When completing any economic impact assessment, the analysis can never include all possible variables and must therefore select a finite number of variables for impact assessment. The variables selected for estimated impact in this analysis are income, employment, retail sales and state government revenue (e.g., state income tax, state sales tax, energy tax). Regardless of the variables selected in any analysis, all of the projections remain estimates and are contingent on the models presented and stated assumptions.

The process of estimating impact based on these variables started by analyzing net savings to residential and commercial buildings. Next, the economic impact of residential savings is calculated utilizing income multipliers. The net income effect is then translated into an equivalent employment effect. The new income is then transformed into a likely range of net retail sales impact and the sales are then extrapolated into likely sales tax effect for residential consumers. State income tax revenues are then calculated from the net income effect. The likely projected loss in state energy taxes are then subtracted from the combined increase in state income and sales tax to arrive at a net state government revenue impact assessment.

This analysis assumes that the construction related costs are neutral; that is, the stimulative effect of construction expenditures are equal to any contractionary effects of construction expenditures relative to the balance of the Missouri economy. This analysis does not attempt to calculate economic impacts of demand side management, avoided capacity payments and externality credits.

The process for calculating economic impacts of energy cost savings in commercial buildings is similar to the residential case except that it assumes a different disbursement of savings to factors other than pure income. It is assumed that corporations and other businesses will utilize new income from energy costs savings in the same manner that they will allocate sales revenue on their profit and loss statement in a given year. In other words, a large percentage will be allocated to cost of goods sold (e.g., payroll and other input purchases), overhead (e.g., sales and general administration) and the balance will be allocated to profits and retained earnings for new investment. Once these allocations are made, the income, employment and state government revenue projections can be made in a manner similar to the residential case. The residential and commercial savings can then be combined to give an overall picture of estimated economic impact of the energy cost savings.

Net Cost Savings Calculations - While the energy cost savings are of a benefit to most Missouri residents and businesses there is also a small category of economic *losers* from these savings. These are the businesses and employees within Missouri who derive their income directly from the energy payments of consumers. Their loss in income from decreased natural gas and electricity sales due to energy conservation programs must be calculated into the Net Cost Savings determination.

Because almost all of the raw inputs in energy generation are imported to Missouri from other states or nations only a small percentage of the consumers' energy dollar remains in the state as income. Therefore, the Net Cost Savings will be calculated with a discount factor to account for the loss of income to Missouri businesses and employees who benefit from energy sales.

Because a higher percentage of natural gas sales dollars leave the state the Net Cost Savings for natural gas -- NCS(ng) -- is calculated to be higher than the Net Cost Savings for electricity -- NCS(e). Based on our analysis and discussions with state energy officials these discounting values are assumed to be 0.80 for natural gas and 0.70 for electricity.

Net Residential Savings - Net Residential Savings (NRS) are calculated by adjusting for inflation by multiplying annual savings by a present value discount value (pvd), summing and then further discounting the data shown in the building energy savings (bes) by the NCS(ng) and NCS(e) values. The formulas for these calculations will be separate for natural gas and electricity. The net savings for natural gas are determined by the formula NRS(ng) = bes x pvd x NCS(ng). The net residential savings for electricity are calculated by the formula NRS(e) = bes x pvd x NCS(e). These Net Residential Savings values are shown in the Table III-17.

Table III-17
NET RESIDENTIAL SAVINGS
(Millions 1995 $)

	EPAct	ENHANCED	RESOURCE
Natural Gas (NG)	$32.145	$66.542	$80.181
Electric (EL)	$18.340	$68.147	$95.653
Total (NRS) (NG + EL)	**$50.485**	**$134.689**	**$175.834**

Residential Savings Economic Impact - All residential savings are treated as new marginal income and the assumption is that residential consumers will treat this as normal income. Obviously, different consumers will treat new income differently (i.e., some will spend or save more or less); however, for purposes of this analysis, we treat all residents equally. Because we are analyzing the economic impact the entire state of Missouri the economic multiplier is estimated to be rather large. Empirical studies on economic regions of various sizes suggest that a multiplier of 3.0 is a safe and conservative estimate as studies of metropolitan areas the size of St. Louis have yielded income multipliers of similar size. With that information, we then moved to estimating the net residential income effect.

Net Residential Income Effect: To determine the net residential income effect we start with the net residential savings and project its ultimate income increase for Missouri with what economists call an income multiplier. The formula for determining the net income effect is as follows:

Net New Income = Net Residential Savings X State Income Multiplier

This formula is applied to the three energy efficiency scenarios detailed earlier in this report, EPAct Standard, Enhanced Case and Resource Case, for all buildings using both natural gas and electricity to yield results as shown in the table III-18. The costs savings numbers detailed in the residential and commercial buildings analyses have been adjusted with the appropriate present value discount values (pvd) based on the 3.5% rate of inflation assumed in the earlier calculations.

Table III-18 RESIDENTIAL INCOME EFFECT/THREE SCENARIOS (Millions 1995 $)			
	EPAct	**ENHANCED**	**RESOURCE**
Natural Gas (NG)	$32.145	$66.542	$80.181
Electric (EL)	$18.340	$68.147	$95.653
Subtotal (NRS)	**$50.485**	**$134.689**	**$175.834**
Net New Income(NRS x 3)	**$151.455**	**$404.067**	**$527.502**

In summary the net new income to Missouri residential energy users for the six years of analysis, as derived from the three energy efficiency scenarios, will range from approximately $151.5 million for the EPAct Standard to $527.5 million in the Resource Case.

Employment Impact: Although this analysis makes no attempt to calculate new employment growth based on new investment and expanding production it does translate the new residential income into an equivalent *employment effect.* This is done by dividing the Net New Income by the average employee annual salary in Missouri for 1992. These are adjusted for inflation, at the same 3.5% rate, to 1995, the Present Value Year of these calculations. The 1992 average Missouri salary was $22,640; the 1995 inflation adjusted salary (1995 S) is projected to be $25,100.92. Because this calculation is based on summing all six analysis years, these employment numbers must be divided by six to give a full time employment equivalent average over the life of the analysis. The formula for determining employment equivalent impact of the new income is:
Employment Equivalent Impact = (Net New Income/1995 Average Salary)/Six Years

Application of this formula to the previously derived NNI numbers yields results as shown in Table III-19.

Table III-19 EMPLOYMENT EQUIVALENT IMPACT OF NET NEW INCOME		
Case:	**NNI (Million $)**	**EEI**
EPAct	$151,455	$1,006
Enhanced	$404,067	$2,683
Resource	$527,502	$3,503

Net Residential Savings Retail Impact: The net residential savings accumulates to consumers as income and a large portion of this is transformed into retail sales.

Historic data indicates that approximately 45% of income will become retail sales, with the balance going to taxes, housing, savings and other expenditures. It should be pointed out that the new income and employment *spinoffs* for retail sales are already accounted for in the previous calculations; still, calculations for retail sales are shown to give a general view of impact on retail sales and to specifically show a range of fiscal impact on state sales tax. The formula then for calculating increased retail sales and increased state sales tax is: NNI x 0.45 = Sales x 0.04725 = Sales Tax. The results of these calculations are shown in Table III-20.

Table III-20 RETAIL SALES/SALES TAX EFFECT			
Case	NNI	X 0.045 = Sales	X 0.04725 = Sales Tax $
EPAct	$151,455	$68,155	$3,220,324
Enhanced	$404,067	$181,830	$8,591,468
Resource	$527,502	$237,379	$11,216,016

State Income Tax Effect: The Net New Income (NNI) flowing to the state's inhabitants becomes new marginal income subject to state taxation. For the purposes of this analysis it is assumed that this income will be taxed at the state rate of 6%. Utilizing this model the net increases in state income tax from residential users is shown in Table III-21.

Table III-21 STATE INCOME TAX EFFECT		
Case	NNI	X 0.06 = New State Income Tax $
EPAct	$151,455	$9,087,300
Enhanced	$404,067	$24,244,020
Resource	$527,502	$31,650,120

Net Residential Savings Energy Tax Impact: While there will be gains from net savings to consumers in the form of increased sales and income taxes there will actually be losses in state energy taxes due to the losses in energy sales resulting from the energy conservation programs. While residential consumers are exempt from natural gas use taxes, they are subject to a 4.225% state electric energy tax (set) on electrical energy usage. It should be noted that many residential consumers are also subject to local energy taxes (e.g., city and county), but this model restricts itself to an analysis of state fiscal impacts. The residential savings energy tax impact (ETI) is calculated by taking the cost savings, for electricity (es) only, times the state electric tax (set). The formula for this calculation is ETI = (es) x (set). The estimated loss of energy taxes resulting from conservation programs under the three scenarios is shown in Table III-22.

Table III-22 STATE ENERGY TAX DECLINES FROM RESIDENTIAL SAVINGS		
Case	**Cost Savings**	**Energy Tax Declines**
EPAct	$22,295,000	$968,581
Enhanced	$85,184,000	$3,599,024
Resource	$119,566,000	$5,051,664

Commercial Savings Economic Impact - The estimation of the effect of commercial energy savings requires a different model and different assumptions than the residential case. While this model treated all net residential savings as income, businesses behave differently. Savings are equivalent to sales revenue and the assumption of this analysis is that this *revenue* will be treated the same as other revenue and will be allocated on the profit and loss statement in a manner similar to revenue in past years. Therefore, this analysis makes the following assumptions based on broad behavior patterns of all private firms in a large economy such as that of Missouri: 1) 60% will become Missouri payroll through expansion or new investment, 2) the balance (i.e., 40%) will flow out of the state for inputs. Based on these assumptions the net income effect of business savings is shown in Table III-23.

Table III-23 NET BUSINESS SAVINGS (NBS) INCOME EFFECT:			
Energy:	**EPAct**	**ENHANCED**	**RESOURCE**
Natural Gas	$9,633,000	$14,904,000	$20,483,000
Electric	$10,193,000	$37,996,000	$50,101,000
Sub-total (NBS)	$19,826,000	$52,900,000	$70,584,000
Total(NNBI)(NBSxSIM)	$59,478,000	$158,700,000	$211,757,000

Employment Impact of Business Savings: Employment impact is calculated in the same manner as the residential case and is shown in Table III-24.

Table VIII-24 EMPLOYMENT IMPACT OF BUSINESS INCOME		
Case:	NNBI	EEIB (Jobs)
EPAct	$59,478,000	395
ENHANCED	$158,700	1,054
RESOURCE	$211,752	802

Business Income Retail Sales/Sales Tax Effect: Retail sales/sales tax effect of the new income derived from business savings is calculated in the same manner as the residential savings impact and is shown in Table III-25.

Table III-25 BUSINESS INCOME RETAIL EFFECT			
Case:	NNBI	x 0.45 = Sales	x 0.04725 = Sales Tax
EPAct	$59,478,000	$26,765,000	$1,264,646
ENHANCED	$158,700,000	$71,415,000	$3,374,359
RESOURCE	$211,752,000	$95,288,000	$4,502,358

Business State Income Tax Effect: The state income tax effect from new income derived from business energy savings is calculated in the same manner as the residential savings and is shown in Table III-26.

Table III-26 BUSINESS STATE INCOME TAX EFFECT		
Case:	NNBI	x 0.06 = New Income Tax $
EPAct	$59,478,000	$3,568,680
ENHANCED	$158,700,000	$9,522,000
RESOURCE	$211,752,000	$12,705,120

State Energy Tax Effects: Calculations for state energy tax declines due to business energy conservation are shown in Table III-27 for the three cases.

Table III-27
STATE ENERGY TAX DECLINES FROM BUSINESS

Case:	ETL	NGTL	TETL
EPAct	$1,025,365	$1,204,140	$2,229,505
ENHANCED	$3,821,344	$1,862,940	$5,684,284
RESOURCE	$5,039,918	$2,560,320	$7,600,238

Combined Residential/Commercial Savings Economic Impact Summary - The total or combined economic impacts for the energy conservation scenarios are obtained by summing the residential and business impacts in the separate categories of income, employment, retail sales and tax effects. The combined data are shown in Tables III-28 to III-33. These combined effects are also summarized in the Conclusion.

Table III-28
COMBINED INCOME EFFECT

Case:	Residential	Business	Combined
EPAct	$151,145,000	$59,478,000	$210,623,000
Enhanced	$404,067,000	$158,700,000	$562,767,000
RESOURCE	$527,502,000	$211,752,000	$739,254,000

Table III-29
COMBINED EMPLOYMENT EFFECT

Case:	Residential	Business	Combined
EPAct	1,006	395	1,401
ENHANCED	2,683	1,054	3,737
RESOURCE	3,503	1,406	4,909

Table III-30 COMBINED RETAIL SALES EFFECT			
Case:	Residential	Business	Combined
EPAct	$68,155	15,025	$94,920
ENHANCED	$181,830	40,913	$253,245
RESOURCE	$237,376	54,332	$332,664

Table III-31 COMBINED STATE INCOME TAX EFFECT			
Case:	Residential	Business	Combined
EPAct	$9,087,300	$3,568,680	$12,655,980
ENHANCED	$24,244,020	$9,522,000	$33,766,020
RESOURCE	$31,650,120	$12,705,120	$44,355,240

Table III-32 COMBINED ENERGY TAX DECLINES			
Case:	Residential	Business	Combined
EPAct	$968,581	$2,229,505	$3,198,086
ENHANCED	$3,599,024	$5,684,284	$9,283,308
RESOURCE	$5,051,664	$7,600,238	$12,651,902

Table III-33 STATE REVENUE SUMMARY							
Case:	Sales Tax	+	Income Tax	-	Energy Tax	=	Total
EPAct	$4,484,970		$12,655,980		$3,148,086		$13,992,864
ENHANCED	$11,965,827		$33,766,020		$9,283,308		$36,448,539
RESOURCE	$15,918,374		$44,355,240		$12,651,902		$47,421,712

Summary of Macro Economic Analysis - Based on the energy cost savings for residential and commercial buildings as presented in this report, the economic impacts for Missouri are considerable. This analysis is based on the combined residential and commercial building energy costs savings of the three scenarios, EPAct Standard, Enhanced Case and Resource Case, presented earlier in this report and is adjusted to 1995 dollars. Based on the models and assumptions presented, this analysis estimates the economic impacts over the six year period of 1995 - 2000 as follows:

Increased State Personal Income:

EPAct Standard	$210,623,000
Enhanced Case	$562,767,000
Resource Case	$737,254,000

Increased Employment (Full time positions for entire six years.):

EPAct Standard	1,401 jobs
Enhanced Case	3,737 jobs
Resource Case	4,409 jobs

Increased Retail Sales:

EPAct Standard	$ 94,920,000
Enhanced Case	$253,245,000
Resource Case	$332,644,000

Net Increases in State Revenue:

EPAct Standard	$13,992,864
Enhanced Case	$36,448,539
Resource Case	$47,421,712

CHAPTER IV
PROGRAM REVIEW

Overview to Program Analysis

Introduction

In the 1992 *Missouri Statewide Energy Study* conducted by EIERA, an extensive analysis demonstrated that there is a substantial untapped potential for cost-effective energy efficiency improvement in the state's major energy-using sectors. A wide range of energy efficiency options were analyzed, in the following areas:

- Information and education
- Energy efficiency for residential buildings
- Residential energy efficiency equipment
- Energy efficiency for commercial buildings
- Commercial energy efficiency equipment
- Motor vehicle fuel efficiency
- Motor vehicle usage reduction/transit options
- Emerging energy technology options
- Integrated resource planning by utilities
- Traditional energy resource options
- Renewable energy resource options

Most, but not all, of these options were demand-side energy efficiency options. Interestingly, based on its analysis of demand-side options from an economic development perspective, the Study concluded as follows:[1]

> *Energy efficiency will sustain more employment opportunities than either the continued current level of energy use or the development of new energy supplies.* Therefore, investments in energy efficiency represent a significant economic development opportunity for the state.

However, the optimal level of investment in energy efficiency will not necessarily occur based on the operation of market forces alone. There are a number of barriers to investment in energy efficiency by households, businesses, and other parties – barriers which thoughtfully designed policy and program initiatives can help to remove. The barriers fall into three general categories, which have been summarized as follows by a regional planning agency in the Pacific Northwest:[2]

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[1] Environmental Improvement and Energy Resources Authority, *Missouri Statewide Energy Study*, page I-33. Italics in original.

[2] Northwest Power Planning Council, Conservation Acquisition Program Design, Staff Issue Paper 89-32 (Portland, Oregon, Northwest Power Planning Council, 1989), page 3.

- Economic barriers - Inadequate access to capital at competitive terms, inaccurate price...signals; high rate-of-return/payback requirements; low priority investment relative to other uses of limited funds....
- Information barriers - Inadequate information on what to do; inaccurate perceptions, for example, the view that conservation means doing without;
- Institutional barriers - Arrangements that separate the benefits...from the costs...such as tenant/landlord relationship; political resistance to regulatory changes (e.g., codes, appliance standards).

Thus, energy efficiency will not be exploited just on account of being included in an analysis such as EIERA's 1992 Study. Rather, the *behavior* of thousands of individuals and firms must be altered, so that efficiency measures are actually adopted. Several types of potential programs can be developed to help energy users become more energy-efficient.

In this Report to the Legislature, the analysis up to now has focused on energy efficiency measures related to new or substantially renovated residential and commercial buildings; and on related policy options concerning buildings standards to help attain energy efficiency gains in those sectors. However, there are many program options besides building codes --programs which can:

- Encourage the construction of buildings even more energy-efficient than specified by any new building codes or standards that may be adopted; and
- Encourage energy efficiency in other areas besides new construction.

In general, an energy efficiency program's design should reflect the energy use behaviors it is intended to change. In this section of the Report, we focus more broadly on program options to encourage energy efficiency, especially demand-side energy efficiency. First, we review the range of types of programs that can be pursued. We then review concrete program options, first outside the energy utility sector, and then in the energy utility sector. In each sector (non-utility and utility), we first summarize existing programs, then identify promising options for consideration by Missouri citizens and policy makers concerned with investment in energy efficiency in the state. Building code options were discussed in Chapter III and are not included here.

Energy efficiency programs are designed to deliver *cost-effective* efficiency measures through *cost-effective* programs. Energy efficiency is not an end in itself. At the broadest level, energy efficiency programs are justified when the benefits to society -- direct economic cost savings, environmental impact mitigation, net job creation-- outweigh the costs of developing and implementing the energy efficiency programs. The main types of energy efficiency programs are described next.

Types of Energy Efficiency Programs[3]

Programmatic actions to advance energy efficiency may be grouped into four broad categories. These are:

- Education and Technical Assistance;
- Financing and Incentive Programs;
- Codes and Standards; and
- Pricing/Rate Design.

In developing a particular program, it is necessary to be aware of programs in other areas, so that the overall portfolio of energy efficiency programs will be integrated. The interconnectedness of the barriers to investment in energy efficiency is important when considering program options. For example, the lack of information about the costs of energy use and the benefits of energy efficiency may make energy users reluctant to invest in energy efficiency even when capital for the purpose is made available. Programs that *combine* technical information *and* investment capital to energy users may be more effective than programs that provide only one service or the other. Thus, successful programs often combine or coordinate more than one type of action.

Education and Technical Assistance

Information programs present energy efficiency concepts and techniques to present or future energy users or to those who may work for them. Broad educational programs may be sponsored by government agencies, universities, energy utilities, private businesses and community agencies, generally at no charge to users. Many kinds of broad educational programs have been offered, including but not limited to the following:

- Student and teacher education in schools and universities;
- Dissemination of printed and illustrated material on energy efficiency practices and measures to households and enterprises;
- Broadcast or television advertising on energy conservation;
- Centers where energy users can obtain technical information about a range of energy efficiency measures;
- Technical seminars for energy users (e.g. industrial plant managers) or professionals (e.g. building and building design professionals);
- Development of lists of vendors who specialize in various types of energy-efficient equipment or energy efficiency services;
- Information on financing institutions or programs that energy users can access to finance energy efficiency projects.

[3] This discussion is adapted from: Natural Resources Defense Council, Empowering the World (New York: NRDC, 1993), chapter IV.

The above types of information may be more or less technical, but they are not site-specific. *Site-specific* information or technical assistance programs show energy users how to apply energy efficiency technologies in their particular facilities. The site-specific energy *survey* or energy *audit* involves the inspection of individual facilities by persons trained in energy analysis to identify energy efficiency improvements that can be taken by the energy users. In energy audit programs, estimates of the costs and expected energy savings for recommended efficiency measures are typically presented to the energy user, in conjunction with promotional incentives, such as low-cost loans or rebates, for specific technologies.

In the United States, many programs have provided on-site home energy audits. On-site audits assess savings opportunities relative to the chief end-uses in light of the building characteristics and its energy consumption records. They include a report to the householder on the costs and savings to be expected for recommended energy efficiency measures. Household audits generally cost about $100 when delivered on a routine basis across thousands of households. Computerized programs have been developed to allow reconciliation of engineering estimates of improvement savings with the history of energy bills for a particular house.

Energy audits or surveys for the Commercial and Industrial sectors are provided at varying degrees of technical sophistication and cost, owing in part to the great heterogeneity of the nonresidential sector. Audit costs in the Commercial sector, for example, can range from $0.05 to $0.15 per square foot depending on the complexity of the facility and the nature of the audit. Computerized on-site audits for enterprises that use small to medium amounts of energy may be performed on a routine basis for under $1,000. But audits for larger enterprises can easily be $1,000-10,000 or more, costing relatively more when the energy improvements are specified in enough detail that a contractor could be requested to quote his or her price for installing the specified measures for the energy user.

Another type of site-specific program is design assistance to new construction or renovation professionals. This involves review of building and facility plans to suggest specific modifications that could be made to improve the energy efficiency of the structure and its built-in energy-using equipment.

Information/technical assistance programs often involve subsidy of the costs of providing information, covered by a government agency or an energy utility. In an energy audit program, it is often the case that only a residual portion of the audit cost, as little as zero, is borne by the participating energy user. This type of program does not, when offered on a stand-alone basis, provide capital assistance toward the user implementing the recommended efficiency actions. Rather, it relies upon the program participant to undertake energy efficiency improvements from his or her own funds or from some other funding source. However, many types of financing and incentive programs (discussed below) do require that an audit be undertaken as a first step to identify cost-effective facility-specific savings opportunities.

Finally in the area of education, there are various kinds of training strategies. One type involves applied training, that is, training facilities operators to more effectively operate and maintain energy-using equipment. Another training strategy involves encouraging growth in the number of trained professionals capable of evaluating end-use energy consumption and of identifying cost-effective efficiency improvements in buildings, agriculture, manufacturing, etc. This is best done in response to a real demand for additional professionals as a result of government agencies and energy utilities gearing-up to pursue energy efficiency analysis and programs, and also a result of more energy users investing in energy efficiency. However, there is a "supply" component to training, which involves the introduction of energy engineering into the curricula for professional training of civil and industrial engineers, architects, urban planners, etc. Here, universities and technical institutes should take the initiative.

Financing and Incentive Programs

Government and Private Sources: Many means for financial assistance for energy efficiency *improvements can come from government and private sources.* Loans, grants, energy efficient mortgages and tax credits are typical means through which energy efficiency projects can be funded. Some of the money to fund these programs comes from federal sources, while other money is supplied through the oil overcharge funds, which have been recovered from oil companies that violated former federal petroleum pricing regulations between 1974 and 1981. Financing programs that exist on the federal, state and private levels, other than utility programs, include the following forms:

- *Federal and State Funded Grant and Incentive Programs:* These programs either provide free energy efficiency services, or they subsidize the installation of energy efficiency upgrades in qualifying homes and buildings. The Weatherization Assistance Program (WAP) is a federally funded program which installs weatherization measures, at no charge, in the homes of qualifying low-income residents. The Institutional Conservation Program is another federally funded program that provides grants to public and private, non-profit schools and hospitals so that energy efficiency upgrades can be installed.

  State governments also run programs that involve grants and incentives to encourage energy efficiency. The state of Illinois runs the Energy Conservation Interest Writedown Grant Program that helps pay the interest on a small business loan, provided the loan is for the installation of energy saving devices that have been given prior approval by the state through their small business audit program. The Iowa Department of Natural Resources has set up a program that makes loans to improve energy efficiency in Iowa's public buildings, private and public schools, educational agencies, hospitals, and nonprofit organizations. The energy efficiency upgrades must meet certain payback period requirements before they can qualify for loan assistance.

- *Federal and State Energy Efficient Mortgages:* This financing option allows individuals to include the installation of energy efficiency upgrades in the mortgage of the homes they are purchasing. This means of financing allows the individual to spread the cost of the upgrade over the life of the mortgage. The Department of Housing and Urban Development (HUD) has just begun a pilot program of this type that will be tested in five states in the U.S. Many states around the country already run energy efficient mortgage programs, including Arkansas and Nebraska.

- *Energy Service Companies (ESCOs):* These privately run organizations operate programs that encourage energy conservation as well. Shared savings or guaranteed savings is the financial mechanism that is used by these companies in order to make energy conservation profitable for both the participating customer and the company.

- *Federal and State Tax Credits:* Another means the federal government has used to encourage energy conservation measures is through a tax credit. The residential energy conservation tax credit, which expired in 1985, allowed a tax credit of 15% of the conservation measure cost to be taken as a tax credit. The tax credit could not exceed $300. There have also been a number of tax credits designed to encourage the implementation of alternatively fueled vehicles and supply resources. The state of California had a tax credit in place that encouraged the development of solar energy technologies.

- *Charitable Programs*: There are many privately funded programs around the nation which provide a variety of services for energy conservation. One example is the Metropolitan Energy Center in Kansas City, Missouri which provides energy services along with a revolving loan fund to help nonprofit agencies implement efficiency improvements. Another is the Interfaith Coalition for Energy, or ICE, in Philadelphia which provides energy information, audits and technical assistance for religious facilities.

Utility Sources: Programs to reduce or eliminate the costs of installing efficiency measures in buildings can directly address the access-to-capital barrier to energy efficiency. There has been extensive experience with financing and incentive programs in the United States, especially among electric utilities. Where integrated resource planning (IRP) has taken hold most strongly --California, the District of Columbia, New England, New York, Pacific Northwest states and Wisconsin-- the major utilities offer a wide range of incentive programs. Energy efficiency programs include all of the following incentive approaches, and combinations thereof.

- *Rebates to customers or dealers.* In this approach, the incremental cost of energy efficient equipment is reduced by the utility providing a rebate of some or all of that cost. Rebates may be available for a set of pre-specified equipment -- high-efficiency water heating, space conditioning equipment, building insulation, lighting systems, electrical motors, etc. -- or may be available on a "custom" basis for whatever equipment can be demonstrated to be high-efficiency and cost-effective. Rebates may be available to the retail customer (the energy user) who buys the equipment, to the dealers who sell the equipment or both.

- *Loans to finance investment in energy efficiency.* In this approach, the incremental cost of energy efficient equipment is financed through a loan arranged by the utility. The interest rate used for the loan may range from zero to the full cost of capital to the utility. Customers may be required to satisfy conventional credit criteria, or the utility may relax those criteria in extending loan financing. Loan payments are generally collected through the utility bill, though sometimes they are separately remitted. In some cases, the energy efficient equipment is leased to the customer over its lifetime, with the lease payments collected through the utility bill.

- *Cut-rate sales of efficiency measures.* In this approach, energy efficient equipment is sold directly to customer by the utility, which may make arrangements with a bulk-sales company to process customer orders. In some cases the utility charges customers its costs (which may be wholesale rather than retail, since bulk buying from suppliers is used), and in other cases, it charges customers only a portion of its costs for the equipment, thus subsidizing its costs.

- *Rate discounts and credits.* In this approach, customers who adopt certain energy efficiency measures receive a reduction to their rates for service, or credits to their electricity bills. This approach is most commonly used for load-management programs, wherein customers agree to reduce their on-peak demands (on their own, as through "interruptible rates,"[4] or through automatic control equipment installed by the utility) for specified periods of time, when required to do so by the utility. However, it has sometimes been used to reward energy conservation behaviors, such as building a house with high levels of insulation.

- *Direct installation of energy efficient equipment.* In this approach, the utility's agents perform the installation of efficiency measures in customer buildings. The customer avoids the "hassle" of procuring the measures from the marketplace on his or her own. Usually the costs of installation are subsidized, and in some cases, installation is free to the participant. Free installation is most common in direct installation programs aimed at low-income residential customers.

- *Payments to customers or third parties for delivered savings.* In this approach, the utility declares that it will pay up to certain amounts for reductions in energy consumption and/or peak demands. The savings may be generated directly by the customers, or through third-party contractors such as energy service companies (ESCOs). When the savings are generated by third-party contractors, those contractors in turn will provide various incentives to induce the utility's retail customers to conserve energy and/or demand. In this approach, the utility may conduct solicitations (<u>DSM bidding</u>) to secure a given quantity of savings, using competition among bidders to select projects that have the greatest chance of success, or which offer savings at lower prices to the utility. Payments for savings require agreed-upon methods to verify that savings from the efficiency measures have taken place, since payments are based upon realized savings.

Today, there are hundreds of utility operated energy efficiency programs that use the above incentives. The utility industry has begun to develop data-bases of program designs that enable utilities to share information on incentive (and other) efficiency program designs. When utility-operated incentive programs involve a subsidy to the participant, as they generally do, the utility's costs are collected through its rates charged to all customers.[5]

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[4] Interruptible rates are not standard rates, but rather special credits allowed to customers who agree to interrupt their use of energy to enable the utility to forego adding peak-period capacity resources. They must be carefully designed so that they are integrated with utility system needs; in some cases they have been ill-disguised subsidies to energy users who neither are nor expect to be interrupted.

[5] DSM program costs may be recovered using the same principles as are used to recover the costs of power plants, or they may be allocated to the broad customer classes (residential DSM program costs to the residential class, industrial to the industrial, etc.). The variety of approaches used by utilities to recover DSM costs is a subject all its own. See Paul A. Centolella, et al., *Cost Allocation for Electric Utility Conservation and Load Management Programs.* Washington, D.C.: National Association of Regulatory Utility Commissioners, February 1993.

Efficiency Standards

Efficiency standards are specifications applied to the manufacture or sale of energy-using equipment or to the energy-related aspects of the construction of new buildings. Standards may be voluntary, or they may be mandated by statute. The development of standards requires research into prevailing manufacturing and construction practices, and identification of technical options for more energy efficient products and building construction. Research also requires identification of the costs of various levels of efficiency that exceed prevailing practices, and analysis of the cost-effectiveness of efficiency standards programs.

Most states and several countries have enacted mandatory building standards that include requirements designed to ensure that buildings are more energy efficient than they would typically be in the absence of the standards. The efficiency provisions of building codes generally apply to renovated buildings as well as newly constructed ones. In the United States, buildings standards have traditionally been a sub-national (state and local) responsibility. Some states have no such standards, but most do. In a few states, such as California, whose efficiency standards are tighter than the average state's building efficiency requirements, building standards programs are accompanied by training manuals and software to assist builders in complying with the standards. Inspection of new buildings is conducted at the local (municipal) level in the United States, and local inspectors are charged with enforcing state code energy efficiency requirements. See the discussion on building codes in Chapter III of this Report.

Efficiency standards for manufactured products can cost-effectively reduce energy consumption. Beginning in the 1970s, some states, such as New York and California, established efficiency standards for various energy-using equipment. State standards were supplanted by federal standards beginning in 1990. The National Appliance Energy Conservation Act (NAECA) was passed in 1990. This bill established efficiency standards for furnaces and boilers, refrigerators and freezers, water heaters, air-conditioners and heat pumps, clothes washers, some lighting equipment and industrial motors. In 1992, EPAct increased some of the NAECA standards for such equipment as industrial motors, space heating, water heating, and lighting equipment, and added new standards for plumbing fixtures and electric motors.

Missouri failed to pass a minimum standard for refrigerator efficiency, at a time when many of the states in the surrounding area did. As a result, Missouri became a sort of dumping ground for the inefficient refrigerators in the area, and many of those refrigerators were installed in apartment buildings and homes in Missouri. This inability of Missouri to keep up with the neighboring states resulted in the installation of equipment that is inefficient and uneconomic for the residents of the state, since these refrigerators consume much more energy. In addition, since refrigerators have 15-20 year lifetimes, it will take many years before all of these inefficient refrigerators can be replaced by more efficient models.

Efficiency standards set an efficiency "floor." However, they do not set an efficiency "ceiling," since there are always techniques to exceed whatever efficiency level is mandated. For this reason, standards programs work well in tandem with other types of programs, such as education and incentive programs. The latter types of programs can encourage energy users to acquire buildings and equipment that are more energy efficient than is required by whatever mandatory efficiency standards may be in effect.

Pricing/Rate Design

When energy prices reflect the long-run societal costs of energy production, they help to promote long-run energy efficiency. Over the long period of time that energy production facility are in operation, they incur direct economic costs. Over that same period, they also incur costs not currently internalized by the utility or the economy, yet critically important, such as the impact on air quality or acid rain occurrence and damage.

Developing pricing systems for energy that bear a better resemblance to current resource costs is not enough, since the real issue from a planning perspective, is future costs --both economic costs and costs not currently internalized in the economy. The latter are sometimes called "externalities".

In the United States, electricity rates are set to recover the costs of existing ("embedded") plants and equipment as they are amortized over their useful life, the operating costs of the system (fuel and maintenance) plus the cost of capital to finance the system. Environmental costs are included only to the extent that the federal government's environmental regulations, such as its limits on air pollutants, require utilities to invest funds they would not spend otherwise. There has been a 20-year debate in the United States concerning whether electricity rates should reflect forward-looking resource planning considerations, and if so, how. Since the total revenues utilities collect are related to their current costs of production, this debate has focused on the *design* of the pricing structure through which these revenues are collected.

For example, two rate designs which collect the same amount of revenue today may send very different "signals" to energy users regarding consumption tomorrow. A declining block rate design charges a lower price per unit of energy consumed as the customer's consumption increases, thus signalling that marginal consumption is cheap. An inclining block rate design, on the other hand, charges a higher price per unit as energy consumption increases, thereby signalling that marginal consumption is costly.

Certain broad types of innovation in electricity pricing may, if properly implemented, help to capture the full, long-run societal costs of electricity production. Proper implementation relies on robust utility integrated resource plans having been developed, and a careful analysis of how customer electricity usage characteristics are related to the resource requirements in the IRPs to help design rate structure. These broad types of rate innovations include the following:

- Developing time-of-use rates, to reflect the time-varying costs of electricity production.
- Developing seasonal rates, to reflect the seasonally varying costs of electricity production.
- Reflecting long-run production costs in the marginal or "tail" energy charges of multi-block rate designs.
- Reflecting long-run externality costs (e.g., environmental impacts) in the marginal energy charges of multi-block rate designs.
- In general, considering whether the rate designs support the utility's IRP and adjusting designs if required to assure consistency.

There are a number of technical steps that must be taken in cost-of-service studies which are used to help design rate structure. These steps intervene between IRP development and the alignment of prices with IRP . These issues are beyond the scope of this Report. They are addressed, however, in a forthcoming white paper of the U.S. National Association of Regulatory Utilities Commissioners.[6]

[6] John Stutz, et al, Aligning Rate Design Policies with Integrated Resource Planning, A Report to NARUC (forthcoming 1993).

Existing Missouri Programs

The use of energy affects virtually every aspect of commerce and government in the state of Missouri. This section addresses those agencies and programs, public and private, which directly or indirectly impact energy use through their operations and/or responsibilities. For example, agencies and programs charged with financing the purchase or construction of buildings and housing, such as the Board of Public Buildings or the Missouri Housing Development Commission, can participate in new efforts to implement energy efficiency in the state's buildings and housing stock. Others have been charged with directly impacting energy use through their programs such as the Division of Energy of the Department of Natural Resources. Utility programs are addressed in another section of this chapter.

Division of Energy of the Department of Natural Resources

For the past decade, the majority of the Division's funding has been from oil overcharge funds. In the 1990's, at the same time that awareness of the connection between energy use, environmental improvement and economic stability has increased, the oil overcharge funds have been declining. Although other federal dollars may become available for environmental and energy initiatives, the amounts are very small compared to Missouri's past allocation of oil overcharge funds. However, if utility-based energy efficiency programs, also known as "demand-side management" (DSM) are expanded, this could provide a source of efficiency investment funds that would to some extent make up for a decline in oil overcharge (Petroleum Violation Escrow or PVE) funds.

The completion of the *Missouri Statewide Energy Study* in 1992 provided the Division a comprehensive study of the energy situation in the state and an extensive set of opportunities and recommendations for action. It is not the intent of this Report to summarize all of the findings and recommendations of that Study. However, one recommendation in particular holds significant promise for Missouri, the establishment of an Energy Futures Coalition. The Coalition would be a policy advisory committee from all sectors of the energy industry in Missouri, to advise the Governor's office and state government on energy policy and program implementation. This Coalition can provide the forum to facilitate the implementation of many of the programs that are recommended in the Energy Study and this Report.

Missouri has passed some important legislation in the past several years aimed at making a tremendous impact in reducing energy use in state government. These bills, SB80, HB195 and HB45 described below, give the Division much of the responsibility for implementation of these state efficiency programs. The bills also give the Division the opportunity to integrate its primary goal, to improve state energy efficiency, with the entire structure of state government. The Division also has the important responsibility of improving energy efficiency in almost all sectors of the state, private and public. Its many programs have a delivery system currently structured in five areas which include:

Director's Office/Administrative Services - The Division Director's Office is the link between the Legislature, and the services and staff of the Division. Administrative Services assists the Division Director in implementing the departmental and divisional policies and maintaining records. A few of the specific tasks include: payroll processing, purchasing, budget development, inventory, tracking and reporting of expenditures and personnel.

Weatherization - The Weatherization Assistance Program (WAP) provides funding for weatherization of eligible low-income households. This is a high demand program which has received supplemental funding in the past years from the now declining Petroleum Violation Escrow (PVE) funds. Services are provided by community action agencies, a non-profit agency and the City of Kansas City. The addition of the federal Weatherization Incentive Fund has provided opportunities for the state to investigate other funding avenues for Weatherization. This program is designed to help states encourage the addition of private funds to maintain the services normally funded by WAP and oil overcharge monies. $4.9 million have been allocated to the Division to operate the weatherization program, most of this as grants to the local providers.

Community/Education Services - This program covers the energy information needs of state and municipal governments, non-profit organizations and other sectors of the community. Typically it provides a variety of educational programs, information services, demonstration projects and other innovative programs to promote the efficient use of energy. Transportation and agricultural programs are also covered by this program. The current budget for these programs is $1.7 million.

Institutional Services - The Institutional Conservation Program, the Local Government Loan Program, the School Revolving Loan Program and the Industrial/Commercial Loan Program have all been merged under this program area for the purposes of efficiency and increased effectiveness.

- *Institutional Conservation Program (ICP):* This federally funded program provides 50% matching grants to public and private schools and non-profit hospitals for energy conservation improvements. Applicants submit a Technical Assistance Report (TAR) to the Division which is rated and reviewed by staff engineers. Money for ICP grants total just over $4.9 million with the majority of that coming from PVE funds. Administrative monies for ICP are currently budgeted at $198,000.

- *The Public School Loan Program:* The School Loan Program has awarded low interest loans to public elementary and secondary schools amounting to $5.9 million since it was begun in 1989. Payback periods of eligible measures must be between 6 months and 5 years. Savings estimates are over $2 million per year. The Public School program has $2 million in its revolving loan fund.

- *Local Government Loan Program:* This program has awarded over $3.3 million dollars in loans to local governments for implementation of a broad range of energy efficiency improvements having a payback between 6 months and 8 years. Projected savings are over $700,000 per year. This program has $3,000,000 in its revolving loan fund.

- *Industrial/Commercial Loan Program:* This new program began to accept applications in the fall of 1993. It promotes the implementation of energy efficiency measures in Missouri industries and provides low-cost financing for projects up to $150,000. This Program has $3,000,000 in its revolving loan fund.

Energy Services - Energy Services provides a wide variety of support for Division and state operations through five program functions which include Engineering Services, Field Monitoring, Energy Efficiency in State Facilities, Electronic Data Processing Coordination and the State Vehicle Fleet Conservation and Alternative Fuel Program. These programs provide the functions of both providing direct energy services and supporting existing energy services.

- *Engineering Services:* The Division's engineers are responsible for providing the engineering support to the project managers and the Director's office in general. Their most significant task at the present time is to review projects under the Institutional Service's programs.

- *Field Monitoring:* The major task of the monitoring section is to ensure that all state and federal procedures, rules and management requirements are followed.

- *Electronic Data Processing Coordination:* The "EDP" coordinator is responsible for managing the computer environment of the Division and developing systems and methods for data management.

- *State Vehicle Fleet Conservation and Alternative Fuel Program*: The passage of HB45 charged the state with implementing a program to reduce the fossil fuel use in government and evaluate the use of alternative fuels in vehicles. This program is entirely supported with oil overcharge funds allocated in FY1994. The bill charged the Division, in consultation with the Office of Administration, with developing and implementing the program. HB45 also charged the Division with assisting all state agencies in developing and implementing their own vehicle fleet energy conservation plans.

- *The Energy Efficient State Buildings Program*: This program is currently coordinating, with the Office of Administration, implementation of the Green Lights Program. However, the Energy Efficient State Buildings Program will expand dramatically over the upcoming years. Through the passage of HB195 and SB80 in 1993, a major state effort has been undertaken to make its facilities energy efficient. This effort involves many agencies of the state working in concert to implement it. Both bills address some of the same efficiency issues in their requirements, but each also have a unique focus. The unique thrust of HB195 is to create a self-supporting means to analyze state facilities and use a portion of the savings to fund future analyses. SB80 establishes an interagency advisory committee to assist the Office of Administration in implementing energy efficiency projects in state facilities.

In SB80, the Office of Administration has the responsibility of ranking proposed facility projects and deciding on the order of implementation of those projects. Responsibilities for carrying out other specific components of the bills are divided among several state agencies. Developing financing for facility projects is the responsibility of EIERA and the Board of Public Buildings.

The Division of Design and Construction is responsible for assisting the Division of Energy with development of design criteria, standards and analysis criteria and in enforcing and following through with implementation of requirements and standards. The bills specifically charge the Division of Energy with:

- developing minimum energy efficiency standards for state facilities (by 1/1/95 in HB195 and by 1/1/94 in SB80);
- establishing, with the Division of Design and Construction, a volunteer working group to assist with efficiency standards;
- establishing an efficiency rating system by 7/1/94;
- developing energy use baselines for state facilities;
- preparing and disseminating energy efficiency practices information for state facilities;
- establishing criteria for determining projected and actual energy savings in state facilities; and,
- administering the "Energy Analyses Account" to fund future energy analyses.

Environmental Improvement and Energy Resources Authority (EIERA)

The EIERA was created as a self-supporting agency to protect Missouri's environment, develop energy alternatives, and promote economic development. The means to accomplish this mandate include issuing low- and no-cost financing, some of which may be tax exempt, to businesses and local governments for environmental projects, providing technical assistance, and conducting studies and research. Environmental projects can range from pollution control/prevention activities to financing energy efficiency measures in state facilities. Among its research, the EIERA produced a thorough analysis of solid waste issues in Missouri and recently published the *Missouri Statewide Energy Study*.

The EIERA is involved in numerous educational activities across the state in the energy and environmental fields. These include the nationally recognized Household Hazardous Waste Program, the Missouri Energy Resources Project and past assistance in the development of a solar-powered car at Crowder College. EIERA also manages the Missouri Market Development Program, in coordination with Department of Natural Resources and the Department of Economic Development, to provide financial assistance helping develop and maintain a recycling infrastructure in the state.

Financing is one of the most important functions of EIERA. The authority to fund agency projects was set forth in RSMo §260.035.1(7). The EIERA issued its first bond package in December, 1973 and since then has issued over $1.9 billion in tax-exempt bonds, notes and commercial paper, primarily for pollution control and environmental improvement projects. In addition, the EIERA has been involved in a number of other significant efforts for improving the environment in the state.

In 1987, the EIERA, working with other agencies, established the Missouri State Revolving Fund (SRF). The SRF, in cooperation with the U.S. Environmental Protection Agency, provides low-cost loans to Missouri governments for the construction of water, wastewater and sewage treatment facilities. A companion program operated with the Missouri Public Service Commission provides financing to private water companies for the construction of new water systems in Missouri. The passage of SB80 and HB195 in 1993 added the responsibility of financing energy improvements for state buildings.

Office of Administration (OA)

The Office of Administration coordinates the central management functions of state government and is, therefore, a key agency in carrying out many of the efforts toward improving energy efficiency within state government. As mentioned earlier, SB80 and HB195 give the OA much of the responsibility for the implementation of the bill's requirements, often through its Division of Design and Construction and the Board of Public Buildings. In addition, this agency has significant responsibility in the *purchase of vehicles, and is therefore involved in the implementation of HB45* regarding alternative fueled vehicles.

Board of Public Buildings - Chaired by the Governor, the Board of Public Buildings has the authority to initiate the construction of state office buildings and certain other facilities. It may issue revenue bonds for these capital improvement projects. The board works closely with the Division of Design and Construction and now, with the Division of Energy and EIERA in the Energy Efficient State Building program as required by SB80 and HB195. By focusing attention on energy efficiency in the design and construction of state buildings, the Board can provide an important leadership role of infusing a policy of energy efficiency in state operations.

Division of Design and Construction - This Division of the Office of Administration is responsible for building, operating and maintaining the state's buildings. One specific responsibility is to track and analyze the state's energy costs for operating its facilities. The Division of Design and Construction is also one of the agencies responsible for implementation of SB80 and HB195 and will work with the Division of Energy program for Energy Efficient State Buildings.

Missouri Health and Educational Facilities Authority (MOHEFA)

MOHEFA provides financing to the state's public and private, non-profit health and educational facilities. The goal of this financing authority is to provide low-cost financing for these institutions. It is governed by a seven member commission appointed by the Governor with the consent of the Senate. MOHEFA provides the means to improve the quality of medical and educational services to Missourians by assisting institutions to borrow money for improvement of their facilities, assisting public school districts and community colleges with loans to cover operating shortfalls, assisting with financing for organizations that provide services to the mentally disabled and operating a program to assist Missourians to invest in college bonds for their children. In the twelve years of actual operations, MOHEFA has issued financing of nearly $3.3 billion for 107 projects. The majority of the projects are for health care institutions, although a number of colleges and universities have taken part in the financing program.

The opportunities for expansion of the MOHEFA's financing programs can dovetail with statewide energy program development. Many of the state-owned buildings are in the University system and would therefore qualify for financing from MOHEFA. In addition, it appears that the majority of financing projects are in the St. Louis area, so further publicity and outreach to other parts of the state could also increase activity. Between MOHEFA and the Environmental Improvement and Energy

Resources Authority, it appears the infrastructure for financing many of the building improvements in the state are in place.

Public Service Commission (PSC)

The PSC is responsible for regulating the public services within the state including, energy utilities, commercial transit, telephone companies, manufactured housing and water and sewer systems. The PSC is also responsible for developing Integrated Resource Planning (IRP) which is discussed more fully in the Utility Program section, and governing implementation of IRP by the utilities in the state. EPAct requirements and opportunities have a direct influence on the way the PSC will operate in the next few years. Much of the detail of the EPAct effects on the PSC is discussed in the "Utility Programs" discussion of this section.

The Missouri Housing Development Commission (MHDC)

The Commission is responsible for providing financing for decent housing for low and moderate income Missourians. The Commission is authorized to issue and sell tax exempt notes and bonds which provide the funds for MHDC's mortgage financings. MHDC membership is made up of the Governor, Attorney General, Treasurer and six members appointed by the Governor with the advice of the Senate.

Past efforts of MHDC to include energy efficiency in financing programs have been only partially successful. In the mid-1980s, MHDC attempted to use $500,000 in oil overcharge money to buy down loans that would encourage energy efficiency in Missouri homes. This program achieved only limited success. One reason is that it focused on lenders, while providing little public information about the program. As a result, very little of the oil overcharge money was used to fund the resulting loan buy downs. However, this type of program could succeed if the delivery mechanism were focused more towards builders and buyers of new homes.

Although MHDC deals with multi-family buildings, its staff estimates that about 90% of financing provided through their programs is for single family homes. If Missouri carries out EPAct's recommendations in the area of implementing statewide residential building codes, an energy efficient mortgage program and a uniform home rating system, MHDC should be an important player in giving Missouri's homeowners access to the financing needed make their homes energy efficient.

Division of Family Services (DFS)

This Division is responsible for administering the Low-Income Home Energy Assistance (LIHEAP) program. This federal program has three components:

- the energy assistance program, which provides cash grants to the poor to help them meet their winter heating and energy needs;
- a weatherization program for low-income homes that allows the state to elect to spend up to 15% of the LIHEAP funding on low-income weatherization (DFS does not allocate anything for weatherization at this time); and,
- the LIHEAP emergency assistance program, which has the purpose of *providing assistance to people with financial emergencies resulting in the* loss of heat-related utility service or bulk fuel supply.

Future federal funding for LIHEAP is uncertain. There have been many battles in Congress recently that have revolved around attempts to lower the level of funding for this program. As a result, there is no assurance of federal monies for this program in the future. The advance appropriation for the fiscal year beginning July 1, 1994 is $1.475 billion which is an increase of about $27 million over last year. However, next year's appropriation request may be for no more than $1 billion. The termination of this program would exacerbate the plight of low-income customers attempting to meet their heating needs.

The University of Missouri Extension

The Extension Service disseminates energy education materials through centers located across the state. Information distributed covers a large variety of energy conservation subjects for children and adults. Much of the material developed and used by the Extension is aimed at helping homeowners manage energy efficient households in low-cost, common sense ways. The Extension also works in the area of youth education, such as the Junior Conserver program, and assists teachers with energy education efforts in Missouri's schools. The Extension works closely with the Division of Energy's Community/Education services and is and is a logical existing vehicle for the expansion of state energy education programs.

Community Based Programs

The Metropolitan Energy Center - The Energy Center, located in Kansas City, operates a wide variety of energy programs dealing with information, residential conservation, non-profit energy conservation and energy education. The Energy Center is also active in energy policy and program issues on a local, state and regional basis including transportation. Over the past several years the Energy Center has provided consulting services to the Environmental Improvement and Energy Resources Authority, the Division of Energy, the Kansas City Support Office of the U.S. Department of Energy and Kansas State University's Engineering Extension.

Missouri Energy Resources Project (MERP) - MERP provides training, resources and programs to support energy and environmental education in schools and businesses. Past projects have included mini-grants for classroom projects, the Energy Efficient Model Home, student leadership training for the environment, National Energy Education Day and other general services aimed at resources and support for teachers including maintaining a statewide network of teachers.

Neighborhood and Housing Organizations - There are many nonprofit organizations in Missouri which provide assistance to homeowners and neighborhoods to receive financing for home improvements, weatherization and so forth. A Kansas City organization, the Rehabilitation Loan Corporation (RLC) directly provides innovative, low cost financing for low- to moderate-income homeowners for a variety of purposes related to residential property. One program, the Seasonal Improvement Loan Program provides for heating, cooling and weatherization upgrades to a home at 3% interest. Other organizations throughout Missouri, such as the Urban League and ACORN in St. Louis, Neighborhood Housing Services in St. Joseph, the Affordable Housing Action Board in Springfield, to name only a few, can assist homeowners in gaining access to low cost financing and other assistance for energy efficiency upgrades.

Federal Programs

There are also federal programs available on the state and local level to provide technical assistance in promoting and carrying out energy efficiency. Both the U.S. Department of Energy and the Environmental Protection Agency have developed excellent programs in the area of efficiency. These are distinct from federal programs that provide grant funding to local and/or state government.

Department of Energy (DOE) - Although DOE has many programs which provide assistance to all sectors of the community, two programs are mentioned here as examples of their energy efficiency services that have relevance to this Report. The Energy Analysis and Diagnostic Center (EADC) is a national program which provides faculty and senior/graduate students from accredited engineering schools to analyze the plants of business and industry. The energy audits are provided at no cost to these companies. One EADC program is located at the University of Missouri - Rolla and another at the University of Kansas in Lawrence. Both provide services within 100 miles of their respective campus. DOE also has a program to promote efficient electric motors, a large potential energy saver. The Efficient Motors Program can provide technical assistance and product information to business and industry to help with motor retrofits.

The DOE has undertaken a significant effort to increase the acceptance and use of alternative fueled vehicles in federal and non-federal fleets. In response to EPAct, the Secretary of Energy has written to the mayors of the largest city in each of the major metropolitan areas in the nation to invite them to join the Clean Cities program. Atlanta was designated the first Clean City earlier this year. DOE is now attempting to institute this voluntary program throughout the country. They are bringing the various representatives of local government, utilities and private businesses together to work on developing an infrastructure for alternative fuels and speed up the process of conversion of existing vehicles and/or purchase of new alternative fueled vehicles. In Missouri, the St. Louis and Kansas City metropolitan areas are a high priority for inclusion in this program.

Environmental Protection Agency (EPA) - The best known EPA program working toward energy efficiency currently is the Green Lights Program. Green Lights is a comprehensive program that combines technical assistance, product development and review, financing information and promotion for a wide sector of energy users including industry, government and education. EPA is also offering extensive programs in efficiency in building HVAC systems and efficient computers (the Energy Star Program). The State of Missouri, several utilities, businesses, schools, and many others are now members of Green Lights and are, therefore, prime candidates for other upcoming EPA programs.

Missouri Program Options

As has been pointed out, the state of Missouri already operates several programs that target the residential sector, but there are additional possibilities for programs that can be implemented to further promote energy efficiency. This section provides an overview of specific programs that currently operate in other parts of the country. Some may be suitable for Missouri. The following discusses the opportunities, delivery systems and model programs that Missouri should consider.

Home Energy Rating System (HERS)

The energy efficiency of a home is often overlooked by home buyers. Lacking this information, home buyers often do not make the best decisions. A HERS program would provide home buyers this information and allow them to make an educated decision a home by understanding it's energy use and costs. A good HERS system will also give the buyer of an existing home the opportunity to evaluate its comparative efficiency level in making the purchase decision, as well as suggest potential of making energy efficiency improvements after purchase.

HERS programs involve collaboration between the state and the individuals involved in home financing, design and construction and marketing. The purpose is to encourage higher energy efficiency levels for both new and existing homes than is typical or is required by outdated building codes. A HERS program may include its own building standards that a home must meet in order to be certified. In purchasing existing housing, a HERS program can serve as the financial analysis tool for an energy efficient mortgage program. In designing a HERS program, an important point of consideration is if the HERS minimum rating requirements simply meet or exceed those put forth in ASHRAE 90.1-1989 and CABO Model Energy Code 1992.

HERS programs have become popular around the country. Many states have implemented these programs to educate consumers about the benefits of energy efficient homes. In Arkansas, there is an organization called Energy Rated Homes (ERH) of Arkansas. This non-profit organization provides a home HERS for the new and existing homes. The program was initially administered by the state energy office of Arkansas, but is now a separate entity that is funded through private means.

One of the diagnostic tools that is used to determine the efficiency of a home for a HERS is the CALRES model that was designed by the California Energy Commission. This computer model requires the input of certain information about the building shell performance, and with that data it can predict the annual energy use of the home and whether or not the home meets the building standards. The code that ERH uses to test the homes exceeds all of the current federal codes, so that if a home is found to be efficient by the ERH system, then it will be guaranteed to be efficient under federal building efficiency standards.

The rating system that ERH employs is a 0-100 point scale that indicates the efficiency level of a home. If a home receives a rating of 80, then it is 80% as energy efficient as possible. ERH also informs the home owner of how many Btu's of energy that the home might consume in a year, and what that energy might cost. The cost estimates consider average fuel costs, average consumption rates and the number of occupants in the home.

The New York State Energy Star Program (NYSE-Star) is another model HERS program. This program involves the New York State Energy Office, the New York State Builders Association, and the New York State Energy Research and Development Authority. These groups work with the investor-owned utilities of New York to certify homes that exceed the New York state building codes. NYSE-Star has a standard which requires that a home must be at least 25% more efficient than indicated in the New York state building code standards. This allows buyers to make an informed evaluation of the value of the a home by reviewing its relative energy efficiency.

Title I, Section 102 of EPAct requires the DOE to develop voluntary home energy rating guidelines. EPAct also mandates that the DOE must develop a set of national, uniform guidelines for State and local authorities, utilities and others involved in the residential housing community to use in assigning energy efficiency ratings to residential buildings.

Energy Efficient Home Mortgage Program

Energy efficient homes may be more expensive owing to the cost of the energy efficiency measures incorporated. This can create a barrier for home buyers, even though the savings that result from these measures over the life of the home will far outweigh the initial costs. An energy efficient mortgage (EEM) program can help to overcome this problem by allowing the home buyer to qualify for a larger mortgage. The fact that the home buyer could be spending less money each month on energy bills allows a larger mortgage which, in turn, allows the energy efficiency measures. It also allows the home buyer to spread the cost of the efficiency measures over the life of the mortgage.

The program would work in such a way that once an individual is interested in purchasing a home that has qualified under a HERS program, then he or she would apply for an energy efficient mortgage through a state agency and a qualifying lending institution within Missouri. The lending institution and the interested individual would then work out the specifics of the energy efficient loan, which would include the interest rate, the payment schedule, and the length of the financing agreement. The federal government also operates several energy efficient mortgage programs such as the VA, FHA, Fannie Mae, and Freddie Mac programs. It would appear to be to Missourian's benefit if the state financing programs and lending institutions participated in these programs.

The Energy Saver Loan program that was started by the Bank of New England (BNE) in 1983 is a specific example of an energy efficient mortgage program. This program was for individuals who wished to either purchase a new home, or refinance an old one. The individual qualified for the loan if energy conservation improvements were to be made on the home. An audit was performed on the home to appraise the value of the proposed upgrades. Once the upgrade had been appraised, the funds to cover the cost of the upgrade were placed in an escrow account. The amount in the escrow account could be no more than 15% of the value of the loan if it was a FNMA loan, and no more than 10% of the value of the loan if it was a FHLMC loan. The energy upgrade also had to be completed within 120 days of the closing.

This program allows participants to spread the cost of the energy upgrades over the life of the mortgage. The other benefits that result from a program of this kind are lower energy bills and a higher resale value owing to a higher energy rating of the home.

The marketing of an energy efficient loan program is a key element for a successful program. The institutions that operate the program must be sure that parties involved in the construction, sale and purchase of new homes are aware of the program. The more people that are involved from the beginning of the building process, the more likely the program is to succeed.

EPAct sets up a pilot energy efficient mortgage (EEM) program through the Department of Housing and Urban Development (HUD). The five states that qualified to take part in this pilot program are Alaska, Arkansas, California, Vermont, and Virginia. This pilot program only targets the retrofit market. It does allow the borrower to finance the mortgage 100 percent of the cost of the eligible energy efficient improvements without the need for appraisals. Eligible improvements are those that are cost-effective. That is, the total cost of the improvements must be less than the energy savings that occurs over the useful life of the improvements. The borrower must use a HERS to estimate the energy savings that will be achieved by the improvements.

Public Sector Efficiency Improvement Funding Program

The promotion of energy efficiency in schools and other public buildings would demonstrate to the people of Missouri that the state is serious about conserving energy. However, since public monies would be used to finance efficiency upgrades in public buildings, the state must first draft legislation that would make the funding of these projects a more straight forward process. The state must then administer the a comprehensive program that would result in improved efficiency in the public buildings of Missouri, which would be a major task.

The appropriation of funds for improvements to public schools and other municipal buildings are strictly controlled by capital budgeting laws. If a jurisdiction wants to upgrade a public school, municipal leases must contain an executory clause under which payments are subject to annual appropriations. Otherwise, the leases would be general obligations and subject to voter approval and strict underwriting requirements. To address this, the Iowa Legislature, for example, passed a law in 1987 that authorized school districts to enter into financial arrangements "obligating the school district area school to make payments on the loans beyond the current budget year." This authorization applies only for energy-related improvements effected through the Iowa Department of Natural Resources (Iowa-DNR) programs.

A bill that would allow the public sector to finance the loans in the same fashion as is now done in Iowa, would give jurisdictions more freedom to implement energy-related upgrades. The investment would be recovered over the payback period of the upgrade (no longer than five years, for example). In this manner, the money would be available for the upgrade, and the amount that the institution pays out to finance the loan would be recovered each year in the form of lower energy costs.

Having addressed these legal questions, the state would then need to set up a program that provides assistance to cities, counties and local governments that wish to identify energy efficiency improvements qualifying under this program. Qualifying projects would be those that improve the energy efficiency of the building, or in some way reduce the overall energy consumption of the building. The project would be proven to have a reasonable payback period (such as 5 years) in order to qualify for financial assistance.

Subsidized energy audits for interested jurisdictions would be the first step in the delivery of such a program. Once an audit is complete, and the energy-related improvements have been identified, then the participating financial institution would sign a municipal lease with the jurisdiction under which the jurisdiction repays principal and interest over the fixed term. Interest payments on municipal leases are tax exempt, so long as the transaction meets certain conditions. The other aspects of the financing agreement (interest rate, length of financing, payment schedule, processing time and fees) could all be flexible and negotiable between the jurisdiction and the lending institution.

As noted above, the state of Iowa passed a law to facilitate the successful operation of a public sector energy efficiency improvement loan program. The Iowa program, described earlier and run by the Iowa Department of Natural Resources (Iowa-DNR), has set up a group of state-funded lending organizations such as the School Energy Bank Program and the Local Government Energy Bank Program. The Iowa-DNR provides financial assistance for all project costs incurred prior to installation of the improvements and the initiation of the lease. These costs include the costs of the audit, design engineer's fees, Iowa-DNR's project management fees and fees for financial and legal consultants assisting in the preparation of the financing documents. These funds are advanced through a Promissory Note contained in a Memorandum of Agreement that the Iowa-DNR signs with each client. In Iowa, Norwest Investment Services has an informal agreement with Iowa-DNR through which it offers a standard project financing package to all jurisdictions that wish to participate in the Iowa school program. Specific terms of the long-term financing agreement (interest rate, length of financing, payment schedule) are determined on a case by case basis.

The Iowa Building Energy Management Program[7] makes loans to finance energy efficiency projects in public buildings, private and public schools, educational agencies, hospitals, and nonprofit organizations. The program is operated by the Iowa-DNR and has a $2 million funding level. Funds are used to leverage additional financing from other sources such as businesses and utilities. The program has four main components that target different areas, as follows:

- The Local Government Energy Bank Program assists counties, and local governments with energy efficiency projects. Eligible projects include improvements to buildings, street lighting, water and wastewater-treatment plants. Power generating plants also qualify. Northwest Investment Services, an Iowa financial institution, helps provide financing.

- Another of the Iowa-DNR programs aims to improve energy efficiency in Iowa's private colleges and universities. In conjunction with the Higher Education Loan Authority, Iowa-DNR's energy conservation efforts involve the members of the Iowa Association of Independent Colleges and Universities and the Iowa College Foundation. Accredited private schools also are part of Iowa-DNR's energy management efforts. Technical analysis to determine what improvements are possible precedes the creation of affordable financing for energy improvements.

[7] The following program description is summarized from Charles Bartsch and Diane DeVaul, *op. cit.*

- The School Energy Bank Program assists public school districts with energy-saving improvements. Two hundred and twelve jurisdictions participate with a total of 691 buildings involved. All facilities in the program have received energy audits. Program officials have scheduled engineering analyses for about half of these buildings. The program has provided more than $3.1 million in loans, which is expected to produce over $4.6 million in energy savings over a five-year period.

- The Iowa Facilities Improvement Corporation (IFIC) funds energy improvements for state government facilities. Set up in 1986, this program has saved the Departments of Corrections, General Services and Human Services more than $1 million annually through energy efficiency improvements. Those savings are used to fund projects in other departments. The Department of the Blind received $64,000, the Department of Public Safety $45,000, and the Department of Transportation $1.3 million. IFIC outlined $35.5 million in energy-management improvements for the Board of Regents facilities, with a projected annual savings of $7.2 million. Program officials plan to implement these measures by fiscal 1994.

Missouri already has two programs in place that promote energy efficiency projects in public buildings. The Local Government Loan program allows local governments to install energy saving devices, and the loans to pay for the approved improvements are low-interest (2% simple interest). The energy savings achieved with the upgrade will also pay off the interest of the loan. The Institutional Conservation Grants program provides matching grants to eligible public and private, non-profit schools and hospitals. To qualify for the grant, the upgrade must be a retrofit operation, it must have a payback period of between 2 and 10 years, a Technical Assistance Report must be completed by an engineer, and the building must have a heating or cooling system, or both. Both of the programs listed above are funded by a combination of federal and state funds.

EPAct Section 141 of Title 1 establishes a State Building Energy Incentive Fund of up to $1 million per state for financing energy efficiency improvements in state and local government buildings. Missouri must adopt the ASHRAE 90.1-1989 standards or its equivalent for commercial building, and the CABO Model Energy Code 1992 or its equivalent for residential buildings in order to be eligible for these funds.

Small to Medium Sized Commercial/Industrial Program

The small- to medium-sized commercial and industrial markets tend to be more difficult for the utilities to target than large customers because the benefits, while still cost-effective, do not tend to be as large as in the large industrial sector. State government could fill this gap by providing technical and financing services. In addition, a $250,000 grant, authorized by EPAct, is available to industrial associations to promote industrial energy efficiency through workshops, training seminars, handbooks, newsletters and databases. The State could examine how to work in partnership with these associations to develop such a program and access these funds.

A successful program in this area could convince the utilities that the small- to medium-sized businesses are a market sector worth pursuing to promote DSM. Once the state can get a program up and running in a cost-effective manner, the utilities may be able to take over the program and run it within the scope of their own DSM programs.

In such a program, initial contact with the businesses is through an energy audit. This audit is performed by efficiency experts for the interested businesses. The opportunities for energy savings are determined during a free walk-through audit. Once the audit has been completed, it is then up to the business to install the energy saving devices. Qualifying businesses, which must meet certain criteria regarding number of employees, annual revenues and certain stipulations regarding the installation and monitoring of the efficiency upgrades, would then pursue a conventional small business loan approved by a Missouri lending institution to finance the identified efficiency upgrades. The second phase of the program subsidizes the financing of the loan by prepaying the interest costs.

The Small Business Energy Management Program, along with the Energy Conservation Interest Writedown Grant Program, run by the state of Illinois, are examples of model programs that promote energy efficiency in small businesses through energy audits or financial assistance. The two programs, which provide audits and financial assistance respectively, are housed within the Department of Commerce and Community Affairs (DCCA) and the Department of Energy and Natural Resources respectively.

The basic purpose of the programs is the same as that outlined above. Efficiency experts perform energy audits for interested businesses, and then financial assistance is provided by the Energy Conservation Interest Writedown Grant Program. In order to qualify for financial assistance in Illinois, the businesses have to meet the following criteria:

- the business is a for-profit, non-farm commercial or industrial business;
- it has a net worth of less than $6 million and average after-tax profits of less than $2 million in the last two years;
- it does not operate in a home, residence or apartment building;
- it provides the DCCA with copies of all energy bills for the 24 months following the completion of the energy-conservation project;

- it certifies that the project applied for is a retrofit or replacement of an existing structure and/or equipment;
- it will complete the project within six months of approval; and,
- it agrees to allow DCCA or its representatives to inspect the facilities and improvements at any time before, during, or after a project is approved and to conduct a free energy audit if DCCA determines that one is necessary prior to the start of the project.

The U.S. Department of Energy also funds a program that is administered by engineering schools around the country. Energy Analysis and Diagnostic Centers (EADC) have been set up with the purpose of providing free energy audits to industrial facilities. The result of an audit is a report that contains recommended upgrades that can improve the energy efficiency of the facility. The EADC schools are available to provide audits to facilities within a 100 mile radius of the center. An EADC school is located at the University of Missouri-Rolla and at the University of Kansas in Lawrence, which has analyzed buildings in the western side of Missouri.

Opportunities Created by EPAct for Industrial Efficiency

The passage of EPAct gives the state an opportunity to expand its existing programs, while also creating an opportunity to broaden their scope. A $250,000 grant is available to industry associations. The Division of Energy could work with Missouri industry associations to assist them to obtain funding. This would allow the Division to expand its programs by promoting industrial energy efficiency through workshops, training seminars, handbooks, newsletters and databases in cooperation with industry associations.

Transportation

EPAct mandates that an increasing percentage of state vehicles must operate on alternative fuels starting in 1995. It will become more and more critical for the Office of Administration and other vehicle-purchasing agencies to be aware of the state of the art of alternatively fueled vehicles.

Through EPAct, DOE is providing grants to states for the accelerated introduction of alternatively fueled vehicles. States must develop a plan that includes provisions designed to result in progress toward the goal of introducing substantial numbers of alternative fueled vehicles in each state by the year 2000 as well as a detailed description of the requirements, including the estimated cost of implementing such a plan. The plan must also describe how the State, Federal, and local government entities would coordinate in implementing the plan. This plan must be submitted to the DOE for approval before it can qualify for the grant. A grant creates an opportunity for gas utilities and state organizations to work together for the promotion of alternatively fueled vehicles. The grants can aid in the implementation of the state plan, as well as help in the establishment of an alternative fuel bus program.

The states must provide at least a 20 percent match as part of the grant program. The state should approach the electric and gas utilities of Missouri to see if they would be interested in providing at least a portion of the 20 percent matching funds.

Existing Missouri Utility Programs

Introduction

Natural gas and electric utilities can play an important role in helping to overcome the economic, informational and institutional barriers that deter utility customers from investing in energy efficiency options. Utility customers, who consider energy efficiency investments, compare the up-front costs of the investment with the flow of benefits it produces over time. Benefits in future years are devalued at a rate reflecting the explicit or implicit "discount rate" the customer applies to income (and expenses) realized in future years. In empirical studies, various groups of customers have been found to have effective discount rates above those used by utility planners. When evaluating resource planning options, utilities will typically apply a discount rate of five to six percent (real) per year. While customer discount rates vary substantially, they tend to be significantly higher than the discount rates used for utility resource planning.[8]

Utilities can respond to customers' high discount rates by offering Demand Side Management (DSM) programs. DSM programs offer information, technical assistance, financing programs, and financial incentives designed to spur energy efficiency actions beyond those customers would implement based on utility rates and other market forces alone.

Other advantages of utility-based DSM programs have been summarized as follows by Eric Hirst at Oak Ridge National Laboratory:[9]

> *[Utilities'] monopoly franchise, active participation in their communities, and promotion of economic development all speak to their sense of public responsibility. More important, demand-side programs offer resources that are often less expensive...than supply resources. Thus, aggressive utility programs save money for customers by lowering overall energy-service costs. In addition, these programs provide environmental-quality and risk-reduction benefits not available with power plants. Also, electric utilities have long-standing relationships and monthly contacts...with their customers. Utilities are generally highly regarded as sources of reliable and credible information on efficiency options.*

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[8] See Prefiled Direct Testimony of Dr. John Stutz, Ohio Public Utilities Commission Case No. 91-410-EL-AIR (Boston, The Tellus Institute, December 1991), Exhibit JS-11.

[9] Eric Hirst, Electric-Utility Energy Efficiency and Load-Management Programs (Oak Ridge, Tennessee: Oak Ridge National Laboratory, Report ORNL/CON-285), pages 16-17.

The realization of the potential contribution of investor-owned utility (IOU) DSM to the overall level of investment in energy efficiency usually follows the establishment of an integrated resource planning (IRP) process. IRP processes require the identification of mixes of demand-side and supply-side resources that can minimize the total costs of energy services over a long-range planning period. Missouri established its first IRP process for electric utilities in March, 1993, but is just beginning to consider a parallel process for natural gas IOUs. For a publicly owned utility system, DSM emerges when the governing board establishes energy efficiency as a strategic priority of the utility.

The electric utilities that serve the majority of electricity customers in the state operate DSM programs. Not all of the utilities listed below are investor-owned, an example is Columbia Water and Light. Those utilities that are not investor-owned are not required to take part in the IRP process. Missouri electric utilities are also considering developing additional DSM programs, in the context of the 1993 IRP rule adopted by the Public Service Commission. As the utility filings under the IRP rule are only just beginning, their long-term goals are uncertain at the moment.

Kansas City Power and Light

Kansas City Power and Light (KCPL) included DSM programs in its KCPLAN for the first time in 1991. It now has full-scale programs that cover the following areas:

- Load Curtailment: Large customers sign up for load curtailment during peak load periods in return for rate reduction.
- Residential Air Conditioner Load Control: Install devices on individual A/C compressors to limit operation during peak load periods. Can be temperature activated or radio controlled.

KCPL also has several programs that are still in the planning phase. Action will not be taken on these programs until after the July 1994 filing date for KCPL's next IRP filing. The programs that are still in the planning phase are as follows.

- Industrial Process: Assist industrial customers in adopting higher-efficiency technologies in areas such as pumps, motors, refrigeration, compressors and lighting.
- Residential High-Efficiency Air Conditioner: Promotion of selection of high-efficiency air conditioning equipment at the time of replacement.
- Home Energy Audit: Promote Residential use of compact fluorescent lights and hot water insulation wraps.
- Commercial Air Conditioning: Promotion of high-efficiency cooling equipment in the Commercial sector.
- Residential High-Efficiency Refrigeration: Promotion of selection of high-efficiency refrigerators at the time of replacement.

- Residential Water Heater Load Control: Install devices on individual water heaters to limit operation during peak load periods.
- Energy Efficient Commercial & Industrial Lighting: Replacement of fluorescent lamps, ballasts or fixtures with higher-efficiency units.
- Commercial/Industrial Motors: Promote the purchase of efficient motors in Commercial/Industrial sector.
- Residential Insulation Program: Promote higher levels of insulation in homes that use electric space heating.

Union Electric Company

Union Electric Company (UE) is also fairly new to the DSM arena. It currently runs four programs, mainly focusing on information dissemination and load control. Its full scale programs are as follows:

- Energy Plus: *Community Services to support individual customer energy* needs (elderly and low income)
- Information Literature: This literature focuses on ways to reduce energy usage.
- Primary Service Interruptible Rate: Curtailable service rate offered to Primary Service customers.
- Short-Term Interruptible "Additional Energy" Rider: Curtailable service rate offered to customers willing to accept interruptions while increasing their energy usage.

UE, which also operates outside of Missouri, has several pilot or test programs listed in its 1992 report to the Illinois Commission. These programs focus more on conservation of energy than on load management. These pilot or test programs are as follows:

- Cold Cash Appliance Recycling Program: Pickup and recycling of spare, operating refrigerators and freezers for residential customers.
- Commercial End-Use Data Project: On-site surveys of 800 commercial customers, in order to gain more detailed knowledge of end-use loads for forecasting and demand-side planning.
- Energy Savings Partnership Program: Energy efficiency auditing and *project management support for large commercial customers*.
- Energy Efficient Residential Construction: New and rehab building envelope and appliance efficiency improvements.
- *In Concert with the Environment*®: An educational program for high school students, focusing on the linkages between personal energy efficiency and environmental quality.
- Industrial Market Research Project: A survey of electric loads and services needs among 150 key industrial customers.

- Industrial Process Audit Pilot Program: Provides nationally recognized consulting on process efficiencies to large industrial customers.
- Interruptible Pilot Program: Curtailable service with remote interruption feature (for smaller primary customers).
- MotorMiser Information Program: Distributing software for analyzing the economics of high efficiency motors.
- No Sweat Residential Energy Management Program: Direct load control experiment for residential central air conditioners and heat pumps.
- Residential Market Segmentation Study: A survey to quantify customer attitudes about energy efficiency, identify opportunities to provide energy services and develop geographically-specified market segments.

Some of these programs appear to belong in marketing and not DSM. Further, some of these programs are studies which, while critical to future success in the area of DSM, do not qualify as DSM while they are in the study phase.

Columbia Water and Light

Columbia Water and Light (CW&L) has been recognized in the past for its energy service and demand management programs. CW&L currently runs the following full scale programs:

- Residential Energy Audits: A "walkthrough" type of audit, an air infiltration test and infra red thermal scan is performed for residential customers.
- Commercial Energy Audits: Provide business customers with expert information regarding potential efficiency improvements to their operations.
- Residential Load Management: Radio controlled switches are installed on central air conditioners to cycle operation during peak load periods.
- Efficiency Upgrade Loans (Residential): Low interest loans are provided to qualifying customers who want to perform energy efficiency improvements. Air conditioner replacements, heat pump installations, and ceiling insulation are covered by this program.
- *Lighten Up!*: Residential and Commercial customers are given incentives to purchase compact fluorescent lamps by contributing $7.50 toward the purchase of a compact fluorescent lamp.

CW&L is also considering several new programs that are currently in the pilot phase. These are as follows:

- Restaurant Seminar to Promote Efficiency: Seminar conducted in the summer of 1993 aimed at providing energy efficiency ideas to managers of restaurants and other cooking establishments.

- Second Refrigerator Turn-in Program: Old, inefficient second refrigerators will be removed from residential dwellings. Incentives will be offered to the participating customers.
- Good Cents New Construction Building Evaluation Program: Promote energy efficient construction and design through a construction scorecard that will be based on the current Columbia building codes. These codes already promote very high thermal integrity for new construction.

Other Electric Utilities

The rest of the electric utilities in Missouri are still in the early stages of developing a full complement of DSM programs. The City Utilities of Springfield have hired the consulting firm, Stone and Webster, to help them decide how to shave 16 MW off of their peak load through DSM, but as yet no active programs. Empire District Electric Company has one active program that was started in 1990, an Interruptible Service program focused on commercial/industrial customers. The Missouri Public Service Company has no active programs, but has several programs under serious consideration. These programs under consideration cover all sectors and focus on energy conservation rather than load control.

Natural Gas Utilities

At the time of our survey of Missouri's natural gas utilities, we found very little DSM activity. Although the IRP rule adopted in Missouri does not currently cover natural gas utilities, this situation is likely to change as the Public Service Commission starts the development and implementation of IRP for natural gas utilities.

Missouri Utility Program Options

DSM Information Sharing Workshops

There is interest among the electric utilities in Missouri to set up an information sharing system for DSM program ideas. A series of workshops that would gather DSM professionals from all of the state's electric utilities (and, if possible, gas utilities) would afford a way to provide this system. This could help some of the more inexperienced utilities over initial hesitation about setting up an array of DSM programs. The more experienced utilities could also benefit from the workshops, since it would provide them with a forum in which they could discuss new program concepts, as well as ideas on how to improve their existing programs. The state of New York has implemented such a program, which brings together national experts and in-state utility DSM personnel. Wisconsin has set up the Center for Demand-Side Research which has a somewhat similar objective. Various approaches to collective information sharing are also occurring in other parts of the country, and such a system can only help Missouri utilities to run more effective DSM programs.

Natural Gas Utility IRP Process

In our survey of the gas utilities of Missouri, as noted above, we found virtually no DSM activity in the state. This lack of activity provides a huge opportunity for the Missouri PSC to promote DSM on the part of gas utilities by initiating a gas Integrated Resource Planning (IRP) process in the state. Kansas has recently drafted gas IRP rules, and New Jersey drafted a gas DSM rule in November of 1991. The amount of energy that can be conserved in the state through DSM by the gas utilities is likely to be very significant. Natural gas IRP would allow the gas utilities to begin to play a significant role in the promotion of natural gas conservation in the state.

Opportunities in EPAct to Promote Natural Gas Vehicles

The proliferation of natural gas vehicles is something that the natural gas utilities of Missouri should keep a close eye on. There is potential for an increase in natural gas sales if natural gas vehicles can gain a share of the vehicle market. That is why the natural gas utilities should be paying close attention to the fleet guidelines, found in EPAct, with regard to the percentage of alternatively fueled vehicles.

EPAct includes an opportunity for the gas utilities of Missouri to be at the forefront of technology with the promotion of natural gas vehicles. EPAct has stringent guidelines concerning the percent of fleet vehicles that will have to be powered by alternative fuels by the late 1990s. The Act also authorizes the Federal Energy Regulatory Commission to allow advance recovery of research, development and demonstration costs by the Gas Research Institute for transportation-related and emissions-related natural gas projects. This legislation provides an excellent opportunity for the gas utilities to begin to develop natural gas vehicles in Missouri.

Become Green Light Partners

At the time of this report, Kansas City Power and Light, City Utilities of Springfield, Graybar Electric Company, Missouri Valley Electric Company, and Union Electric Company are partners in the EPA's Green Lights program. Other utilities should consider joining the program since it could serve a dual purpose for them. First, it could save them money on their own energy expenditures, and second, it could let their customers know that the utility is serious about conserving electricity.

Once a contract is signed between the EPA and a new "Green Lights Partner" a survey of all of the facilities is conducted with consideration of a full set of lighting options to maximize energy savings. These savings will provide an annualized internal rate of return equivalent to the prime interest rate plus six percentage points. Ninety percent of the square footage for which retrofits are appropriate must be retrofit within five years of signing the contract. The facilities will be re-surveyed no later than five years after completing the retrofit. The contract also calls for an agreement to educate employees on the benefits of energy efficient lighting products and to encourage employees to purchase them.

Develop Comprehensive New Construction Programs

New construction is one of the most important markets to reach as far as DSM is concerned. Once a home is built and occupied, it is much more difficult to install conservation measures. An opportunity exists for electric utilities in Missouri to develop comprehensive programs for new construction. New construction is one of the programs that UE is looking at for possible future opportunities, but there needs to be a solid commitment.

The adoption of an energy efficiency building code as the standard for Missouri would be a positive first step, that the legislature can take, to encourage the development of new construction programs. These building codes would provide a baseline from which the utilities could work in their analysis of the energy efficiency of new homes.

An important aspect of a successful new construction program is the inclusion of all parties involved in the new home market. This should include builders, lenders, and buyers. The development of such a program also provides an opportunity for the utility new construction programs to work in concert with a state home energy rating system.

New construction programs need to concentrate a significant amount of effort before construction begins. Designers and builders must be convinced that installing energy efficient products will help and not hinder the marketability of a house. If these groups are convinced that the utility program will sufficiently offset the incremental costs of the efficiency measures, then they will be more likely to install the measures in the first place. Home buyers must also be a key target for the new construction program. These individuals need to be assured that the savings that will result from lower energy bills will outweigh the initial incremental costs of building an energy efficient home.

The typical delivery mechanisms for new construction programs is through financial incentives, design assistance and training for builders, and marketing to potential home buyers. The builders must install measures that exceed the program standards in order to qualify for the incentives. The builders also attend a training workshop on the techniques of energy efficient construction. The plans for the home are submitted to the utility for approval, and inspections are made throughout the construction process to ensure that the home will live up to the design standards. Once a qualifying home is complete, it is certified by the utility, and the builder is certified as able to construct energy efficient homes.

There are a number of effective new construction programs that are run by utilities all across North America. New England Electric Systems (NEES) offers their Energy Crafted Home program to target the new construction market in New England. The program goal is to encourage the construction of homes that exceed the current building code standards in New England. Incentives and training for builders along with marketing the program to prospective home buyers are the primary means of ensuring that energy efficient homes are built. NEES provides the incentives to the builders for equipment that meets the efficiency standards of the program. The utility also pays the support services if the builder is a first time builder of an Energy Crafted Home. The utility analyzes the plans for the home to make sure that it conforms to the program requirements. Once that plans have been approved, the utility does on-site audits during construction to ensure that the home is being built in accordance with the plans.

When the home is completed, it is certified. The builder also becomes a certified Energy Crafted Home Builder. One example of the success of this program is an Energy Crafted Home that was built in Southbridge, MA. The utility paid out $1,800 in builder incentives and $665 for support services for the first-time Energy Crafted Home Builder. The estimated customer benefit is $208/year in lower energy bills. The utility benefits are that 3.6 kW of winter peak demand have been saved, along with 2,227 kWh of annual energy savings.

Work with State Agencies to Target Industrial Customers

Some of the best opportunities to save energy can be found in the industrial sector. Owing to their use of highly energy intensive end-uses, industrial facilities tend to be the largest consumers of electricity in any utility service territory. Currently, Kansas City Power and Light is the only utility in Missouri that is offering a full scale industrial DSM program. It is clear that there must be a concerted effort on the part of the other Missouri electric utilities to increase their efforts to target industry for DSM programs. Since the Division of Energy operates a program that is designed to give energy audits and some financial assistance, in the form of low interest loans, to industrial facilities, the state and utilities should explore potential partnerships.

A key element to a successful industrial DSM program is convincing the industrial customer that the ultimate goal of the program is not only to save electricity, but to save money. Since this program is dealing with businesses that operate with profit as their goal, it is not enough for the utility to tell the company that an audit shows it can save energy. The utility must also outline the amount of money that can be saved over the life of the measures that the audit indicates to be cost-effective. The utility must be diligent about explaining the payback period. If the company is aware of the fact that the money that it spends on the upgrades will be recovered in full, through lower energy bills, then they it will be much more willing to accept this initial expenditure.

NEES has an industrial efficiency program that has provided cost-effective retrofit savings to a number of industries around New England through the Design 2000 program. The Design 2000 program offers incentives to building owners and trade allies for incorporating energy efficient equipment and design into new construction and retrofit projects in industry. The program includes a long list of measures including energy efficient lighting; heating, ventilation and air conditioning systems and controls; storage cooling; refrigeration; motors and adjustable speed drives; building envelope measures such as wall and roof insulation and energy efficient windows; and food service and industrial process efficiency improvements.

The incremental cost of the energy efficiency measures is covered through financial incentives. Both fixed and custom rebates are made available. Design incentives are also offered to help offset the cost of engineering design services that evaluate building efficiency options. A pre-installation review of the facilities or plans is conducted once a customer has applied for the program. The utility pays the incentive after the installation has been verified. Advance payment is also an option once construction has been verified.

An example of the effectiveness of this program can be seen in upgrades that NEES performed for Milton-Bradley in East Longmeadow, MA. The energy efficiency measures that were installed cost the utility $1,574,175. But the savings to the customer will be approximately $594,177 per year. The utility will also benefit through a 1,510 kW peak demand reduction, and an annual savings of 8,474 MWh.

CHAPTER V
RECOMMENDATIONS

Introduction

The investment in energy efficiency is an excellent economic opportunity for Missouri, as it is for other states. With the information base and analyses provided by the *Missouri Statewide Energy Study* of 1992, the requirements and opportunities of the Energy Policy Act of 1992, this Report and with the experiences of other states, Missouri is now well-positioned to make sound energy decisions. Unforeseen situations and opportunities for the state will arise which this Report cannot predict. ***However, the recommendations contained in this Report provide a timely, solid basis from which Missouri can actively move forward in a responsible manner.***

In the process of developing a comprehensive set of recommendations for the state of Missouri, there are two dominant considerations. First, is that, historically, we have measured success of our energy efficiency programs in terms of number of contacts made, number of technical studies initiated, number of audits completed or number of dollars spent. These can not be the measures of success for the future; energy saved should be the key measure of success of any of our recommendations. Second, all of our programs should rest on a foundation of partnerships among all of the various stakeholders. This will ensure the greatest potential for success.

Our technical analysis reveals the cost-effectiveness of investing in the energy efficiency of Missouri's buildings. Integral to this Report is the basic assumption that making the most efficient use of energy while also improving both the economy and the environment will be the measure of our success. Saving energy is the foundation of all the program recommendations. It is our conviction that key to improving the energy efficiency of buildings and reducing the amount of energy consumed within the state, is a reordering of the way we develop and provide services. It is the reorganization of programs and our philosophical base, that will provide for the creation of new opportunities for energy efficiency in Missouri.

The recently published book, *Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector*, authored by David Osborn and Ted Gaebler, has been widely discussed as a model for the new partnerships for the nineteen-nineties. The authors established a strong framework for their observations and recommendations. They included four points about government in their introduction:

> *First we believe deeply in government....Second, we believe that civilized society cannot function* ***effectively*** *without* ***effective*** *government....Third, we believe that the people who work in government are not the problem; the systems in which they work are the problem....Fourth, we believe that neither traditional liberalism nor traditional conservatism has much relevance to the problems governments face today.*

This section was restated in the introduction to *Creating A Government That Works Better and Costs Less*, the Report of the National Performance Review by Vice President Al Gore released in the fall of 1993. In both books, the authors were making the case that the critical issue for our future success is not just *what* government does but also *how* it does it. It is in this context we are recommending a change in how the state of Missouri promotes energy efficiency and how it delivers services to the residents of the state.

The National Performance Review indicated some important benefits of making government more effective and efficient that could complement Missouri's efforts to increase the efficiency of the state. Although all of the details are not yet developed and some require legislation, some of the recommendations of the National Performance Review include:

- *Congress should allow states and localities to consolidate separate grant programs from the bottom up.* - Depending on how this is implemented, some of the various categorical grants could be combined, such as Weatherization Assistance and Low Income Home Energy Assistance.
- *Give all cabinet secretaries and agency heads authority to grant states and localities selective waivers from federal regulations or mandates.* - Many of the categorical grant programs come with extensive federal requirements. As innovative programs are developed, this might provide the opportunity to test new program approaches.
- *Strengthen the Federal Energy Management programs.* - Although this is primarily directed at federal facilities, the focus on buildings in Missouri and the lessons learned from improved efficiency at these facilities may be useful to Missouri.
- *Redirect Federal Energy Laboratories to post cold war priorities.* - As the national laboratory system changes, Missouri should prepare itself to work with them. For example, the National Renewable Energy Laboratory operated by Midwest Research Institute in Kansas City is developing more programs to assist state and local governments to reduce energy use and increase the use of renewable energy resources.

Our recommendations are aimed at achieving actual, cost-effective savings while encouraging partnerships among the many public and private participants. The first part of the recommendations addresses the use of rating systems, standards and codes to achieve energy efficiency. The second part recognizes the opportunity for partnerships to develop strategies and programs for the long-term economic and environmental benefit of the state. The last part of the recommendations outlines specific programmatic opportunities that can and should be immediately pursued.

Energy Efficiency Through Rating Systems, Standards and Codes

There are basic methods of ensuring that buildings meet minimum energy efficiency levels - codes or standards and rating systems. As has been described, the Energy Policy Act of 1992 (EPAct) establishes certain responsibilities for Missouri in terms of examining how its building codes deal with energy efficiency. EPAct also sets requirements for federally insured mortgage programs to require minimum levels of energy efficiency. And finally, it will standardize energy rating systems across the country. In order to comply with EPAct requirements Missouri must take steps to improve the energy efficiency of its buildings. This section details our recommendations regarding codes, standards and rating systems.

Residential Codes and Standards

✔Adopt a state-specific *residential energy standard,* equivalent to MEC 92, that provides two alternatives for compliance: a prescriptive path and a "points-based" path.

Missouri is obligated to certify to the Department of Energy (DOE) that it has reviewed the merits of state-wide residential energy standards relative to the Council of American Building Officials Model Energy Code 1992 (MEC 92) and has reported the results of such review. Missouri is not obligated to adopt and implement MEC 92 or any other residential energy code/standard, as the response by states to the EPAct provision is voluntary. However, there are several compelling reasons why Missouri should seriously consider adoption and implementation of a state-wide residential energy standard:

- the availability of certain Federal mortgage financing for new homes is now tied to meeting MEC 92 (or equivalent) efficiency levels, so many Missouri lending institutions, builders, and home buyers are already affected by minimum residential energy requirements;
- our assessment indicates that significantly higher levels of energy efficiency beyond current construction practices can be justified on a net cash flow/affordability basis (i.e. no "out of pocket" cost increase to the homeowner); and,
- more energy efficient housing results in a reduction of electrical demand, lessening or forestalling the construction of new power plants; such housing also uses less energy, reducing the amount of environmental emissions associated with fossil fuel energy use.

If a state-wide residential code is pursued, Missouri has three basic options that will most readily satisfy the Department of Energy that Missouri's code meets or exceeds MEC 92: (1) Adopt and implement MEC 92 (or MEC 92 with supplements);

(2) Codify ASHRAE Standard 90.2 (with modifications); or, (3) Develop a Missouri-specific Standard Using DOE's Automated Standards System.

These options are quite different in nature, and will yield significantly different programmatic and technical results. Of these, Missouri should choose the option that meets a majority of the following criteria:

- allow for more than one compliance path without requiring computer calculations;
- based on prevailing economics and Missouri utility and construction cost data;
- reflect prevailing construction practices in Missouri;
- address, in addition to insulating properties of construction assemblies, key aspects that affect residential energy use (e.g. air tightness, window orientation, mechanical system sizing);
- encourage use of designs or systems that use renewable energy;
- account for Missouri climatic conditions, which means accounting of heating <u>and</u> cooling requirements;
- encourage (not require) the use of space conditioning and water heating equipment which exceed the Federal minimum standard;
- be generated using credible energy analysis procedures;
- be designed to simplify the implementation, builder compliance, and enforcement processes; and,
- be easily updated.

This recommendation envisions a standard equivalent, but not necessarily identical to MEC 92, which is the suggested residential energy code in EPAct. Significant drawbacks to MEC 92 are:

- it meets very few of the objectives listed above;
- it is not a builder-friendly document or process;
- its <u>pairing</u> of compliance paths is not well suited for most homebuilders, financial institutions, or enforcement agencies (a prescriptive approach which may limit design and construction flexibility or a computerized performance approach which may be impractical and cumbersome for most builders, lenders and enforcement agencies);
- it does not adequately address the importance of cooling in Missouri housing;
- it does not distinguish between unheated and heated basements;
- it does not consider location of ductwork (as ASHRAE 90.2 does);
- it uses an archaic U_o format that is intended to ensure overall thermal integrity but is extremely cumbersome to use, communicate and enforce; and,

- it has an overly stringent requirement for foundation insulation for unheated, deep basements (for heated basements, the requirement is generally appropriate).

A better standard option for Missouri than MEC 92 is the American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 90.2, although it has similar drawbacks (same pairing of compliance paths, use of U_o values, treatment of basements, etc.).

Tools are available to help Missouri develop its own MEC 92 equivalent standard. The Department of Energy has developed software that is intended to assist states or local jurisdictions develop location-specific residential energy standards. The software, *Automated Residential Energy Standard* (ARES), accounts for varying economic conditions such as mortgage rates and utility costs and can be based on Missouri-specific construction and energy measure costs. Use of *ARES* with prevailing economic data would provide Missouri a better tailored residential energy standard.

Once a standard is generated, *it must be properly packaged* to communicate its requirements and to minimize administrative burdens for builders, lenders, and enforcement agencies. The state of New York recently amended its residential construction code. It provides Missouri one of the best "off-the-shelf" models for a residential code of any state code reviewed (subject to simplification and adjustment for Missouri values). It provides a prescriptive set of requirements, but it *also provides an alternate points-based compliance path*. The popularity and usability of the point-based path has also been demonstrated in other states, notably California and Florida.

The inclusion of a point-based approach in a state-wide residential code allows design and construction flexibility but precludes the need for the builder and/or the enforcement agency to conduct and compare computerized results. A combination of prescriptive or point-based paths is consistent with the DOE voluntary residential standard approach. Also, the Kansas City Home Builders Association's *SAVE*™ program, which is a blend of prescriptive and points-based approaches, may serve as a "home-grown" model for packaging Missouri's residential standard, because of it's ease of use by builders, lenders, and enforcement agencies.

Home Energy Rating System

✔Adopt a state-wide *home energy rating system based on the* residential energy standard, and use the standard as an equivalent substitute for MEC 92 for builders, home buyers, and lenders participating in HUD/DoA-backed mortgage programs.

A state-wide home energy rating system will best serve the state if it is developed in direct coordination with:

- efforts to develop a state-wide residential energy standard ;
- lenders and Federal agencies who are required to determine compliance of new housing financed with U.S. Department of Housing and Urban Development (HUD)/U.S. Department of Agriculture (DoA)-backed mortgages; and,
- utility demand side management programs.

The point-based approach that is recommended as part of the state-wide standard for new housing is also highly applicable to the energy rating concept for existing housing. An example of the advantage of this would be the case of a new home built to the state-wide points-based standard selling three years hence. That house could be easily re-rated (as an existing home) based on the same point-based system established in the residential energy standard.

HUD/DoA-backed housing is generally applicable to smaller, less expensive housing because of loan amount limits. Responding to MEC 92 requirements and its complex calculations, places an unreasonable burden on small builders or builders with very tight margins. Given the deficiencies of MEC 92 and the advantages of a Missouri-specific residential energy standard based on either a prescriptive or points-based approach, the state-wide standard could be used in lieu of MEC 92 for HUD/DoA-backed financing programs if certification is provided to DOE that Missouri's standard meets or exceeds MEC 92. Such certification would also likely be required by HUD and/or DoA.

Utility demand side management (DSM) programs for residential buildings could be based on the point-based system used in the state-wide standard or home energy rating system. Utility DSM incentives such as avoided capacity credits (i.e. kW reduction or reduced cooling tonnage) could be based on a higher level of energy efficiency than required by the state-wide standard yet be determined by the same points-based system.

Commercial Codes and Standards

✔Adopt a state-specific *commercial energy standard* based on ASHRAE Standard 90.1-1989 that provides two alternatives for compliance: a prescriptive path and a "trade-off" path.

Although recent problems in the rapidly growing areas around Branson have prompted calls for a statewide building code, code jurisdiction (for other than state-owned buildings) lies with local, county and municipal governments. Some people have advocated that language in Section 101 of EPAct be interpreted to require states without statewide building energy codes to adopt one. Others consider local adoption under state encouragement or mandate only an alternative for achieving the intent of EPAct. Either way, the intent of Congress is clear. States and/or a majority of local jurisdictions should adopt commercial building energy standards, although the Federal government has little leverage and few incentives to pressure or encourage states/local jurisdictions to comply.

However, there are several compelling reasons why Missouri should seriously consider adoption and implementation of a state-wide commercial energy standard. First is that this assessment indicates that significantly higher levels of energy efficiency beyond current construction practices can be justified on a net cash flow/affordability basis (i.e. no "out of pocket" increase to the building owner).

Second, the more energy efficient commercial buildings results in a reduction of electrical demand, lessening or forestalling the construction of new power plants; such buildings also uses less energy, reducing the amount of environmental emissions associated with energy use. A less compelling reason, but a consideration, is Section 141 of EPAct which requires that states must adopt commercial energy standards that meet or exceed ASHRAE 90.1-1989 in order to be eligible for a grant of up to $1 million per year for a revolving loan fund to improve the efficiency of state and local government buildings.

If a state-wide commercial code is pursued, Missouri has two basic options that will most readily satisfy the Department of Energy that Missouri's commercial code meets or exceeds ASHRAE 90.1-1989:

- Adopt, Codify and Implement ASHRAE 90.1-1989 (there are no other consensus standards).
- Adopt, Codify and Implement a Simplified Version of ASHRAE 90.1-1989.

Any state-wide commercial building code should be user friendly and relatively convenient to use. A simplified Version of ASHRAE 90.1-1989 state-wide program would:

- provide simplified tables specific to each building type, minimizing time required for interpretation by building designers and code officials.
- provide simplified method of trade-off for envelope components.
- provide clear check lists for compliance.
- include a concise non-mandatory section on guidelines for other high value opportunities, such as control systems.

The rationale for adopting a simplified version is that ASHRAE Standard 90.1-1989, the prescribed energy standard in EPAct, has several drawbacks in its current version:

- ASHRAE Standard 90.1-198 is highly redundant to new minimum equipment performance standards set forth by EPAct. By using ASHRAE Standard 90.1-1989 in its present form, Missouri would be in effect trying to prevent the use of equipment that had already been eliminated from the market by federal standards.
- Lighting power limits contained in ASHRAE Standard 90.1-1989 are, in general, higher than most current practice.
- Window area requirements force a use of trade-offs, a complex process in ASHRAE Standard 90.1-1989 that causes the standard to dominate the design process.
- Thermal storage is not addressed.
- Air quality is addressed only by reference to ASHRAE Standard 62.
- Important details regarding equipment controls are not included.

Energy Standards for Manufactured Housing

✔**Develop *energy efficiency standards for manufactured housing.***

EPAct requires the Secretary of the Department of Housing and Urban Development (HUD) to develop new energy efficiency standards for these manufactured housing units and allows states to set standards at or above these levels established by HUD. Missouri has a significant amount of manufactured housing that could benefit from a higher level of energy efficiency. By developing statewide standards that are comparable to the HUD developed standards, we can ensure that the owners and tenants of these units would be able to benefit from cost-effective investments in energy efficient construction.

Partnerships for Developing and Implementing Energy Strategies

A key first step for Missouri is to ensure that we integrate the various energy efficiency programs, to the maximum extent possible, both within government and outside of government. Vice President Al Gore's National Performance Review, described it as "...across all levels of government, we need collaborative, community-based, customer driven approaches through which providers can integrate the full network of services."

The rationale for the following recommendation is the notion that *we are all in this together.* By bringing the various energy efficiency service providers together with the service recipients, we can develop new ways of operating programs and ensuring quality service delivery. EPAct provides Missouri with a host of opportunities and some requirements to improve the efficiency within the state.

✔The Energy Futures Coalition should work closely with state governmental entities, utilities, private business, design, development and construction professionals, nonprofit and citizens groups and other interested parties to develop cooperative methods for the delivery of energy-efficiency services in Missouri.

There are two primary sources of information and services regarding energy efficiency in Missouri - state government and utilities. In addition, there are a number of other groups from community based agencies to universities to trade associations that to some degree provide information and services.

Our analysis of the current program alignment in Missouri shows that a variety of programs are operated by various departments of state government, utilities and private sector sources. These programs are rarely integrated in their service approach. A partial listing of services and providers for the residential sector may be illustrative of the array of programs.

- **Energy Efficiency Information** - Division of Energy, University Extension, Utilities, Private Business, non-profit agencies, local governments, media
- **Energy Audits** - Utilities, local agencies, Division of Energy, private business
- **Financing** - Missouri Housing Development Commission, Utilities, Banks and lending institutions

The services and providers for the industrial sector are similar in their diversity:

- **Information** - Division of Energy, Department of Economic Development, University of Missouri, Utilities, Private Business
- **Audits** - Private Business, Utilities
- **Financing** - Banks, Division of Energy, Environmental Improvement and Energy Resources Authority, Department of Economic Development

A situation where the customer or the client does not know where to turn for the most complete service, inhibits the delivery of those services. Studies on energy efficiency decision making often show that the gaps in service delivery between information, audits, financing, construction and inspection and training are often the reason why individuals do not carry through on efficiency projects.

To improve the efficiency and effectiveness of the delivery of services, we must consider ways to rearrange the structures that provides those services. The key consideration in that restructuring should be the consumer and user of those services to allow their effective delivery. The programs we develop need to be:

- Client centered
- A team services approach
- Involving public/private partnerships
- Geographically disbursed around the state
- Measuring success in energy saved

A key aspect of making programs work is to orient them toward the client they are intended to serve. There should be specific and distinct programs aimed at the residential, commercial, industrial, institutional, government and other markets. Too often, we design and implement programs that are aimed at too many groups with differing interests. We water down the components of the programs to make them palatable and understandable to all of the potential participants, consequently they may become useless to many of the prospective customers. To improve service delivery, we must start by attacking the problem from the perspective of the client, not from the perspective of the service provider.

State government has created a myriad of programs that are housed in different departments often serving the same clients with similar services. For example, a low income resident wanting to make their home more energy efficient may be referred to the Division of Energy Weatherization Assistance Program, or the Missouri Housing Development Commission home improvement loan program, or the Department of Social Services Low Income Home Energy Assistance Program or the University of Missouri Extension. In most cases, one department will not know that the client requested and/or received services from any other department. Yet the goal for all of the departments is to help the client.

The same issues that government faces also occur in the private, non-governmental sectors. Utility assistance programs operated by community agencies might not refer clients to weatherization services; equipment suppliers might not be aware of financing programs; local government small business assistance programs might not be integrated with utility energy efficiency programs. We must develop an infrastructure that helps bridge the service gaps between the various state departments, private businesses and other interested in promoting energy efficiency.

Most governmental programs have come with strict guidelines and rules. And the adherence to those rules has often served as a barrier to integrating various programs, particularly between the public and private sectors. We need to explore ways to break down those barriers to create less rigid yet accountable partnership programs between public resources and private resources.

A client looking for services does not want to have to make ten calls to get one unit of service. They want to see all their needs met in a *one-stop-shop* approach. To accomplish that, we should design programs that integrate all of the aspects of accomplishing energy efficiency into a unified team that provides services to the distinct client group. For example, that may mean an educator/trainer, technical analyst or engineer, financial advisor and construction management person may all be on a team to serve the needs of a single client. The team should include both public and private members.

Finally we must always remember the bottom line - improving the efficient use of energy. Programs need to be evaluated on their basis of actually increasing the energy efficiency of the client, or their conversion to a more environmentally sound and economical source of energy. We should measure the energy use of the clients before and after we work with them and record that improvement. For that is the most important measure of success for any energy efficiency program.

The *Missouri Statewide Energy Study* recommended that the Governor appoint an Energy Futures Coalition "to serve as a coordinating point for energy policy development." The Coalition's membership reflecting the partnership of citizens, government, business and community groups that are interested in promoting a more energy efficient future, can be a valuable resource for Missouri. The establishment of this Coalition coupled with a redefinition of the state's role in delivering energy efficiency services can lead to a new paradigm for service delivery in Missouri.

Energy Efficiency Program Opportunities for Action

Introduction

In keeping with a new vision of how we provide services in Missouri, our recommendations for program opportunities are based on the concept that we must start with a customer perspective. To that end, the following recommendations are aimed at creating the tools, resources and infrastructure to assist all Missourians to improve the efficiency of their energy use.

It is important to note that these recommendations are not all intended for implementation solely by state government. There are ample opportunities for public/private collaborative efforts to accomplish the broad goal of improved energy efficiency. Some of the references for these recommendations are based on the EPAct review in Chapter II and the Program Review in Chapter IV. The reader is encouraged to review the EPAct and Program Review Chapters to ensure full understanding of the nature of the recommendations.

There are six specific recommendations in this section. To encourage the implementation of each of the recommendations, an implementation plan should be developed to provide opportunities for action for each of the recommendations. Those opportunities for action should not be considered as the only actions that should be undertaken, but they should provide some direction to initiate implementation. Although the recommendations are not organized according to customer groups, for example, residential, commercial or industrial, one intent of this Report is to encourage the development of a comprehensive array of services for each distinct sector.

As the residential sector represents over fifty percent of all of the buildings in Missouri, effective programs will be necessary to achieve a substantial improvement in the energy efficiency for the state. For the residential sector, we are talking about thousands of individual decisions to save energy, as compared to a commercial building of 100,000 square feet, where one decision can affect as much energy consumption as 50 homeowners.

An important step in making residential buildings more efficient would be taken with the adoption of a Missouri specific energy standard as was described earlier. In addition, the creation of a residential energy rating system based on that energy standard would also provide the foundation for a more efficient residential sector.

In terms of the federal legislation, there are really three primary areas that the state of Missouri needs to consider, These are residential codes or standards, Home Energy Rating Systems and Energy Efficient Mortgages. The last two of these apply to both new and existing homes. In addition, utility demand side management programs will also have some components to address the energy use of the residential sector.

Although the commercial sector represents only sixteen percent of all the energy consumed in Missouri it uses almost thirty-five percent of all electricity consumed in the state. It is a sector in which a significant variation exists in the size and types of buildings that make it up, ranging from small one-room stores to large office towers. Addressing the needs of such a diverse population is difficult.

Our analysis of building efficiency has documented the opportunities to increase the energy efficiency of commercial buildings. The recommendation for commercial building standards is based on this analysis. An important consideration in insuring how increased commercial building efficiency is in the means of delivering programs to this diverse sector.

Institutional buildings include a wide variety of types and uses from small school buildings to large hospital complexes to multi-story offices to the State Capitol Building itself. The institutional sector includes facilities operated by state government, local government, university systems and private non-profit agencies. The services provided out of these facilities - health, education, government, social services and more - are vital to the well-being of Missourians. The amount of square footage of buildings to be heated, cooled and lighted in this sector is tremendous. The State, alone, operates in 61 million square feet of buildings. The energy savings potential is obviously also tremendous.

There are many state agencies now providing most of the components needed to carry out the programs necessary to reduce energy use in institutional buildings. The Division of Energy and the Division of Design and Construction provide technical assistance to other state agencies and other sectors. The Division of Energy, the Environmental Improvement and Energy Resources Authority. the Missouri Health and Educational Facilities Authority and the Board of Public Buildings are able to provide financing on a broad scale. There are many partners available including the university system and other state and private agencies to carry out energy efficiency activities. Coordination of these agencies and inclusion of additional services and investment from the private sector will offer the maximum potential for improving energy efficiency in institutional buildings.

The Industrial sector represents approximately seventeen percent of the total energy use within the state. Its use of energy has been declining in recent years. This is not primarily due to an increase in efficiency, but rather on the closing of a number of industrial plants within the state. The *Missouri Statewide Energy Study* outlined the relative efficiency per dollar of gross domestic product for Missouri and other

Midwestern states and six foreign countries. It showed Missouri using nearly twice as much energy per dollar of gross domestic product as West Germany and nearly three times as much as Japan. This difference in efficiency can give foreign competitors up to a five percent price advantaged over domestically produced goods. Improving efficiency makes us more competitive.

Improving industrial efficiency is primarily directed at motors, process heat and production related energy uses. Because individual industrial operations can be large energy users, they have received some attention from utilities and from private businesses that provide energy efficiency services. The recommendations in this section encourage further exploration of the opportunities for improving industrial efficiency and creating a framework for supporting these activities in Missouri.

Electric and natural gas utilities can play an important role in helping to overcome the economic, informational, and institutional barriers that deter utility customers from investing in energy efficiency options. Demand side management (DSM) programs offer resources that are often less expensive than the cost of increasing supply, so they offer cost saving benefits to the customer and environmental-quality and risk-reduction benefits to the utility. The electric utilities that serve most of the customers in the state operate some level of DSM programs.

The Integrated Resource Planning (IRP) process is the mechanism, required of investor-owned utilities, that identifies the mix of DSM and supply-side resources that can minimize the long-range costs of energy services. All sectors of utility service companies can participate in some form of long-range planning and management that will, through the direction of the Public Service Commission and the assistance of the Division of Energy, help the state in realizing its energy efficiency goals.

The transportation sector represents over forty percent of all of the energy used in Missouri. While the *Missouri Statewide Energy Study* examined ways to reduce overall transportation energy use, EPAct focuses on the potential of change to the use of alternative fuels, generally domestically produced fuels that cause less air pollution. Missouri has already implemented a number of efforts to develop alternative fueled vehicle strategies, so this recommendation primarily reviews the requirements of EPAct and recommends appropriate action to comply with it's requirements.

Program Recommendations

✔**Develop effective strategies to give Missourians from all sectors access to *reliable and usable energy information*, including a method to assure *access to reliable building energy audits and analysis* for all building owners or tenants.**

The first step to improving the energy efficiency of Missouri is to ensure that comprehensive, reliable and usable information is available to all of the citizens of the state. The information has to be focused on individual buildings and energy use, and one of the most effective methods of accomplishing that is to ensure that individual building analysis or audits are readily available. High quality, reliable energy audits should be available throughout the state. They should provide energy efficiency and investment information that is easily understood and readily usable in the selection of energy efficiency investments.

✔**Develop an effective variety of specific *financing mechanisms* for energy efficiency investments.**

Once the information is available on what is a cost effective energy efficiency investment, the next step is to develop the financing to assist in implementing a project. From the residential to the commercial and industrial to the governmental and institutional sectors, adequate sources of capital needed. The state has a number of financing programs for energy efficiency and capital improvements. Utilities have either implemented or are developing specific financing programs. EPAct provides a number of incentives for financing efficiency investments. To successfully implement energy efficiency projects in Missouri, the number and variety of financing programs should be promoted and integrated whenever possible. From the government's efforts should be made to encourage as much private sector participation as possible and economically feasible.

✔**Support and encourage *programs that promote energy efficiency* such as the Home Energy Rating Systems (HERS), Green Builder Councils and training and certification programs. Encourage the *transfer of successful experiences* by recognizing and promoting effective local and regional programs.**

Effective marketing is an important aspect of all successful businesses and services, and energy efficiency is no exception. To encourage investments in energy efficiency, promotional activities need to be implemented across Missouri. One easy first step would be the promotion of a residential energy rating system. Extensive promotion of a rating system will not only provide specific building information; a broad promotional effort will also raise the awareness of the value of energy efficiency and encourage people to take action. Coupled with the promotion of rating systems should be the establishment and/or expansion of local efforts to promote energy efficiency. These should be public/private efforts that include the building industry, utilities, community groups and government. One aspect of that promotion should be the recognition of successful efforts around the state and sharing information on programs that work.

✔**Assure continued, improved and cost-effective delivery of *energy efficiency services to low income households,* leveraging federal funding with utility and private sector participation.**

Low income household's energy expenses are a larger portion of their income than for other households, often over 25% of total expenses. Even though these families have a smaller income, their expenses for heating and cooling their homes can be equal to or greater than middle and upper income families. A significant reason for this is that these families tend to live in older, less well maintained properties with less efficient equipment. An important way of assisting these families is to improve the efficiency of their homes. Although federal funds are a significant source of support, these funds need to be leveraged with utility and private funds to extend their reach and impact. In addition, the low income weatherization programs should continually review the results of their energy efficiency installations to make the most cost effective investments possible.

✔**Promote the development and implementation of comprehensive *Integrated Resource Planning* including demand side management strategies.**

Integrated Resource Planning is an important shift in the way utilities will do business in the future, in Missouri. Investor owned electric utilities are just beginning the IRP process with the submission of Union Electric Company's plan last year. Others will follow shortly. The Public Service Commission is beginning to examine the IRP process for natural gas utilities. We should examine the potential of expanding this process to cooperative and municipal utilities and, encourage aggressive IRP implementation with all utilities. In addition, the process should include an examination of the use of renewable sources of energy and rate structures that reward conservation, not consumption.

✔**Ensure the development of an *alternative fuels infrastructure* that significantly contributes to the economic and environmental betterment of Missouri and support the *conversion of vehicles to alternative fuels*.**

Missouri has begun the process of conversion to alternative fueled vehicles after the passage of HB45. With the passage of EPAct, government and private fleets need to step up that conversion process, and we should encourage this in two general ways. First, the government should increase its conversions to help spur the market for these vehicles. Second, the private sector, utilities and government should work to create the infrastructure necessary to support use of alternative fueled vehicles.

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Missouri Public Service Company, filed June 8, 1993;
St. Joseph Light and Power Company, filed January 27, 1993;
Union Electric Company, filed January 14, 1993.

Technical Information

Impact of Energy Standards

The following tables, on pages 219-230, provide a summary of the impact of building to higher energy efficiency standards. There are separate tables for all residential buildings, all commercial buildings and tables for all buildings, commercial and residential combined.

Detailed tables and information on each of the specific buildings can be found in the technical work papers that are on file at the Environmental Improvement and Energy Resources Authority.

Building Specific Information

The following charts, on pages 231-284, provide a summary of the technical findings of each of the nine building types modeled in this analysis. The nine building types modeled were:

- Single Family - 1 Story
- Single Family - 2 Story
- Multi Family
- Small Office Building
- Large Office Building
- Retail Store
- Nursing Home
- Elementary School
- University Library

For each of the nine buildings, there are six charts that detail the findings of the technical analysis. The charts provide the following information for both the north and south zones:

- Building Boundary Energy
- Resource Energy
- Total Cost of Owning and Operating Building

Impact of Energy Standards

Summary Table

Residential Buildings (total, all types)

Peak Natural Gas Demand

(NEW buildings, Billion Btuh)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	0.862	0.743	13.81%	0.488	43.36%	0.379	56.03%
1996	0.831	0.716	13.82%	0.471	43.36%	0.365	56.02%
1997	0.826	0.712	13.81%	0.468	43.36%	0.363	56.03%
1998	0.830	0.716	13.81%	0.470	43.36%	0.365	56.03%
1999	0.830	0.716	13.80%	0.470	43.36%	0.365	56.03%
2000	0.832	0.717	13.80%	0.471	43.36%	0.366	56.03%
Total	5.011	4.320	13.81%	2.838	43.36%	2.204	56.03%
Cumulative	na	na		na		na	

Annual Natural Gas Use

(NEW buildings, Billion Btu)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	1636.070	1385.395	15.32%	1087.676	33.52%	987.660	39.63%
1996	1576.821	1335.070	15.33%	1048.338	33.52%	951.976	39.63%
1997	1567.565	1327.329	15.33%	1042.152	33.52%	946.336	39.63%
1998	1575.575	1334.145	15.32%	1047.466	33.52%	951.154	39.63%
1999	1575.375	1334.064	15.32%	1047.304	33.52%	950.986	39.63%
2000	1578.797	1336.985	15.32%	1049.572	33.52%	953.039	39.64%
Cumulative	31245.360	26093.435	16.49%	20671.069	33.84%	18803.473	39.82%

Annual Natural Gas Cost

(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	9.268	7.848	15.32%	6.161	33.52%	5.595	39.63%
1996	9.638	8.160	15.33%	6.408	33.52%	5.819	39.63%
1997	10.338	8.754	15.33%	6.873	33.52%	6.241	39.63%
1998	11.212	9.494	15.32%	7.454	33.52%	6.769	39.63%
1999	12.096	10.243	15.32%	8.042	33.52%	7.302	39.63%
2000	13.080	11.077	15.32%	8.696	33.52%	7.896	39.64%
Cumulative	244.400	206.947	15.32%	162.481	33.52%	147.542	39.63%

Annual Natural Gas Use

(ALL buildings, Billion Btu)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	150635.969	150385.295	0.17%	150087.576	0.36%	149987.560	0.43%
1996	151758.796	151266.371	0.32%	150681.919	0.71%	150485.542	0.84%
1997	152873.897	152141.236	0.48%	151271.607	1.05%	150979.414	1.24%
1998	153998.109	153024.019	0.63%	151867.711	1.38%	151479.206	1.64%
1999	155123.163	153907.762	0.78%	152464.694	1.71%	151979.871	2.03%
2000	156252.312	154795.099	0.93%	153064.619	2.04%	152483.262	2.41%
Cumulative	920642.25	915519.78	0.56%	909438.126	1.22%	907394.854	1.44%

Annual Natural Gas Cost

(ALL buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	853.315	851.895	0.17%	850.209	0.36%	849.642	0.43%
1996	927.590	924.580	0.32%	921.008	0.71%	919.808	0.84%
1997	1008.224	1003.392	0.48%	997.657	1.05%	995.729	1.24%
1998	1095.874	1088.942	0.63%	1080.713	1.38%	1077.949	1.64%
1999	1191.086	1181.754	0.78%	1170.674	1.71%	1166.951	2.03%
2000	1293.581	1281.655	0.92%	1267.492	2.02%	1262.734	2.38%
Cumulative	6369.670	6332.218	0.59%	6287.752	1.29%	6272.812	1.52%

Electric Peak Demand

(NEW buildings, mW)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	89.436	85.658	4.22%	64.499	27.88%	47.841	46.51%
1996	86.175	82.531	4.23%	62.157	27.87%	46.116	46.49%
1997	85.683	82.062	4.23%	61.796	27.88%	45.841	46.50%
1998	86.126	82.486	4.23%	62.113	27.88%	46.073	46.50%
1999	86.127	82.490	4.22%	62.109	27.89%	46.063	46.52%
2000	86.318	82.673	4.22%	62.245	27.89%	46.162	46.52%
Total	519.866	497.900	4.23%	374.918	27.88%	278.096	46.51%
Cumulative	na	na		na		na	

Annual Electricity Use

(NEW buildings, Million mWh)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	0.272	0.261	4.10%	0.226	17.03%	0.205	24.61%
1996	0.262	0.252	4.13%	0.218	17.04%	0.198	24.61%
1997	0.261	0.250	4.11%	0.216	17.03%	0.197	24.61%
1998	0.262	0.251	4.10%	0.218	17.03%	0.198	24.61%
1999	0.262	0.251	4.09%	0.217	17.03%	0.198	24.60%
2000	0.263	0.252	4.08%	0.218	17.03%	0.198	24.60%
Cumulative	5.562	5.334	4.11%	4.615	17.03%	4.194	24.61%

Annual Electricity Cost

(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	19.159	18.374	4.10%	15.896	17.03%	14.445	24.61%
1996	19.119	18.330	4.13%	15.862	17.04%	14.414	24.61%
1997	19.667	18.859	4.11%	16.317	17.03%	14.828	24.61%
1998	20.458	19.619	4.10%	16.973	17.03%	15.424	24.61%
1999	21.166	20.301	4.09%	17.562	17.03%	15.959	24.60%
2000	21.953	21.057	4.08%	18.215	17.03%	16.552	24.60%
Cumulative	438.749	420.738	4.11%	364.017	17.03%	330.785	24.61%

Annual Electricity Use

(ALL buildings, Million mWh)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	23.143	23.132	0.05%	23.097	0.20%	23.076	0.29%
1996	23.336	23.314	0.09%	23.020	1.35%	23.204	0.56%
1997	23.527	23.494	0.14%	23.392	0.58%	23.331	0.83%
1998	23.720	23.677	0.18%	23.540	0.76%	23.460	1.10%
1999	23.913	23.859	0.23%	23.906	0.03%	23.588	1.36%
2000	24.107	24.042	0.27%	23.837	1.12%	23.717	1.62%
Cumulative	141.746	141.517	0.16%	140.791	0.67%	140.377	0.97%

Annual Electricity Cost

(ALL buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	1628.803	1628.018	0.05%	1625.540	0.20%	1624.089	0.29%
1996	1699.854	1698.253	0.09%	1693.219	0.39%	1690.269	0.56%
1997	1773.780	1771.315	0.14%	1763.563	0.58%	1759.020	0.83%
1998	1850.914	1847.523	0.18%	1836.855	0.76%	1830.603	1.10%
1999	1931.280	1926.905	0.23%	1913.124	0.94%	1905.051	1.36%
2000	2014.318	2008.924	0.27%	1991.915	1.11%	1981.952	1.61%
Cumulative	10898.949	10880.937	0.17%	10824.216	0.69%	10790.984	0.99%

Construction Cost (labor)

(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Increase from C. P.	Enhanced Case	% Increase from C. P.	Resource Case	% Increase from C. P.
1995	843.439	11.525	1.37%	20.979	2.49%	34.539	4.10%
1996	837.449	11.387	1.36%	20.771	2.48%	34.245	4.09%
1997	864.178	11.787	1.36%	21.472	2.48%	35.370	4.09%
1998	899.906	12.288	1.37%	22.374	2.49%	36.844	4.09%
1999	933.750	12.785	1.37%	23.253	2.49%	38.260	4.10%
2000	969.191	13.280	1.37%	24.145	2.49%	39.720	4.10%
Total	5347.912	73.053	1.37%	132.994	2.49%	218.978	4.09%
Cumulative	na	na	na	na	na	na	na

Construction Cost (material)

(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Increase from C. P.	Enhanced Case	% Increase from C. P.	Resource Case	% Increase from C. P.
1995	1030.870	21.404	2.08%	38.961	3.78%	64.144	6.22%
1996	1023.548	21.147	2.07%	38.574	3.77%	63.598	6.21%
1997	1056.218	21.890	2.07%	39.877	3.78%	65.687	6.22%
1998	1099.885	22.820	2.07%	41.551	3.78%	68.424	6.22%
1999	1141.250	23.744	2.08%	43.183	3.78%	71.054	6.23%
2000	1184.567	24.664	2.08%	44.841	3.79%	73.767	6.23%
Total	6536.337	135.669	2.08%	246.988	3.78%	406.674	6.22%
Cumulative	na	na	na	na	na	na	na

"DSM" Avoided Capacity Payments and Externality Credits

(NEW buildings, $million)

kW pmts based on difference between Enhanced & Resource Cases

Externality pmts based on difference between Current Practice & Resource Case

	Avoided kW Demand	Avoided Gas Externalities	Avoided Electric Externalities
1995	6.365	0.175	0.936
1996	6.123	0.168	0.903
1997	6.094	0.167	0.897
1998	6.128	0.168	0.902
1999	6.134	0.168	0.901
2000	6.149	0.168	0.903
Total	36.995		
Cumulative	na	3.566	19.136

Notes:

Total values are the sum of six years.

Cumulative values are: six times 1995 + five times 1996..... + one times 2000.

Cumulative gas and electric costs are adjusted for cost increases. Cumultive externalities are fixed at levelized costs.

All residential sector fossil fuel energy use for 1994 and before bldgs is imbedded in the natural gas numbers.

All fossil fuel use in new residential buildings after 1995 is assumed to be gas.

Cumulative values include the sum of new buildings and remaining existing buildings.

Dollar values include inflation at 3.5% compounded. Construction costs and electricity prices are equal to inflation.

Natural gas prices include inflation, plus a 4.4% annual real price increase.

Impact of Energy Standards

Summary Table

Commercial Buildings (total, all types, including existing, code covered, code exempt)

Peak Natural Gas Demand
(NEW buildings, Billion Btuh)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	0.950	0.877	7.75%	0.785	17.45%	0.667	29.81%
1996	0.950	0.874	7.95%	0.782	17.72%	0.664	30.14%
1997	0.954	0.876	8.14%	0.781	18.07%	0.661	30.66%
1998	0.979	0.899	8.18%	0.801	18.22%	0.677	30.89%
1999	1.006	0.923	8.27%	0.821	18.42%	0.693	31.16%
2000	1.020	0.934	8.44%	0.830	18.69%	0.699	31.47%
Total	5.860	5.383	8.13%	4.799	18.10%	4.060	30.71%
Cumulative	na	na		na		na	

Annual Natural Gas Use
(NEW buildings, Billion Btu)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	793.832	656.599	17.29%	583.542	26.49%	500.391	36.97%
1996	808.164	669.044	17.21%	593.713	26.54%	508.706	37.05%
1997	817.473	675.171	17.41%	597.416	26.92%	510.210	37.59%
1998	827.320	680.377	17.76%	600.309	27.44%	511.210	38.21%
1999	838.243	685.906	18.17%	603.114	28.05%	512.241	38.89%
2000	844.280	687.581	18.56%	602.488	28.64%	510.893	39.49%
Cumulative	17076.426	14086.029	17.51%	12469.121	26.98%	10655.726	37.60%

Annual Natural Gas Cost
(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	4.625	3.826	17.29%	3.400	26.49%	2.916	36.97%
1996	5.081	4.206	17.21%	3.733	26.54%	3.198	37.05%
1997	5.545	4.580	17.41%	4.053	26.92%	3.461	37.59%
1998	6.056	4.980	17.76%	4.394	27.44%	3.742	38.21%
1999	6.620	5.417	18.17%	4.763	28.05%	4.046	38.89%
2000	7.196	5.859	18.56%	5.134	28.64%	4.354	39.49%
Cumulative	128.626	106.078	17.53%	93.881	27.01%	80.213	37.64%

Annual Natural Gas Use
(ALL buildings, Billion Btu)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	79588.164	79450.932	0.17%	79377.874	0.26%	79294.724	0.37%
1996	79777.907	79501.555	0.35%	79353.166	0.53%	79185.009	0.74%
1997	79973.557	79554.904	0.52%	79328.759	0.81%	79073.397	1.13%
1998	80170.740	79605.144	0.71%	79298.931	1.09%	78954.470	1.52%
1999	80368.768	79650.835	0.89%	79261.830	1.38%	78826.496	1.92%
2000	80560.361	79685.729	1.09%	79211.631	1.67%	78684.702	2.33%
Cumulative	480439.50	477449.10	0.62%	475832.191	0.96%	474018.796	1.34%

Annual Natural Gas Cost
(ALL buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	463.728	462.929	0.17%	462.503	0.26%	462.019	0.37%
1996	501.556	499.818	0.35%	498.888	0.53%	497.828	0.74%
1997	542.506	539.666	0.52%	538.132	0.81%	536.400	1.13%
1998	586.807	582.667	0.71%	580.426	1.09%	583.124	0.63%
1999	634.729	629.059	0.89%	625.987	1.38%	622.549	1.92%
2000	685.989	678.627	1.07%	674.637	1.65%	670.203	2.30%
Cumulative	3415.315	3392.767	0.66%	3380.571	1.02%	3372.122	1.26%

Peak Electrical Demand
(NEW buildings, mW)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	107.432	102.078	4.98%	83.855	21.95%	74.144	30.99%
1996	109.100	103.443	5.19%	84.953	22.13%	75.130	31.14%
1997	110.254	104.355	5.35%	85.475	22.47%	75.486	31.53%
1998	112.039	106.041	5.35%	86.735	22.59%	76.629	31.61%
1999	114.656	108.466	5.40%	88.595	22.73%	78.282	31.72%
2000	117.423	110.946	5.52%	90.503	22.93%	79.913	31.94%
Total	670.905	635.328	5.30%	520.115	22.48%	459.583	31.50%
Cumulative	na	na		na		na	

Annual Electricity Use
(NEW buildings, Million mWh)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	0.270	0.255	5.50%	0.215	20.45%	0.197	27.07%
1996	0.276	0.261	5.48%	0.220	20.54%	0.201	27.12%
1997	0.280	0.265	5.54%	0.222	20.82%	0.203	27.43%
1998	0.284	0.268	5.60%	0.224	20.97%	0.206	27.53%
1999	0.290	0.273	5.66%	0.228	21.12%	0.210	27.65%
2000	0.296	0.280	5.69%	0.234	21.24%	0.214	27.80%
Cumulative	5.849	5.525	5.54%	4.637	20.72%	4.252	27.31%

Annual Electricity Cost
(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	20.294	19.179	5.50%	16.150	20.42%	14.806	27.04%
1996	21.504	20.325	5.48%	17.094	20.51%	15.679	27.09%
1997	22.577	21.327	5.54%	17.885	20.78%	16.392	27.40%
1998	23.660	22.334	5.60%	18.707	20.93%	17.154	27.50%
1999	24.979	23.566	5.66%	19.714	21.08%	18.082	27.61%
2000	26.453	24.948	5.69%	20.846	21.19%	19.110	27.76%
Cumulative	493.322	465.976	5.54%	391.230	20.69%	358.715	27.29%

Annual Electricity Use
(ALL buildings, Million mWh)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	20.279	20.264	0.07%	20.224	0.27%	20.206	0.36%
1996	20.398	20.368	0.15%	20.072	1.60%	20.250	0.73%
1997	20.521	20.475	0.22%	20.350	0.83%	20.296	1.10%
1998	20.645	20.583	0.30%	20.415	1.11%	20.342	1.47%
1999	20.772	20.694	0.37%	20.705	0.32%	20.389	1.84%
2000	20.902	20.808	0.45%	20.548	1.69%	20.437	2.23%
Cumulative	123.517	123.192	0.26%	122.315	0.97%	121.919	1.29%

Annual Electricity Cost
(ALL buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	1532.090	1530.975	0.07%	1527.946	0.27%	1526.602	0.36%
1996	1594.936	1592.603	0.15%	1586.238	0.55%	1583.431	0.72%
1997	1660.555	1656.891	0.22%	1646.861	0.82%	1642.463	1.09%
1998	1728.930	1723.812	0.30%	1709.803	1.11%	1703.698	1.46%
1999	1800.326	1793.615	0.37%	1775.264	1.39%	1767.313	1.83%
2000	1874.060	1865.657	0.45%	1842.694	1.67%	1832.784	2.20%
Cumulative	10190.898	10163.552	0.27%	10088.806	1.00%	10056.291	1.32%

Construction Cost (labor)
(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Increase from C. P.	Enhanced Case	% Increase from C. P.	Resource Case	% Increase from C. P.
1995	194.135	2.905	1.50%	6.626	3.41%	16.196	8.34%
1996	205.496	3.037	1.48%	7.034	3.42%	17.151	8.35%
1997	218.631	3.204	1.47%	7.484	3.42%	18.247	8.35%
1998	233.506	3.405	1.46%	7.945	3.40%	19.469	8.34%
1999	250.225	3.636	1.45%	8.507	3.40%	20.842	8.33%
2000	265.968	3.864	1.45%	9.118	3.43%	22.139	8.32%
Total	1367.961	20.051	1.47%	46.713	3.41%	114.043	8.34%
Cumulative	na	na	na	na	na	na	na

Construction Cost (material)
(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Increase from C. P.	Enhanced Case	% Increase from C. P.	Resource Case	% Increase from C. P.
1995	776.540	11.621	1.50%	26.504	3.41%	64.784	8.34%
1996	821.985	12.147	1.48%	28.135	3.42%	68.602	8.35%
1997	874.522	12.815	1.47%	29.934	3.42%	72.988	8.35%
1998	934.026	13.619	1.46%	31.781	3.40%	77.876	8.34%
1999	1000.901	14.544	1.45%	34.026	3.40%	83.368	8.33%
2000	1063.870	15.457	1.45%	36.470	3.43%	88.554	8.32%
Total	5471.844	80.202	1.47%	186.850	3.41%	456.172	8.34%
Cumulative	na	na	na	na	na	na	na

"DSM" Avoided Capacity Payments and Externality Credits
(NEW buildings, $million)
kW pmts based on difference between Enhanced & Resource Cases
Externality pmts based on difference between Current Practice & Resource Case

	Avoided kW Demand	Avoided Gas Externalities	Avoided Electric Externalities
1995	3.816	0.090	1.688
1996	3.866	0.091	1.721
1997	3.935	0.094	1.763
1998	3.983	0.096	1.803
1999	4.067	0.099	1.845
2000	4.178	0.101	1.874
Total	23.846		
Cumulative	na	1.958	36.758

Notes:
Total values are the sum of six years.
Cumulative values are: six times 1995 + five times 1996..... + one times 2000.
Cumulative gas and electric costs are adjusted for cost increases. Cumultive externalities are fixed at levelized costs.
All residential sector fossil fuel energy use for 1994 and before bldgs is imbedded in the natural gas numbers.
All fossil fuel use in new residential buildings after 1995 is assumed to be gas.
Cumulative values include the sum of new buildings and remaining existing buildings.
Dollar values include inflation at 3.5% compounded. Construction costs and electricity prices are equal to inflation.
Natural gas prices include inflation, plus a 4.4% annual real price increase.

Impact of Energy Standards

Summary Table

All Buildings (total residential and commercial, all types)

Peak Natural Gas Demand
(NEW buildings, Billion Btuh)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	1.813	1.620	10.63%	1.273	29.77%	1.046	42.28%
1996	1.781	1.590	9.03%	1.252	28.52%	1.029	41.25%
1997	1.780	1.588	8.98%	1.249	28.48%	1.024	41.22%
1998	1.810	1.615	10.48%	1.271	29.66%	1.042	42.19%
1999	1.836	1.638	11.78%	1.291	30.68%	1.058	43.03%
2000	1.852	1.651	12.55%	1.301	31.28%	1.065	43.52%
Total	10.871	9.703	10.75%	7.637	29.75%	6.264	42.38%
Cumulative	na	na		na		na	

Annual Natural Gas Use
(NEW buildings, Billion Btu)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	2429.901	2041.995	15.96%	1671.218	31.22%	1488.052	38.76%
1996	2384.985	2004.114	15.97%	1642.050	31.15%	1460.683	38.76%
1997	2385.038	2002.500	16.04%	1639.569	31.26%	1456.546	38.93%
1998	2402.895	2014.522	16.16%	1647.775	31.43%	1462.364	39.14%
1999	2413.618	2019.970	16.31%	1650.418	31.62%	1463.227	39.38%
2000	2423.077	2024.566	16.45%	1652.060	31.82%	1463.932	39.58%
Cumulative	48321.786	40179.464	16.85%	33140.190	31.42%	29459.199	39.04%

Annual Natural Gas Cost
(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	13.893	11.674	15.98%	9.561	31.18%	8.510	38.74%
1996	14.719	12.367	15.98%	10.140	31.11%	9.017	38.74%
1997	15.884	13.334	16.05%	10.926	31.21%	9.702	38.92%
1998	17.268	14.474	16.18%	11.848	31.39%	10.510	39.13%
1999	18.716	15.660	16.33%	12.805	31.59%	11.348	39.37%
2000	20.275	16.936	16.47%	13.830	31.79%	12.249	39.58%
Cumulative	373.026	313.025	16.08%	256.363	31.27%	227.755	38.94%

Annual Natural Gas Use
(ALL buildings, Billion Btu)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	230224.133	229836.227	0.17%	229465.450	0.33%	229282.284	0.41%
1996	231536.702	230767.926	0.33%	230035.084	0.65%	229670.551	0.81%
1997	232847.454	231696.140	0.49%	230600.367	0.97%	230052.811	1.20%
1998	234168.849	232629.163	0.66%	231166.643	1.28%	230433.676	1.60%
1999	235491.930	233558.597	0.82%	231726.524	1.60%	230806.366	1.99%
2000	236812.673	234480.828	0.98%	232276.249	1.92%	231167.964	2.38%
Cumulative	1401081.74	1392968.88	0.58%	1385270.317	1.13%	1381413.651	1.40%

Annual Natural Gas Cost
(ALL buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	1317.044	1314.824	0.17%	1312.712	0.33%	1311.661	0.41%
1996	1429.146	1424.399	0.33%	1419.893	0.65%	1417.636	0.81%
1997	1550.730	1543.058	0.49%	1535.788	0.96%	1532.129	1.20%
1998	1682.681	1671.609	0.66%	1661.139	1.28%	1661.073	1.28%
1999	1825.815	1810.813	0.82%	1796.660	1.60%	1789.499	1.99%
2000	1979.570	1960.282	0.97%	1942.129	1.89%	1932.936	2.36%
Cumulative	9784.985	9724.984	0.61%	9668.322	1.19%	9644.935	1.43%

Electric Peak Demand
(NEW buildings, mW)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	196.868	187.735	4.64%	148.354	24.64%	121.985	38.04%
1996	195.276	185.974	4.76%	147.109	24.67%	121.245	37.91%
1997	195.937	186.417	4.86%	147.271	24.84%	121.326	38.08%
1998	198.165	188.527	4.86%	148.848	24.89%	122.702	38.08%
1999	200.783	190.956	4.89%	150.703	24.94%	124.345	38.07%
2000	203.741	193.619	4.97%	152.747	25.03%	126.076	38.12%
Total	1190.770	1133.228	4.83%	895.033	24.84%	737.680	38.05%
Cumulative	na	na		na		na	

Annual Electricity Use
(NEW buildings, Million mWh)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	0.542	0.516	4.79%	0.440	18.73%	0.402	25.83%
1996	0.539	0.513	4.82%	0.437	18.83%	0.399	25.90%
1997	0.541	0.515	4.85%	0.438	19.00%	0.400	26.07%
1998	0.546	0.519	4.88%	0.442	19.08%	0.403	26.13%
1999	0.552	0.525	4.91%	0.446	19.18%	0.407	26.20%
2000	0.559	0.532	4.94%	0.451	19.26%	0.412	26.30%
Cumulative	11.412	10.859	4.84%	9.252	18.93%	8.445	25.99%

Annual Electricity Cost
(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	39.453	37.552	4.82%	32.046	18.77%	29.251	25.86%
1996	40.623	38.656	4.84%	32.956	18.87%	30.092	25.92%
1997	42.244	40.186	4.87%	34.202	19.04%	31.219	26.10%
1998	44.117	41.953	4.91%	35.680	19.12%	32.578	26.16%
1999	46.146	43.867	4.94%	37.276	19.22%	34.040	26.23%
2000	48.406	46.005	4.96%	39.061	19.31%	35.662	26.33%
Cumulative	932.070	886.714	4.87%	755.246	18.97%	689.500	26.02%

Annual Electricity Use
(ALL buildings, Million mWh)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	43.422	43.396	0.06%	43.320	0.23%	43.282	0.32%
1996	43.734	43.682	0.12%	43.092	1.47%	43.454	0.64%
1997	44.048	43.970	0.18%	43.742	0.69%	43.627	0.95%
1998	44.365	44.260	0.24%	43.955	0.92%	43.801	1.27%
1999	44.685	44.553	0.30%	44.611	0.17%	43.977	1.58%
2000	45.009	44.849	0.35%	44.386	1.39%	44.154	1.90%
Cumulative	265.262	264.710	0.21%	263.106	0.81%	262.296	1.12%

Annual Electricity Cost
(ALL buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Reduction from C. P.	Enhanced Case	% Reduction from C. P.	Resource Case	% Reduction from C. P.
1995	3160.893	3158.993	0.06%	3153.488	0.23%	3150.691	0.32%
1996	3294.790	3290.856	0.12%	3279.457	0.47%	3273.700	0.64%
1997	3434.335	3428.206	0.18%	3410.424	0.70%	3401.483	0.96%
1998	3579.844	3571.335	0.24%	3546.858	0.93%	3534.301	1.27%
1999	3731.606	3720.520	0.30%	3688.388	1.16%	3672.364	1.59%
2000	3888.378	3874.581	0.35%	3834.608	1.38%	3814.737	1.89%
Cumulative	21089.846	21044.490	0.22%	20913.022	0.84%	20847.276	1.15%

Construction Cost (labor)
(NEW buildings, $million)

	Current Practice (C. P.)	EPAct Standard	% Increase from C. P.	Enhanced Case	% Increase from C. P.	Resource Case	% Increase from C. P.
1995	1037.574	14.431	1.39%	27.605	2.66%	50.735	4.89%
1996	1042.945	14.424	1.38%	27.805	2.67%	51.398	4.93%
1997	1082.809	14.991	1.38%	28.956	2.67%	53.617	4.95%
1998	1133.412	15.692	1.38%	30.319	2.68%	56.312	4.97%
1999	1183.975	16.421	1.39%	31.759	2.68%	59.102	4.99%
2000	1235.159	17.145	1.39%	33.263	2.69%	61.859	5.01%
Total	6715.873	93.103	1.39%	179.706	2.68%	333.021	4.96%
Cumulative	na	na	na	na	na	na	na

Construction Cost (material)
(NEW buildings, $million)

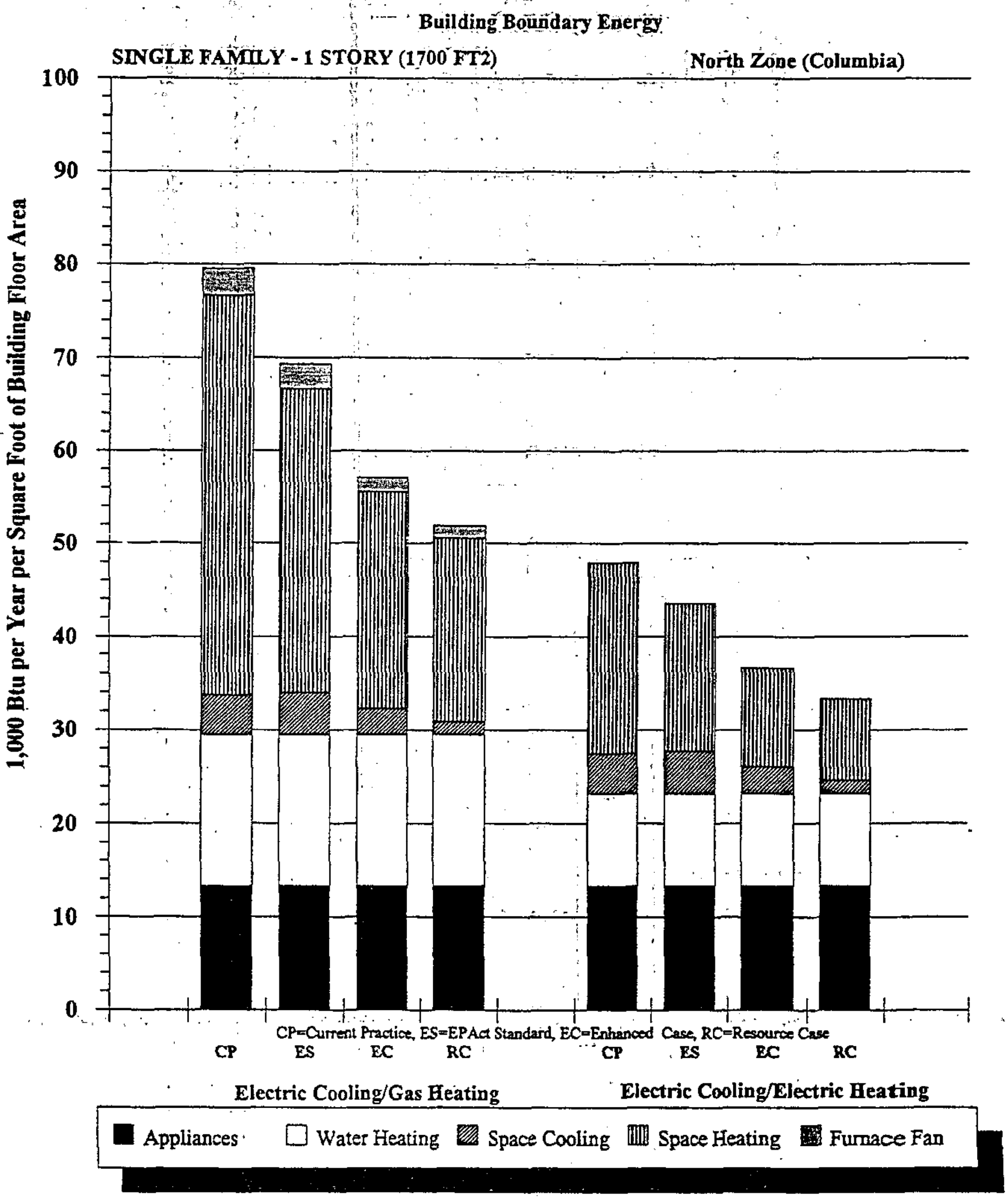
	Current Practice (C. P.)	EPAct Standard	% Increase from C. P.	Enhanced Case	% Increase from C. P.	Resource Case	% Increase from C. P.
1995	1807.410	33.025	1.83%	65.465	3.62%	128.929	7.13%
1996	1845.533	33.294	1.80%	66.710	3.61%	132.201	7.16%
1997	1930.740	34.705	1.80%	69.811	3.62%	138.674	7.18%
1998	2033.911	36.439	1.79%	73.332	3.61%	146.300	7.19%
1999	2142.150	38.288	1.79%	77.210	3.60%	154.422	7.21%
2000	2248.437	40.120	1.78%	81.311	3.62%	162.321	7.22%
Total	12008.181	215.871	1.80%	433.838	3.61%	862.846	7.19%
Cumulative	na	na	na	na	na	na	na

"DSM" Avoided Capacity Payments and Externality Credits
(NEW buildings, $million)
kW pmts based on difference between Enhanced & Resource Cases
Externality pmts based on difference between Current Practice & Resource Case

	Avoided kW Demand	Avoided Gas Externalities	Avoided Electric Externalities
1995	10.182	0.264	2.624
1996	9.989	0.260	2.624
1997	10.029	0.261	2.661
1998	10.112	0.264	2.705
1999	10.201	0.267	2.747
2000	10.328	0.269	2.777
Total	60.840		
Cumulative	na	5.524	55.894

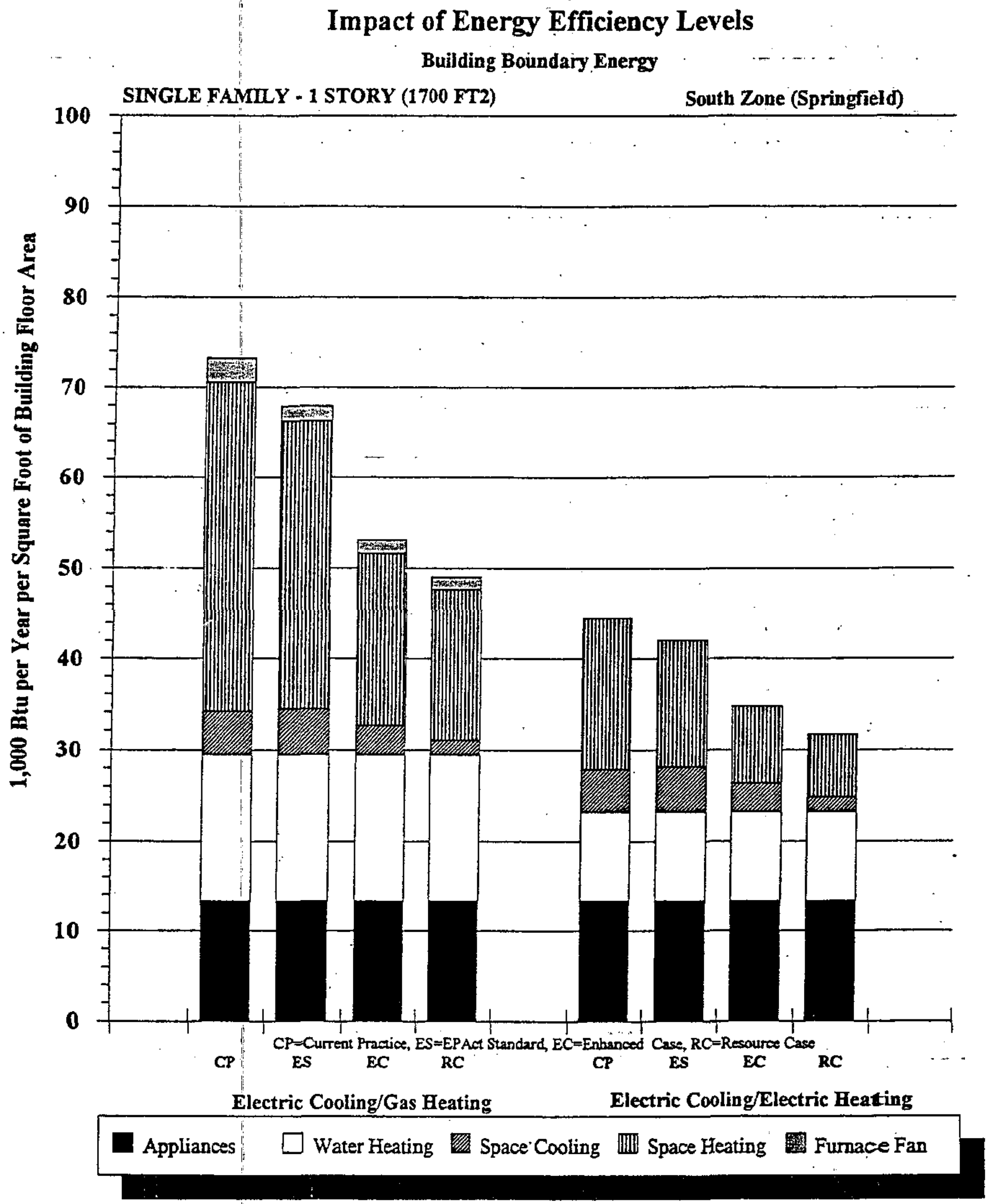
Notes:
Total values are the sum of six years.
Cumulative values are: six times 1995 + five times 1996..... + one times 2000.
Cumulative gas and electric costs are adjusted for cost increases. Cumultive externalities are fixed at levelized costs.
All residential sector fossil fuel energy use for 1994 and before bldgs is imbedded in the natural gas numbers.
All fossil fuel use in new residential buildings after 1995 is assumed to be gas.
Cumulative values include the sum of new buildings and remaining existing buildings.
Dollar values include inflation at 3.5% compounded. Construction costs and electricity prices are equal to inflation.
Natural gas prices include inflation, plus a 4.4% annual real price increase.

Impact of Energy Efficiency Levels



*Note: The Furnace Fan values are embedded in the Electric Space Heating & Cooling values.

Single Family - One Story



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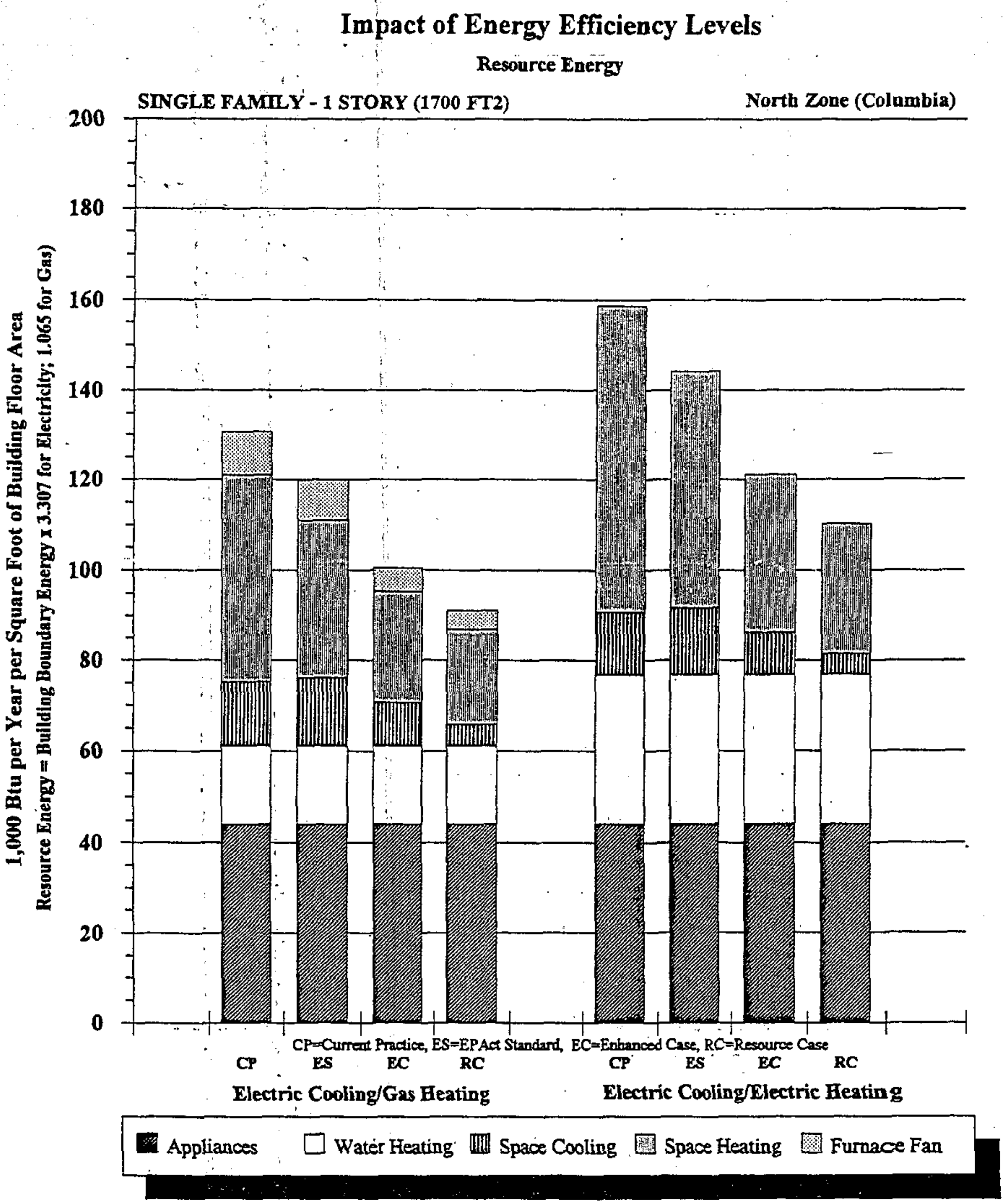
Single Family - One Story



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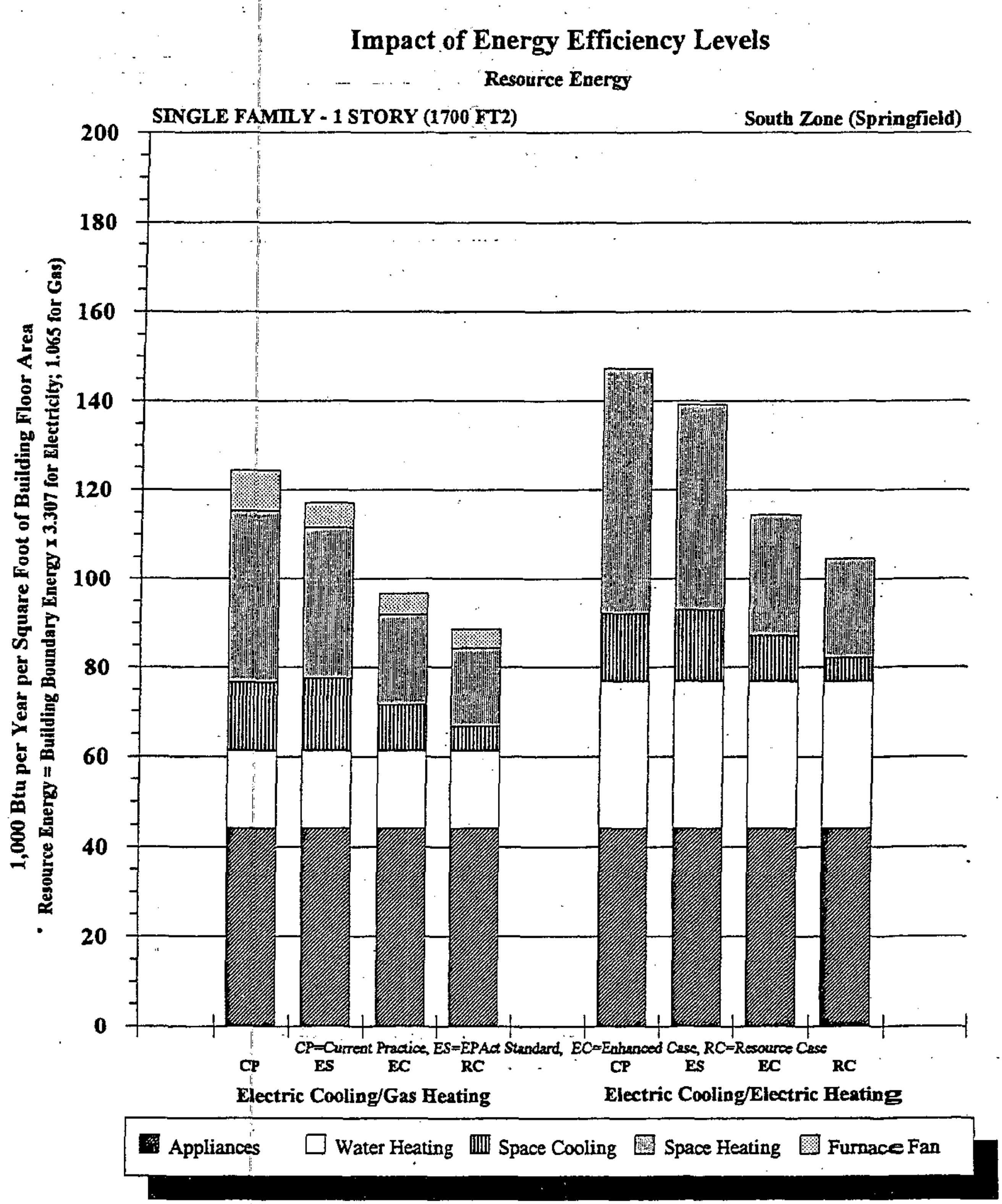
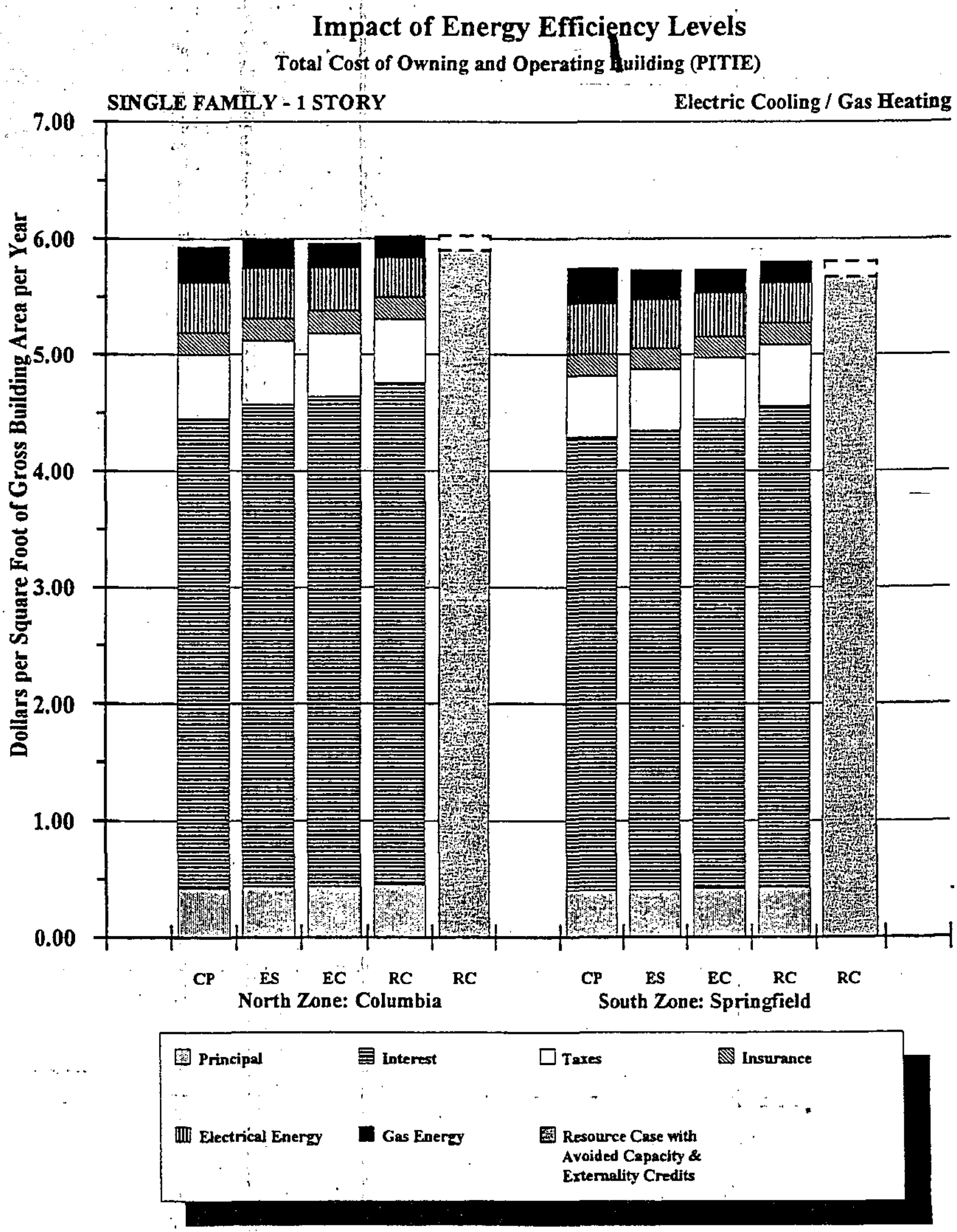
Single Family - One Story



*Note: The Furnace Fan values are embedded in the Electric Space Heating & Cooling values.

Single Family - One Story

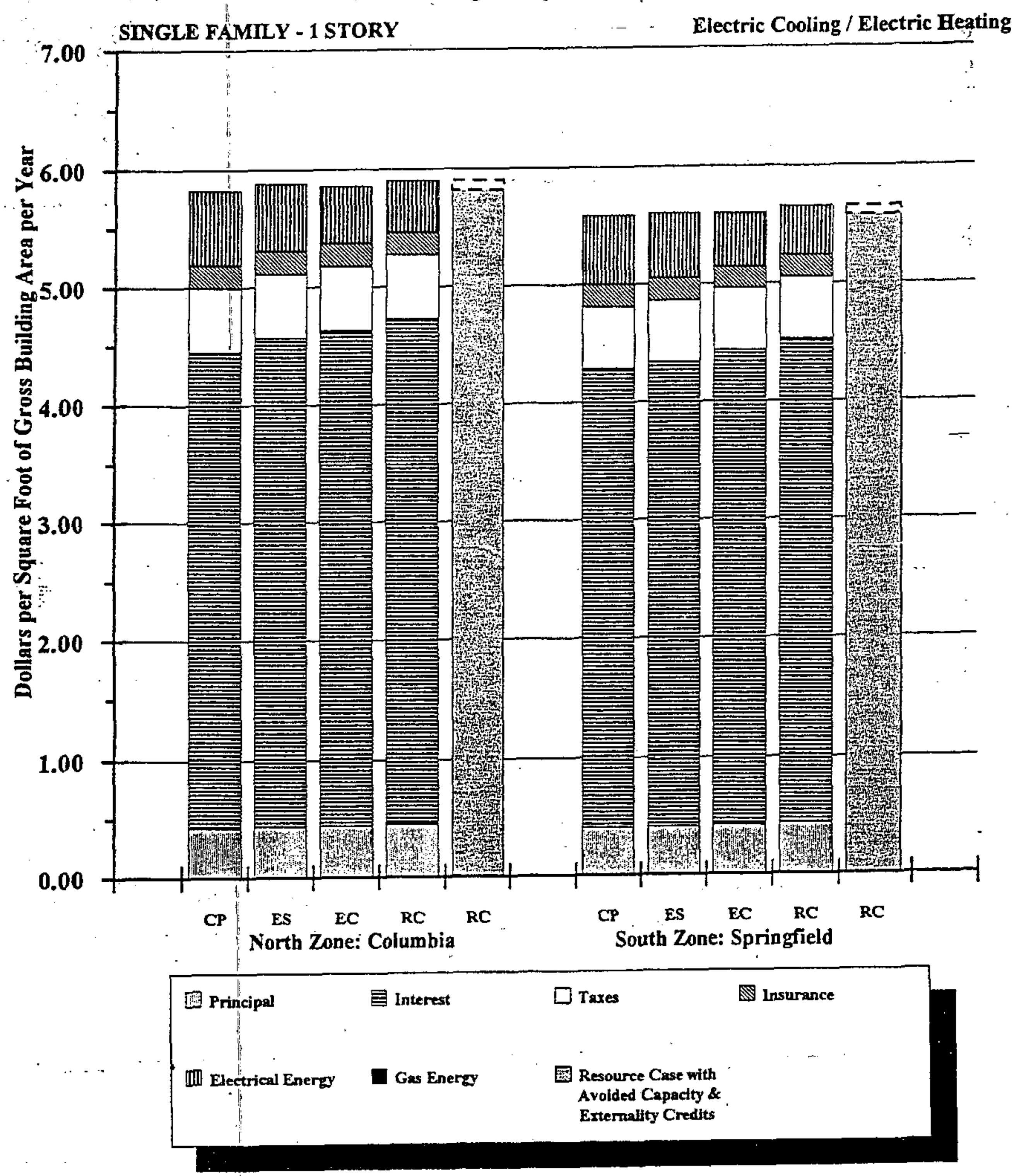


CP=Current Practice, ES=EPAct Standard, EC=Enhanced Case, RC=Resource Case

Single Family - One Story

Impact of Energy Efficiency Levels

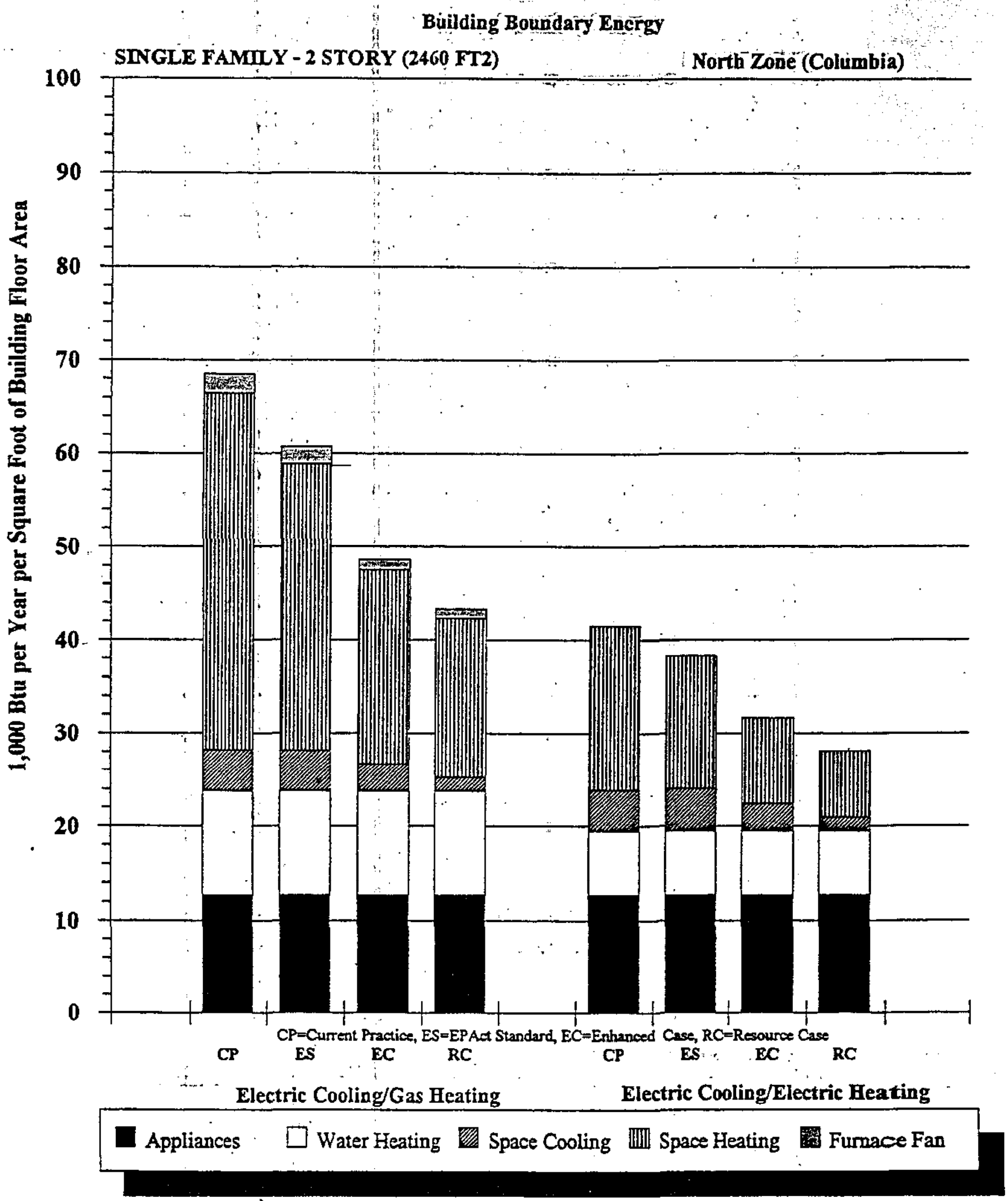
Total Cost of Owning and Operating Building (PITIE)



CP=Current Practice, ES=EPAct Standard, EC=Enhanced Case, RC=Resource Case

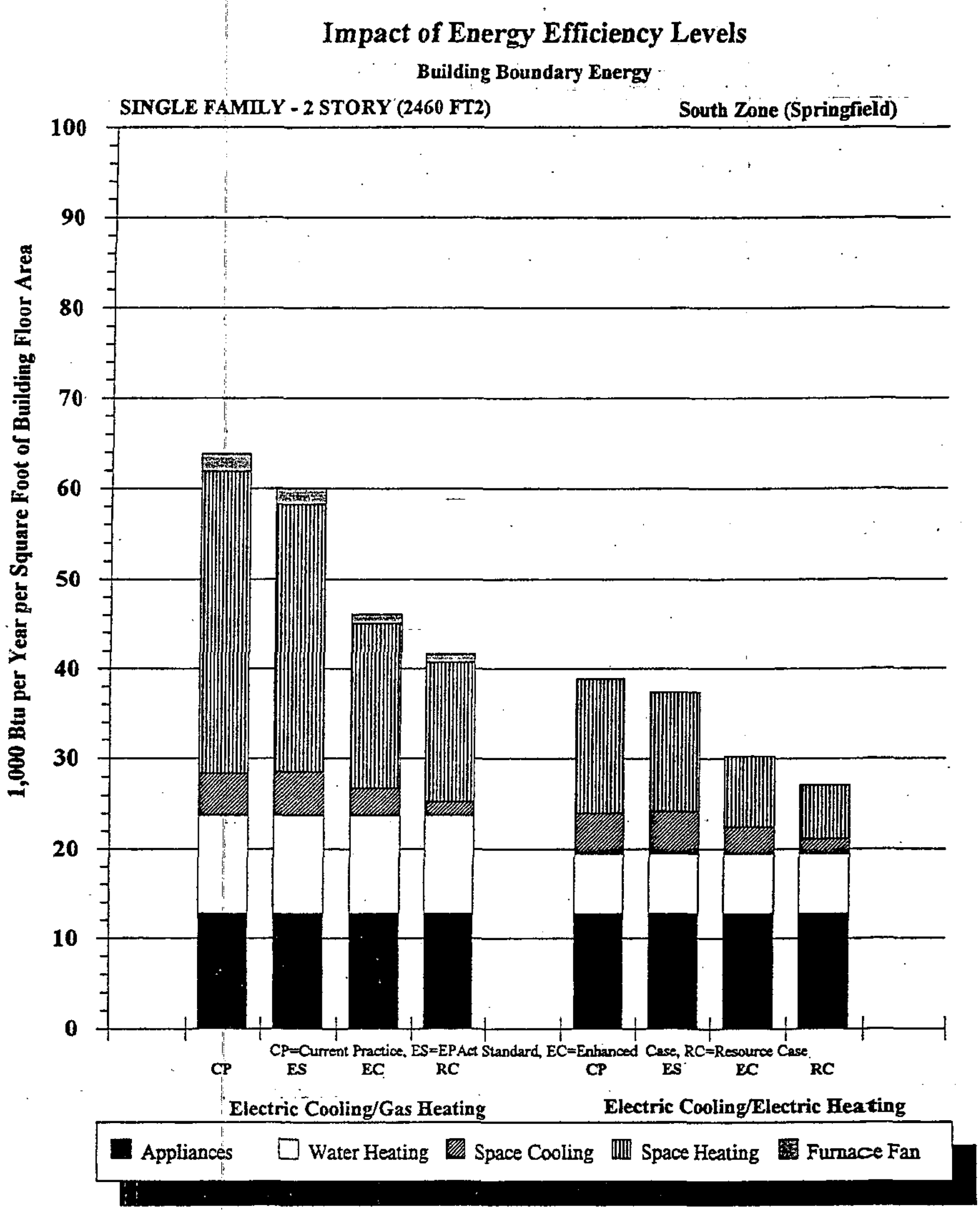
Single Family - Two Story

Impact of Energy Efficiency Levels



*Note: The Furnace Fan values are embedded in the Electric Space Heating & Cooling values.

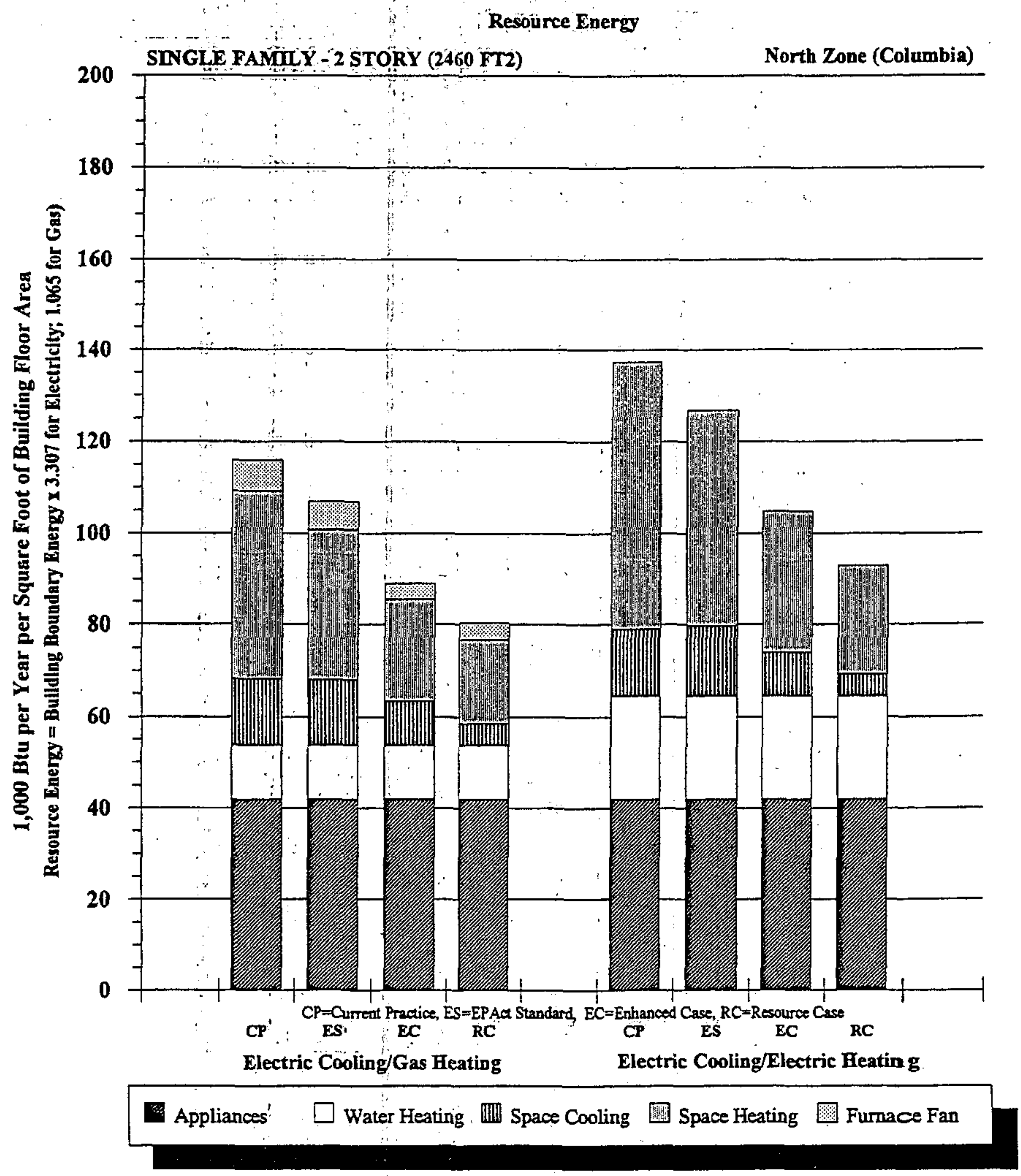
Single Family - Two Story



*Note: The Furnace Fan values are embedded in the Electric Space Heating & Cooling values.

Single Family - Two Story

Impact of Energy Efficiency Levels

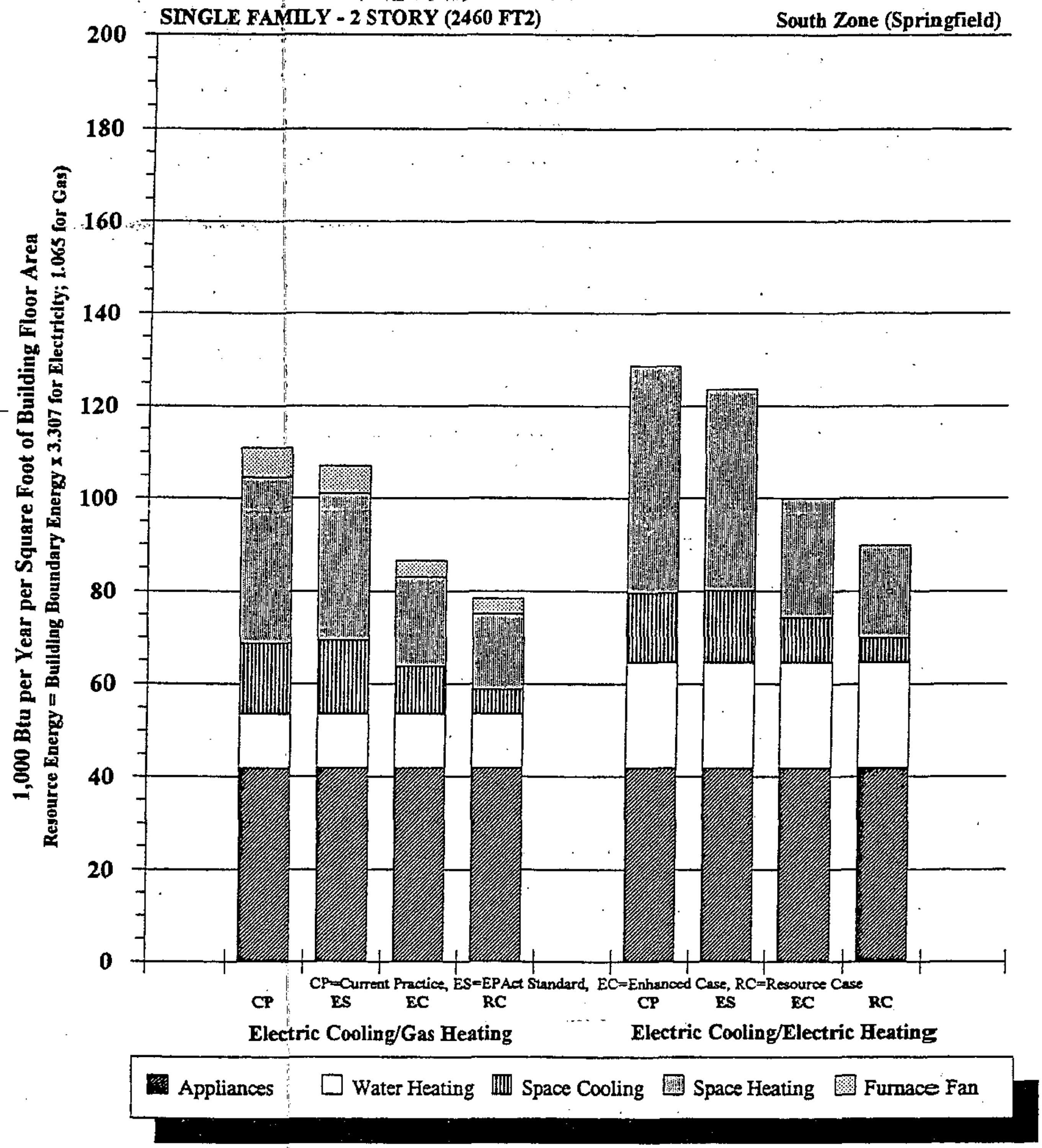


*Note: The Furnace Fan values are embedded in the Electric Space Heating & Cooling values.

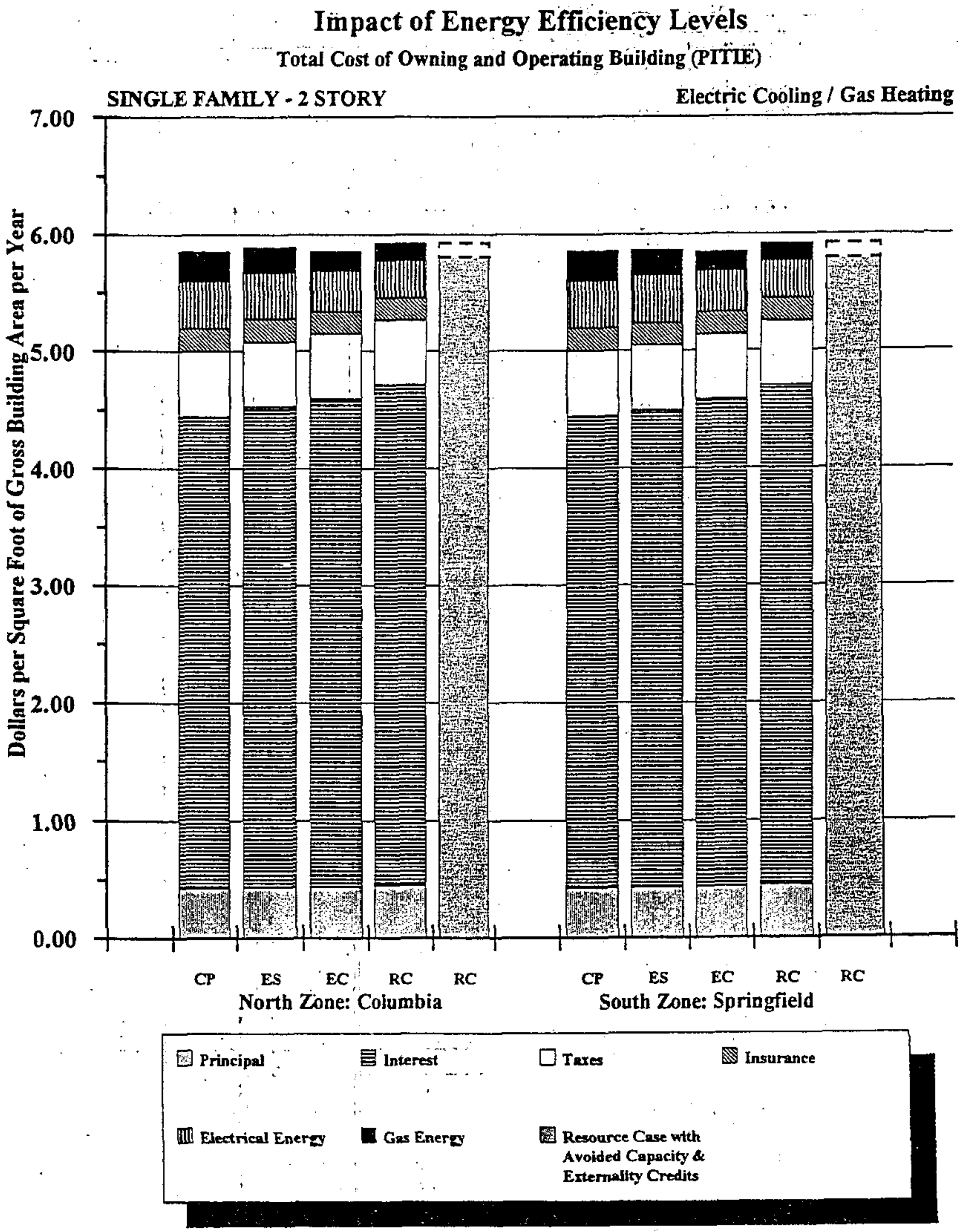
Single Family - Two Story

Impact of Energy Efficiency Levels

Resource Energy



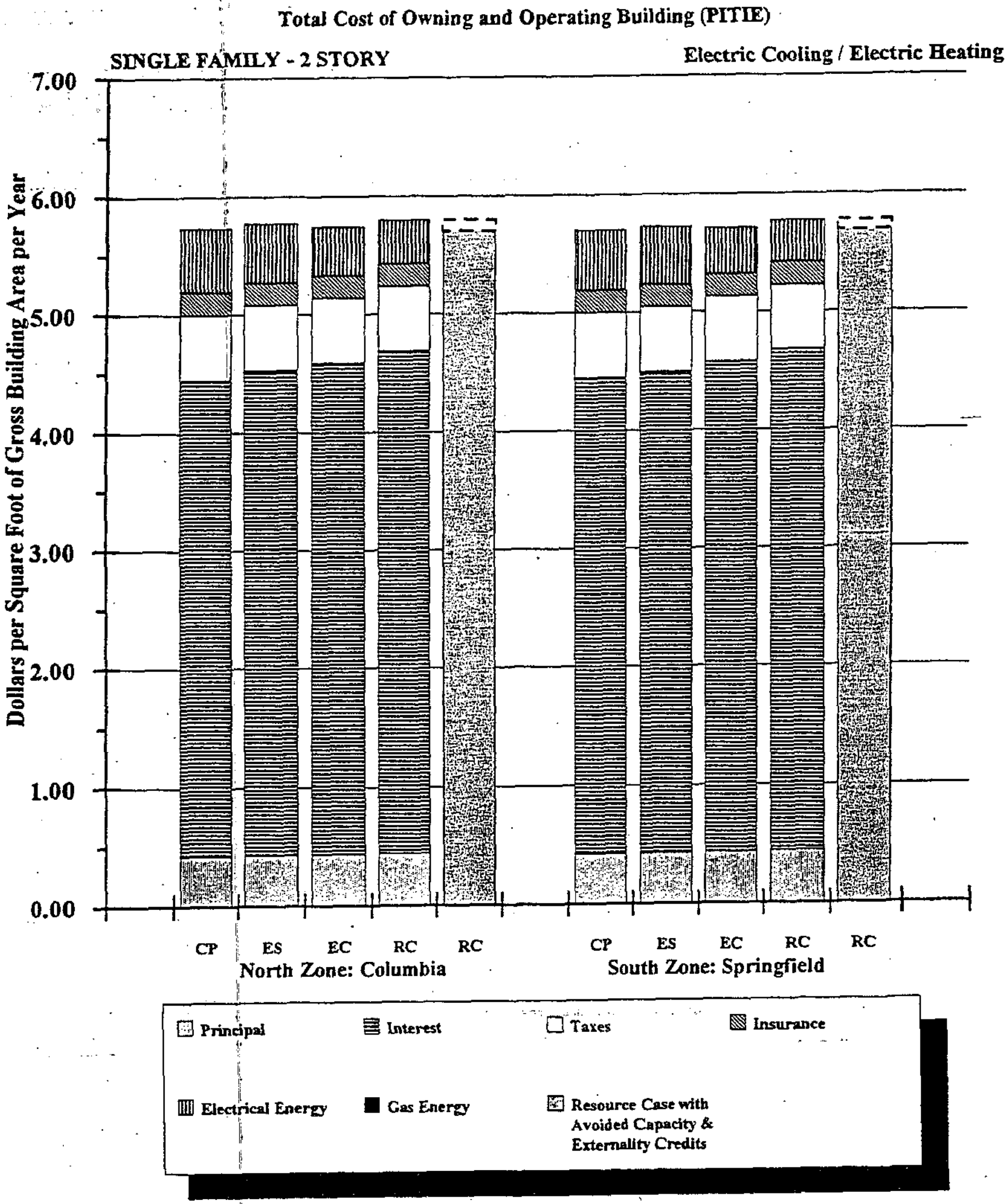
*Note: The Furnace Fan values are embedded in the Electric Space Heating & Cooling values.



CP=Current Practice, ES=EPAct Standard, EC=Enhanced Case, RC=Resource Case

Single Family - Two Story

Impact of Energy Efficiency Levels



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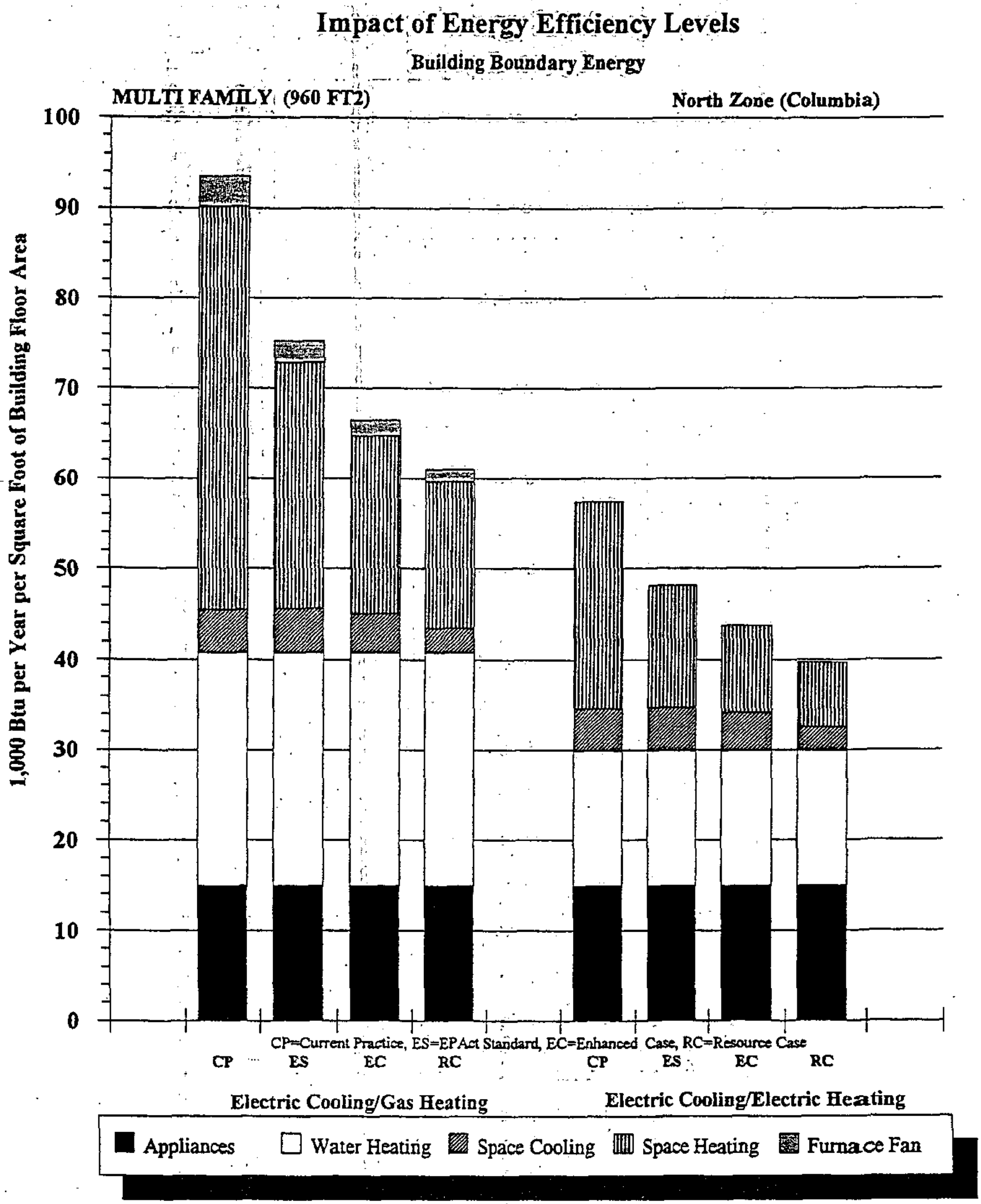
Multi Family



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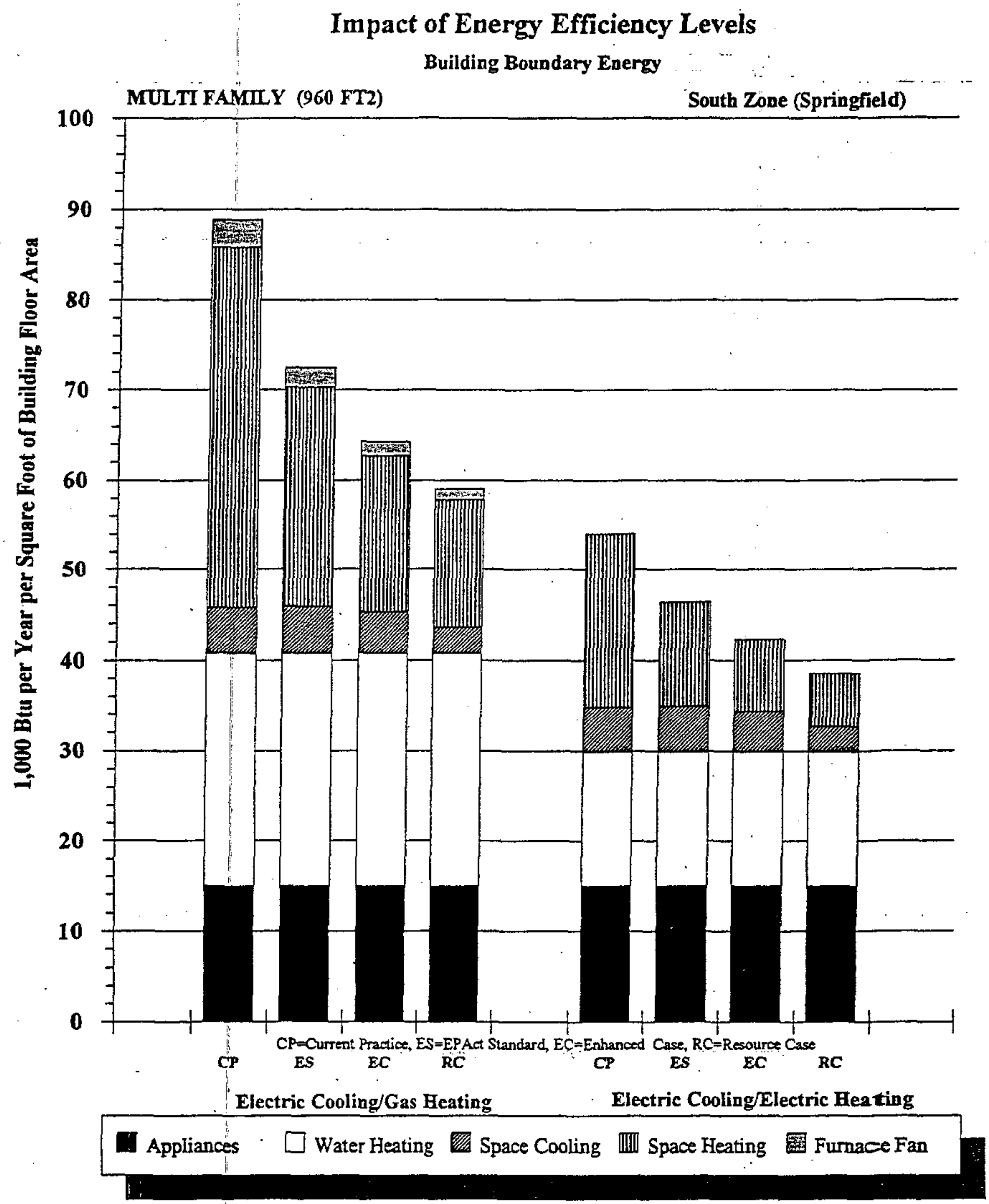
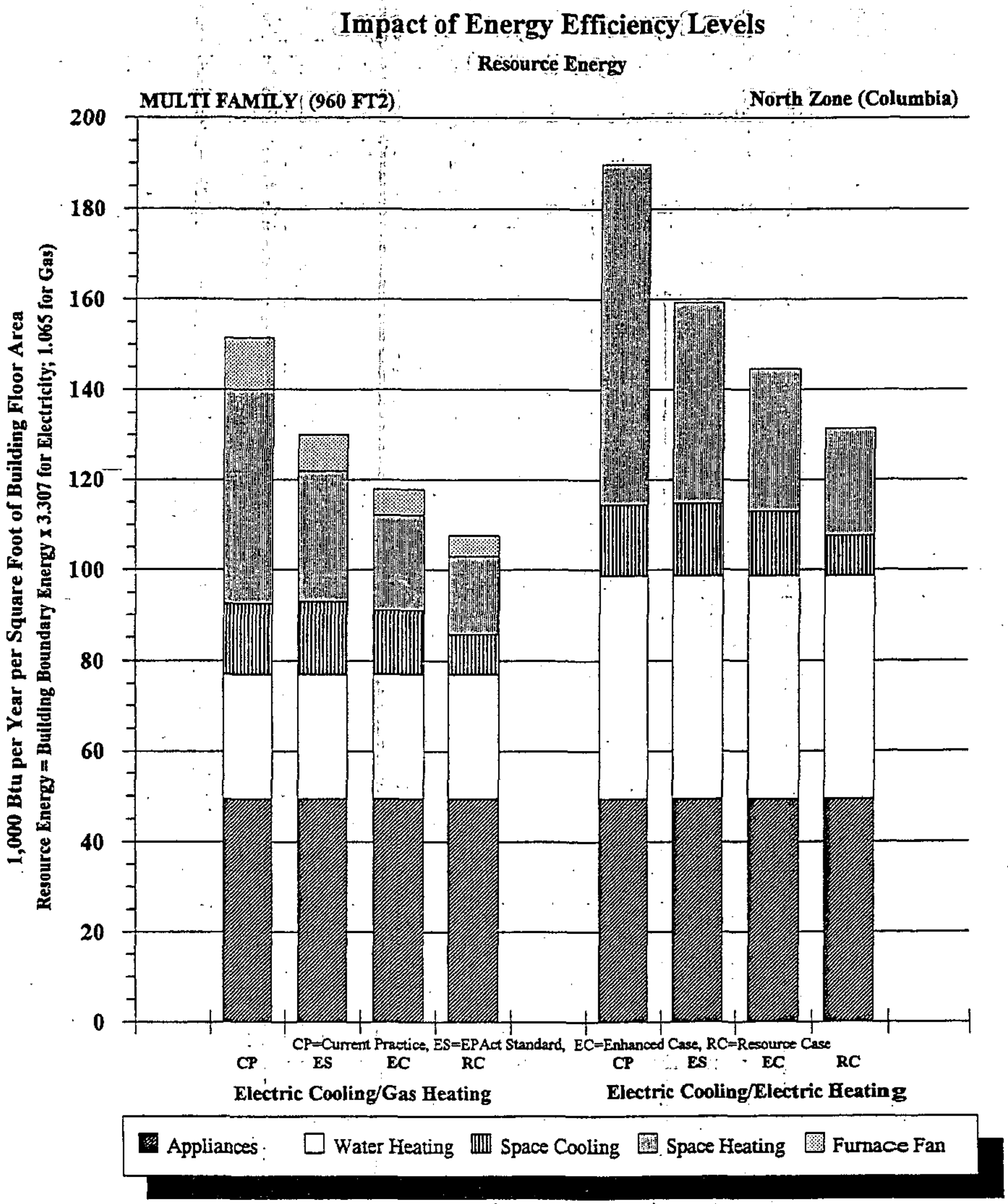
Multi Family



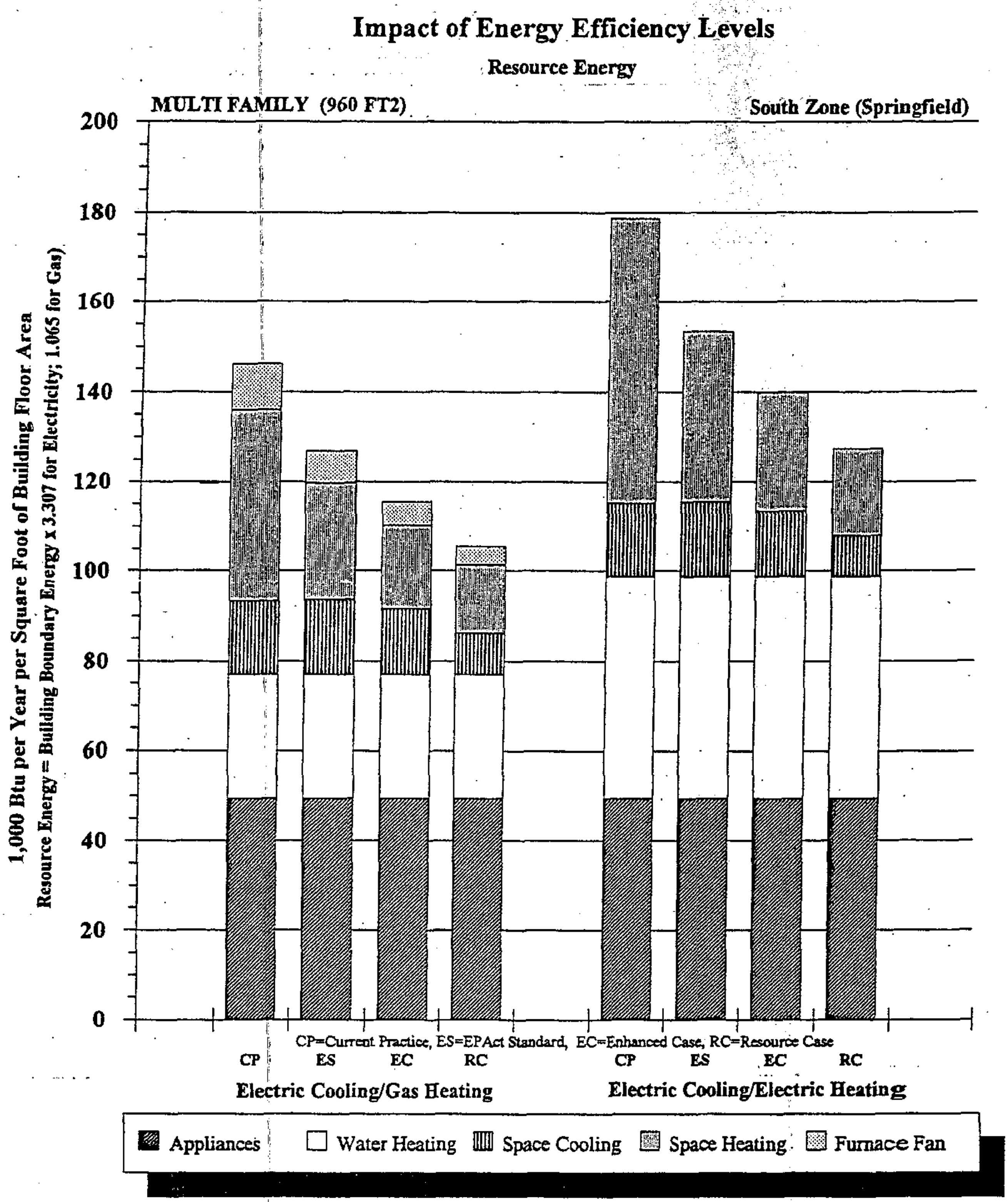
*Note: The Furnace Fan values are embedded in the Electric Space Heating & Cooling values.

Multi Family



*Note: The Furnace Fan values are embedded in the Electric Space Heating & Cooling values.

Multi Family



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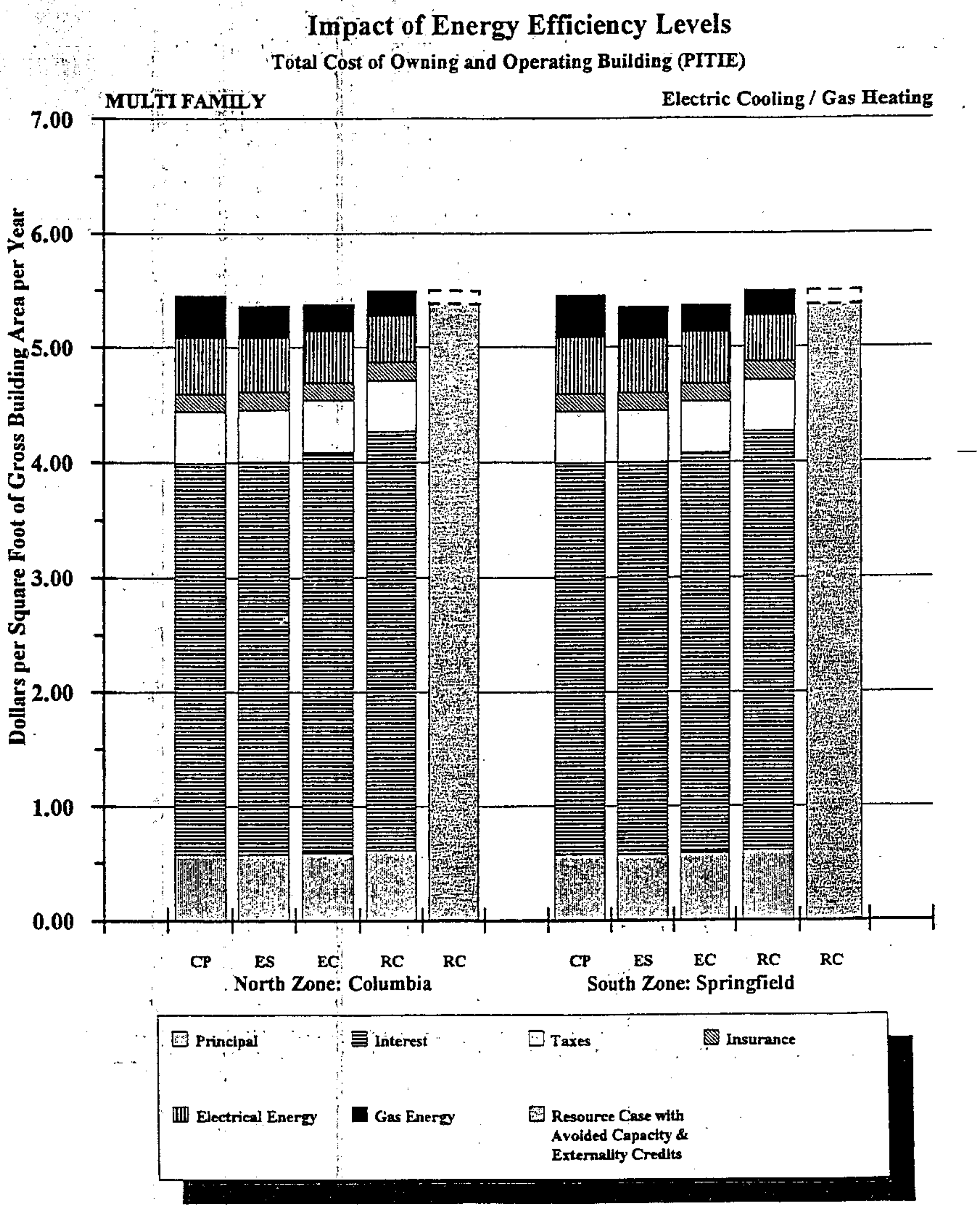

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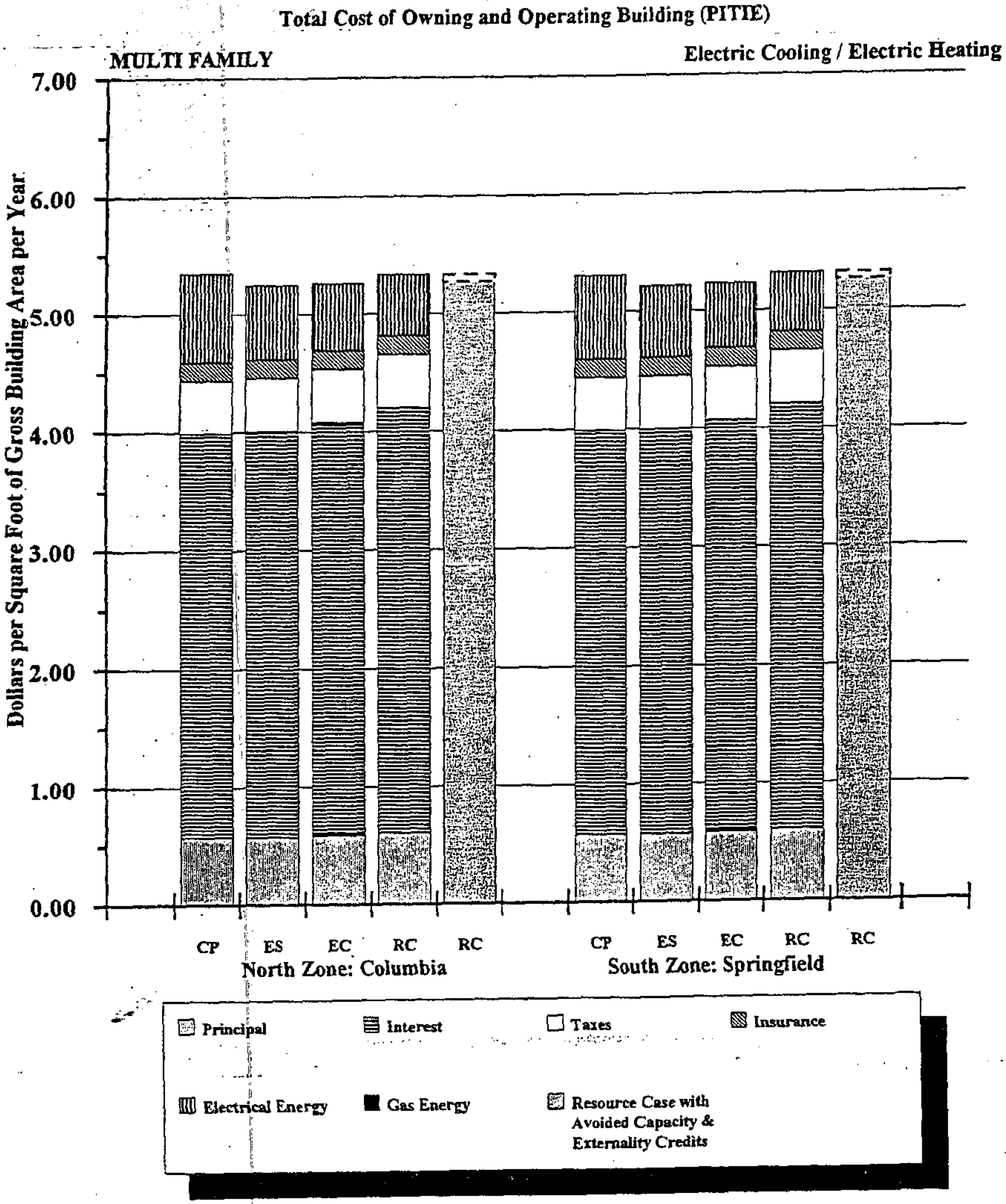
Impact of Energy Efficiency Levels



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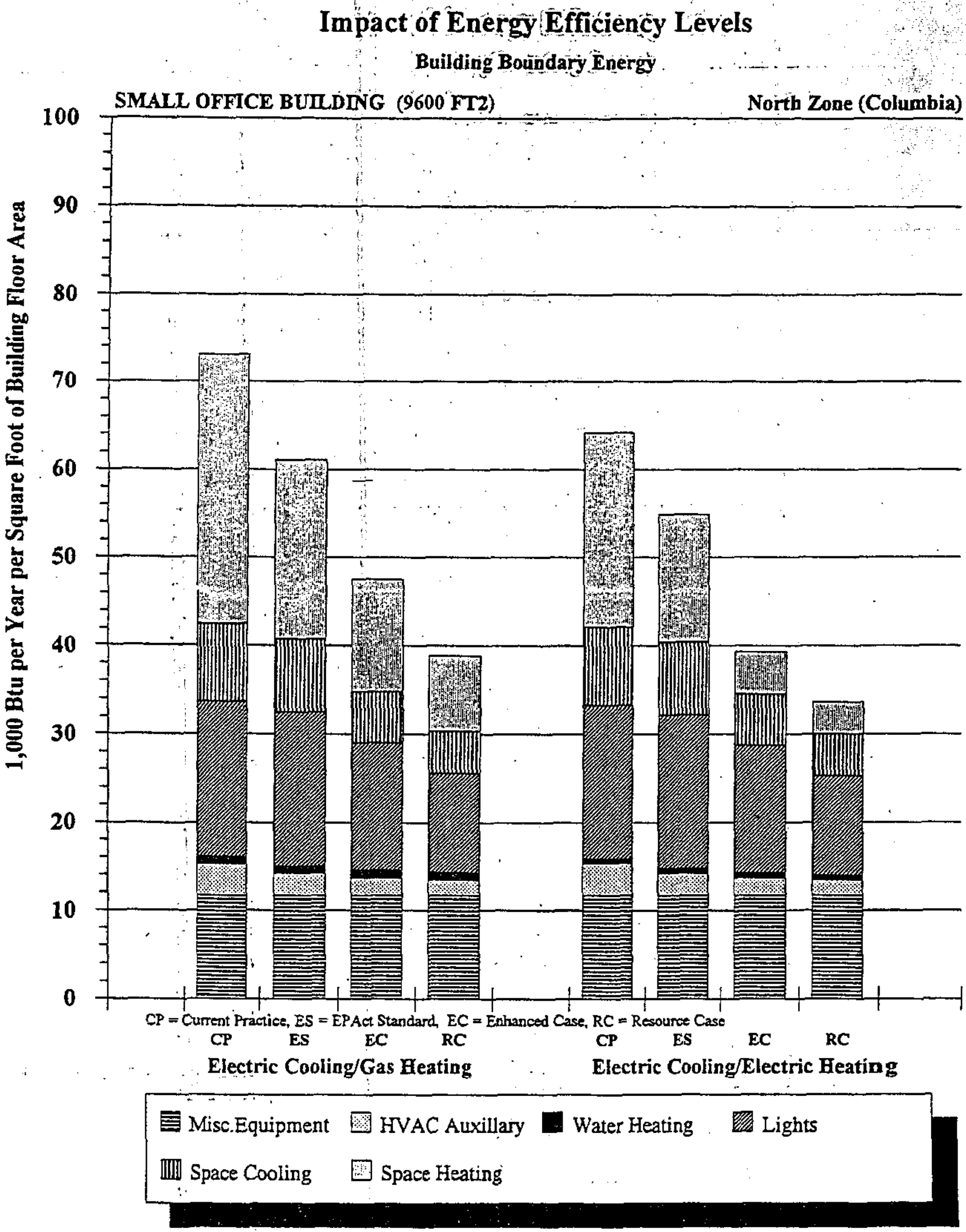
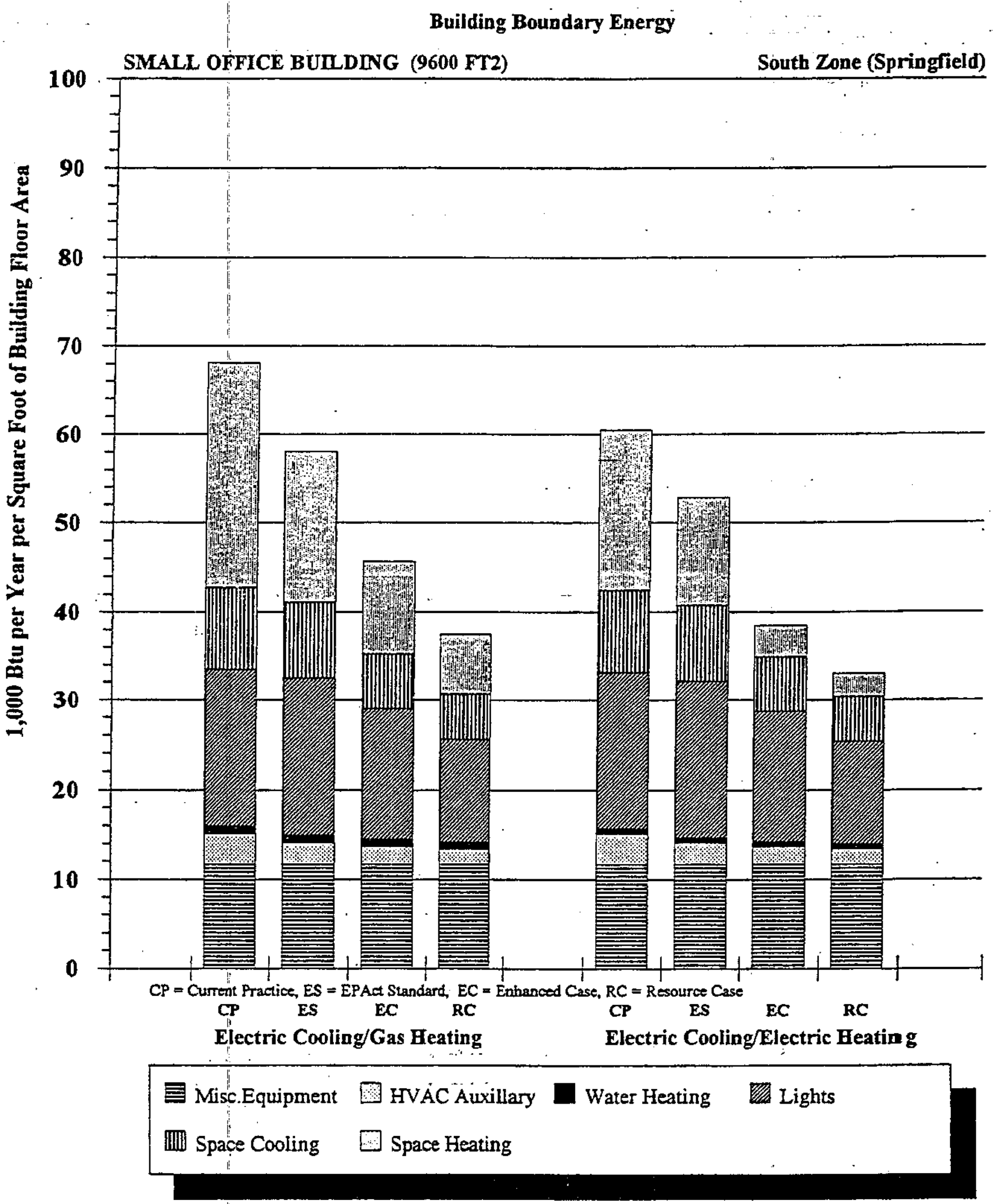
Small Office Building



Small Office Building

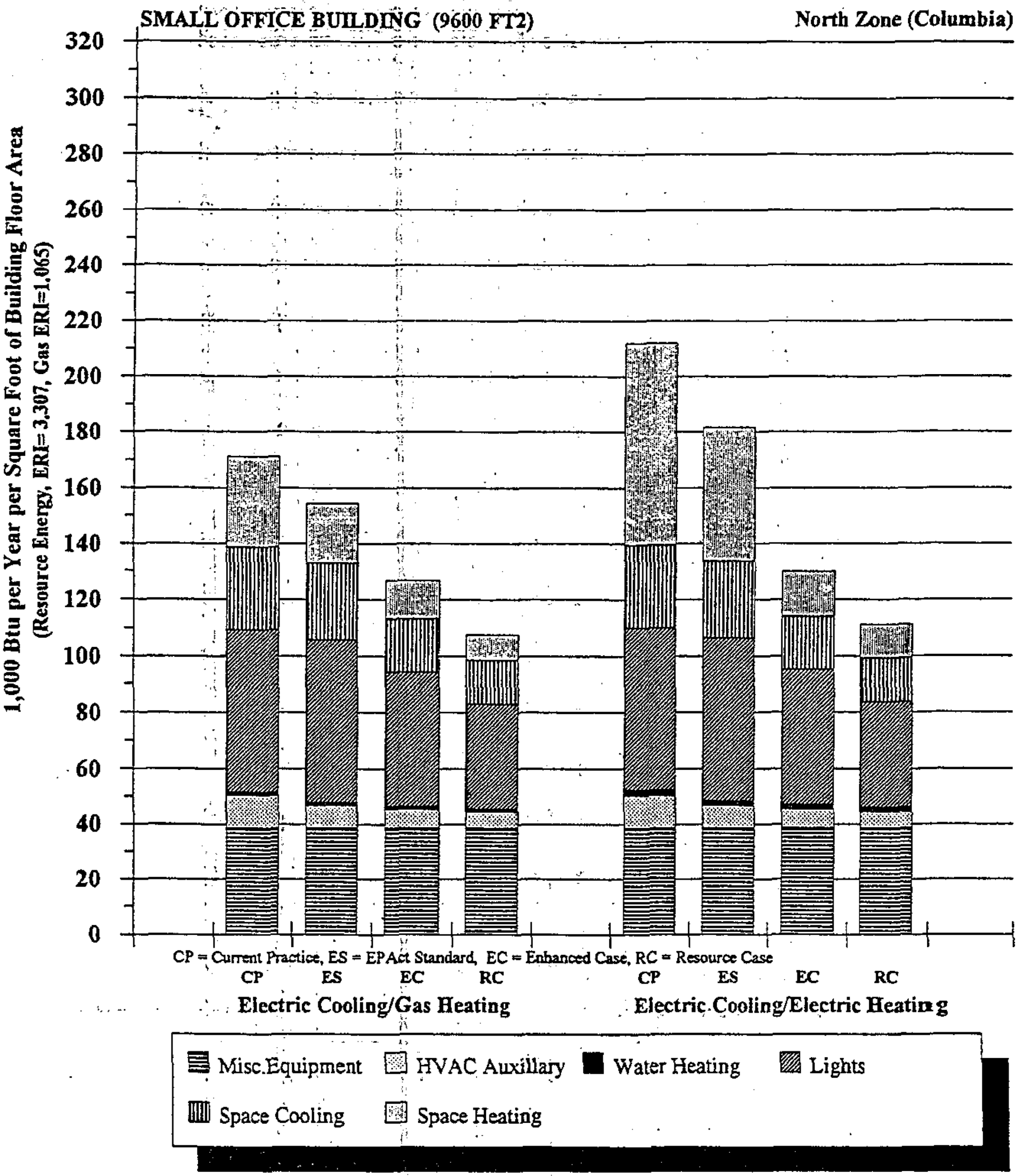
Impact of Energy Efficiency Levels



Small Office Building

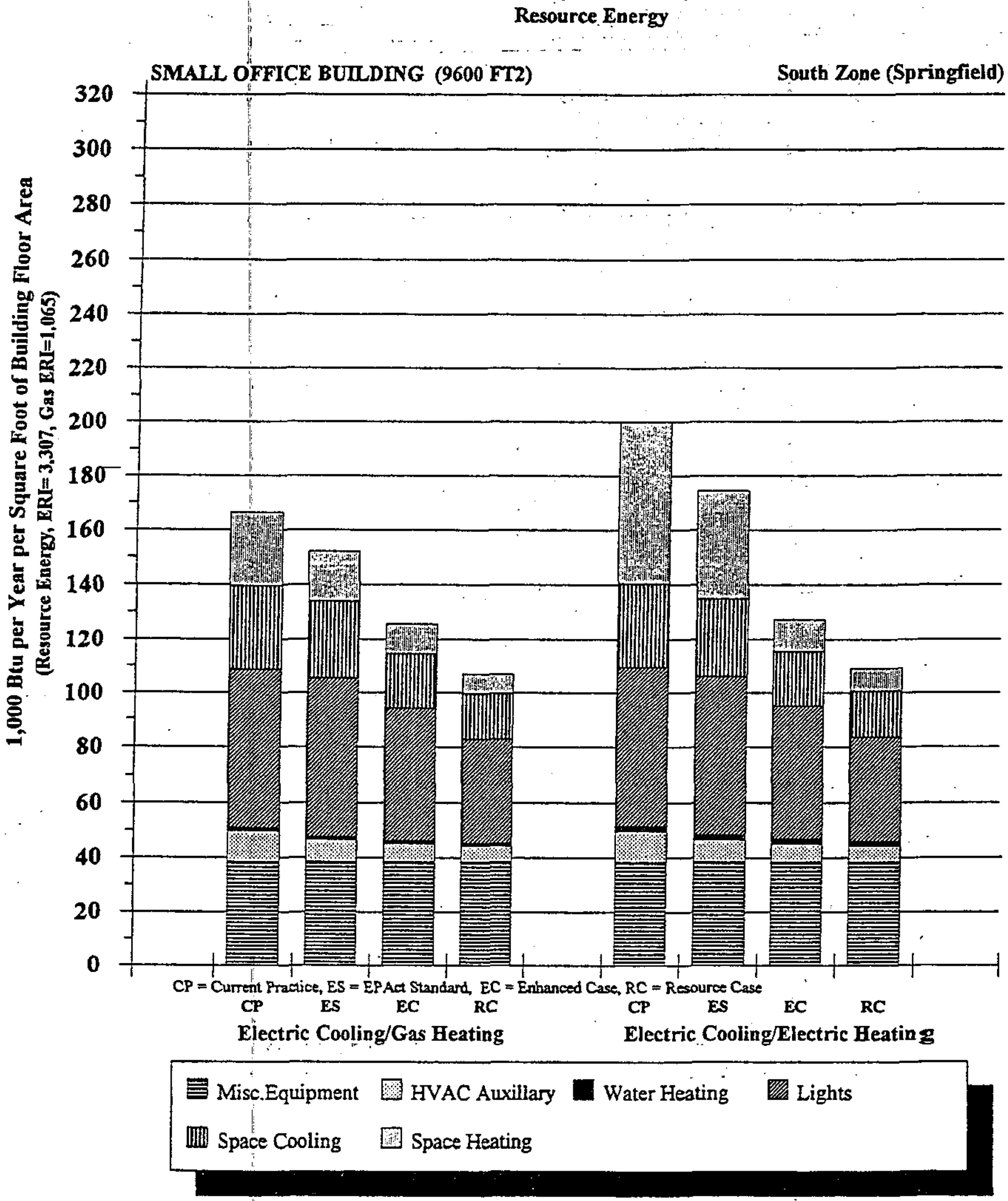
Impact of Energy Effiency Levels

Resource Energy



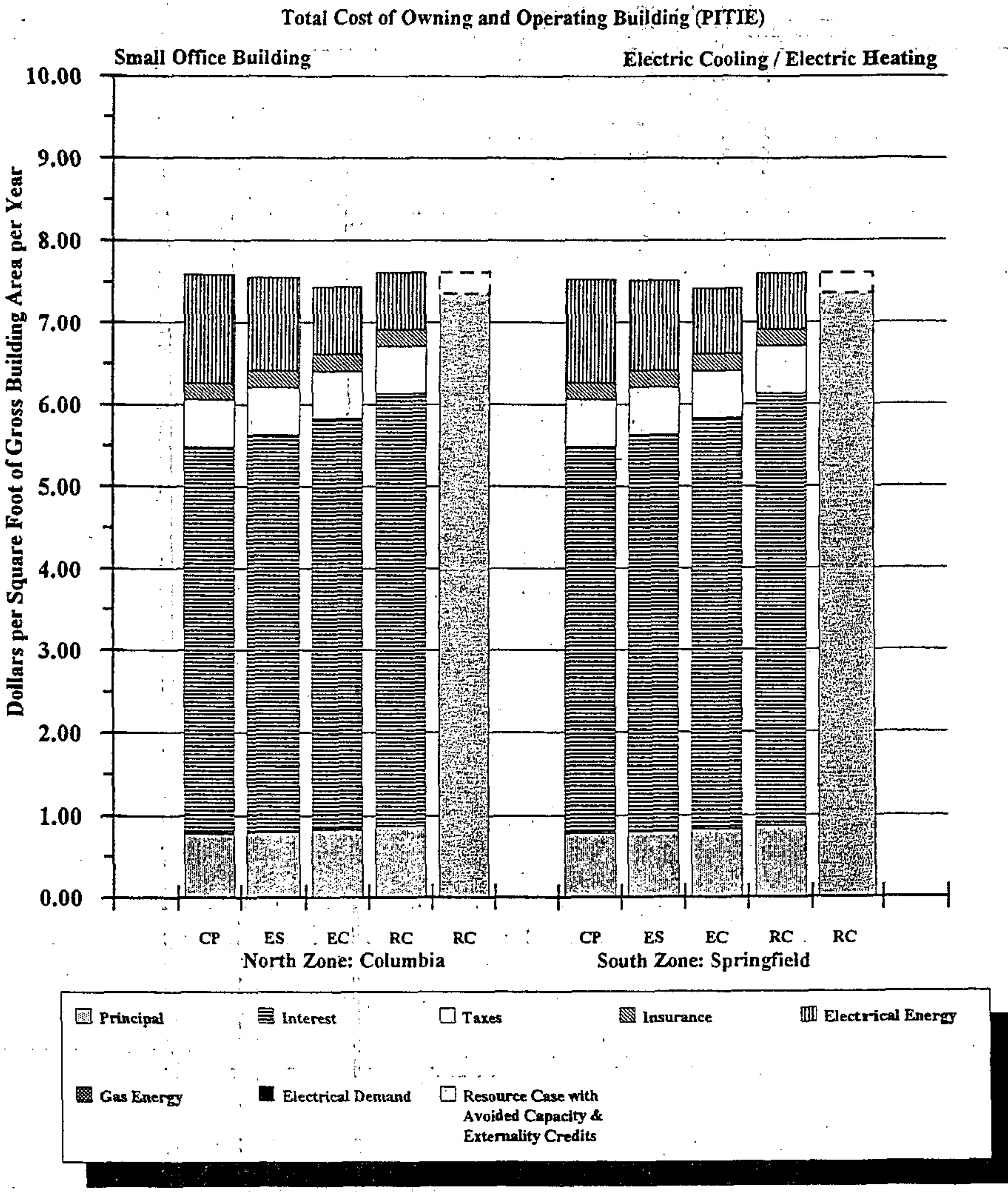
Small Office Building

Impact of Energy Effiency Levels



Small Office Building

Impact of Energy Efficiency Levels



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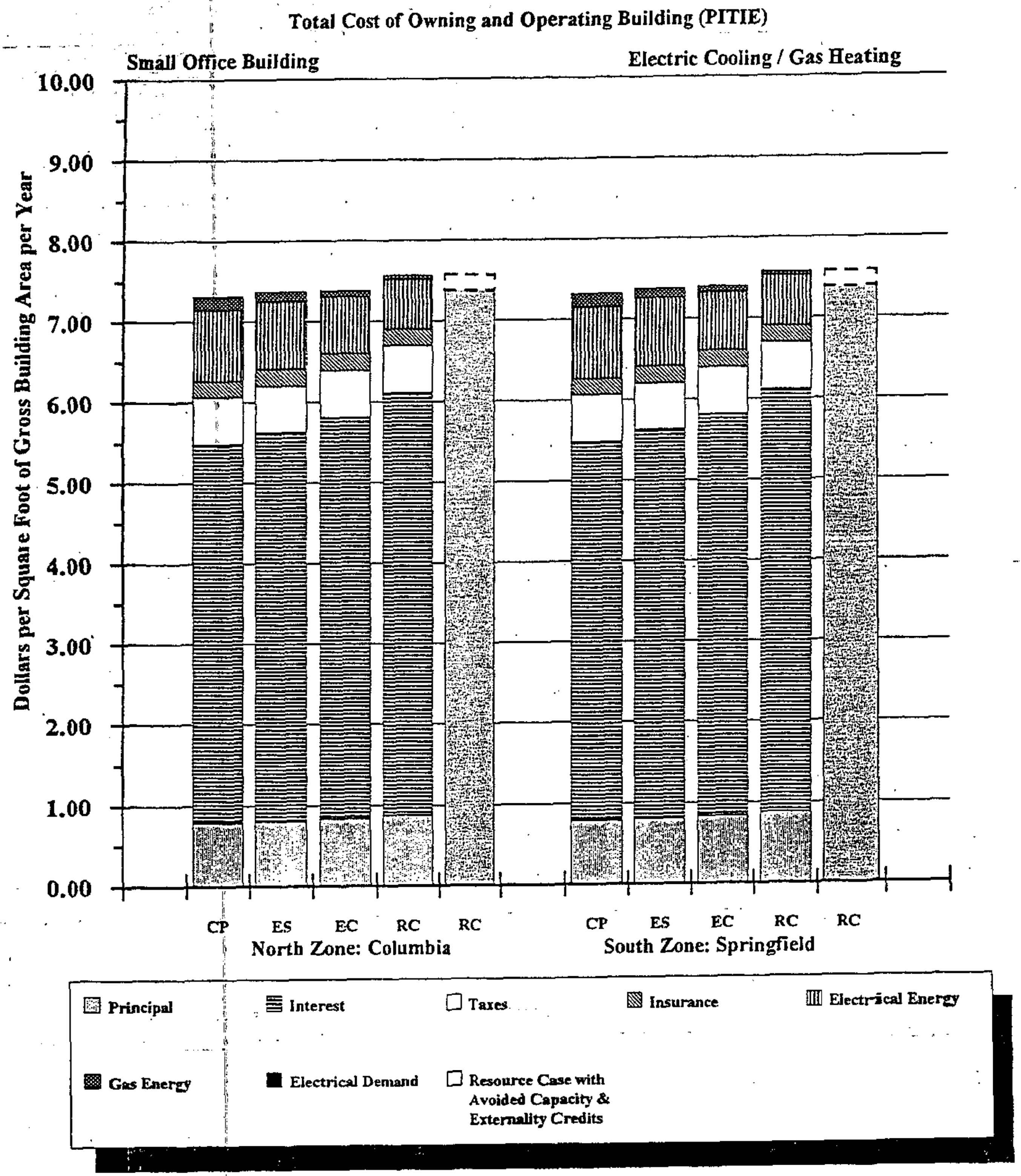
Impact of Energy Efficiency Levels



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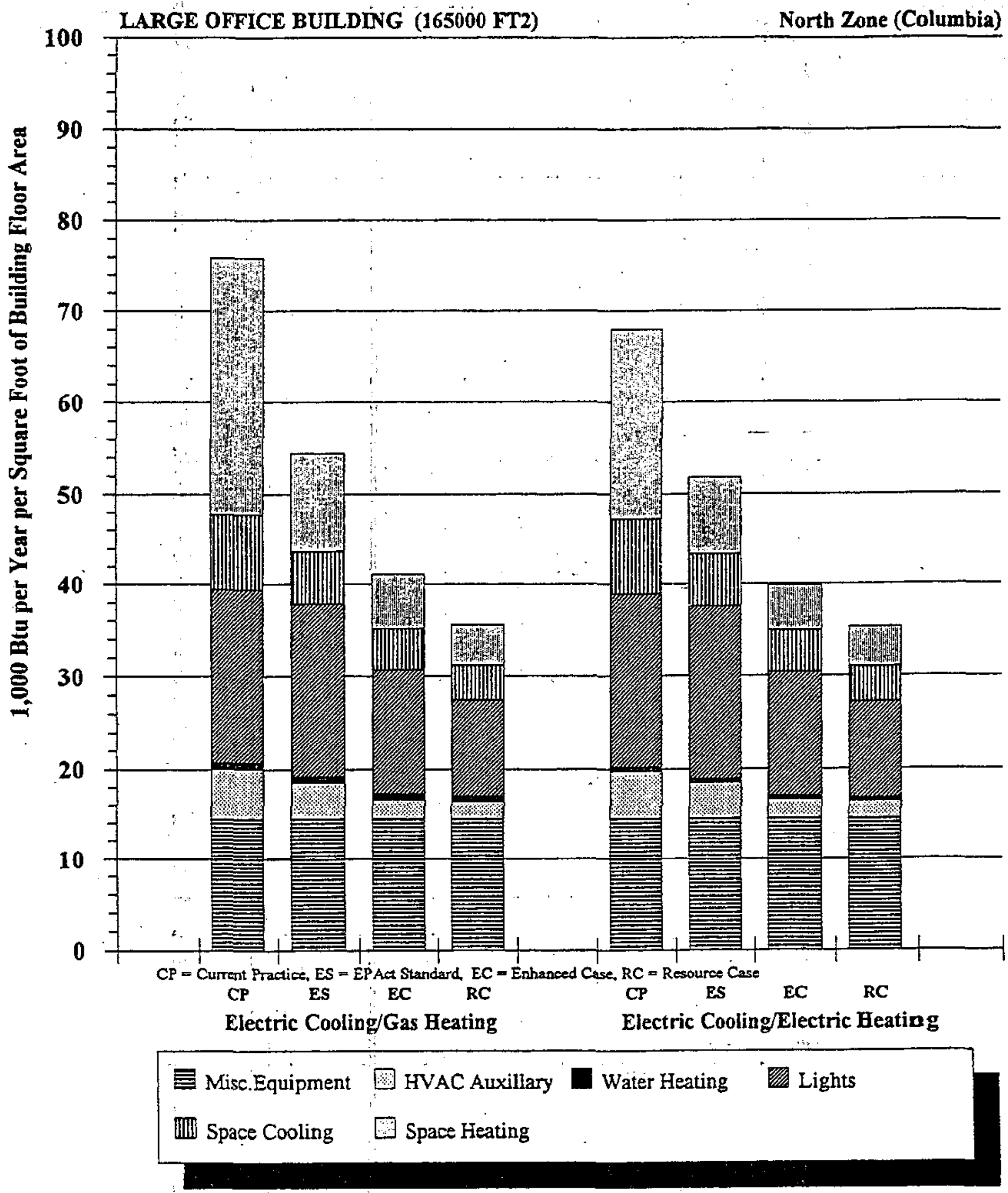
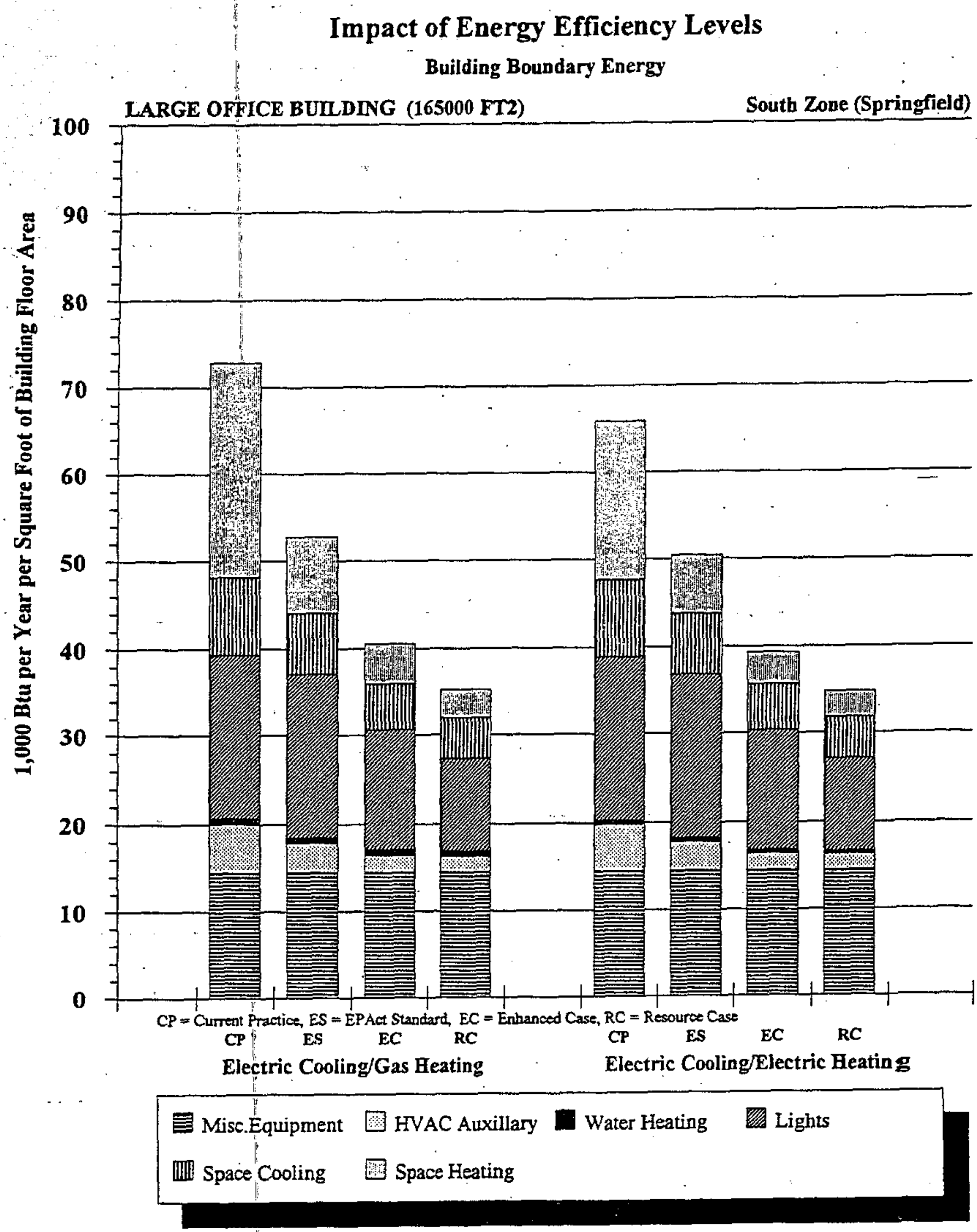
Large Office Building

Impact of Energy Efficiency Levels

Building Boundary Energy



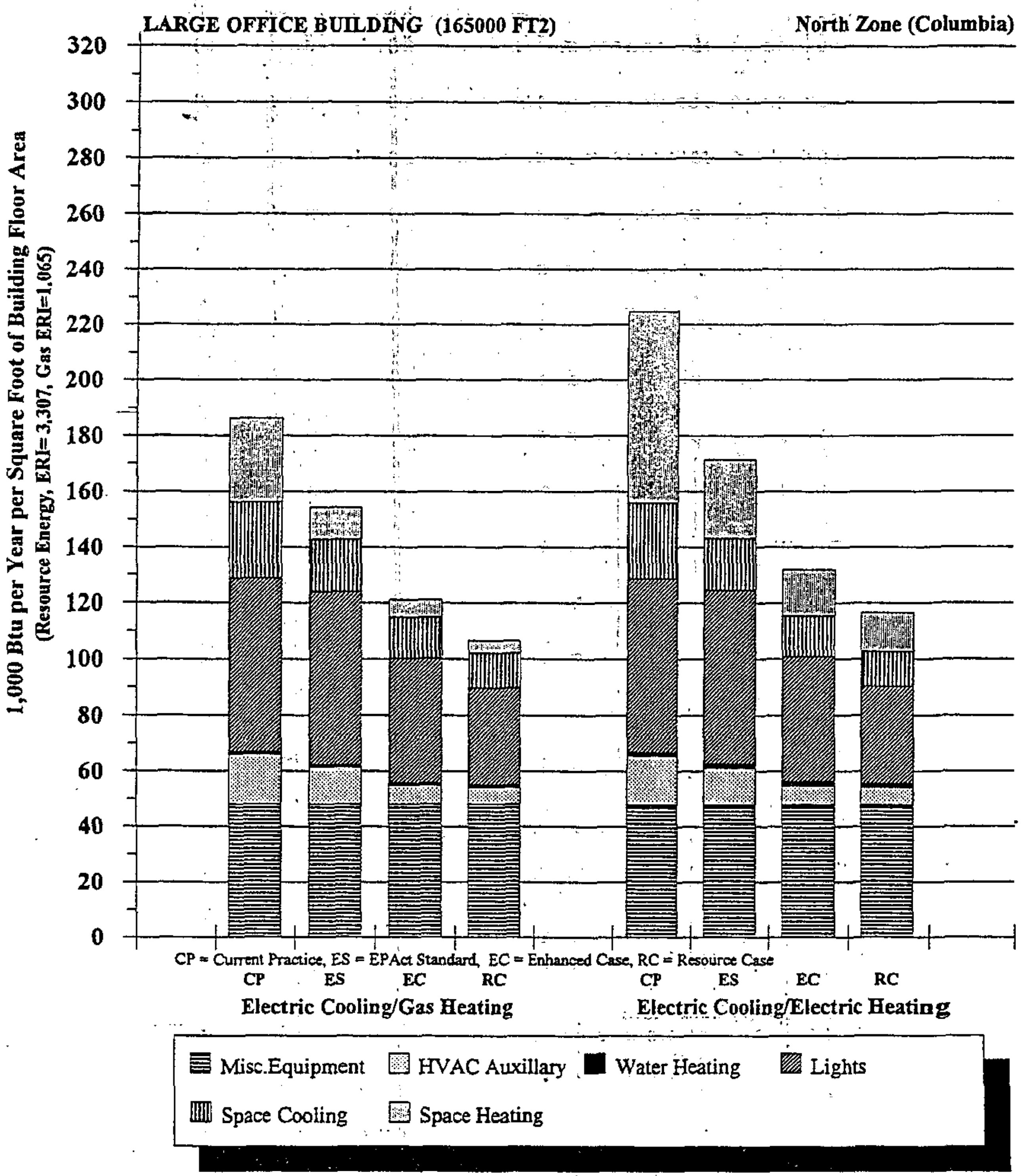
Large Office Building



Large Office Building

Impact of Energy Effiency Levels

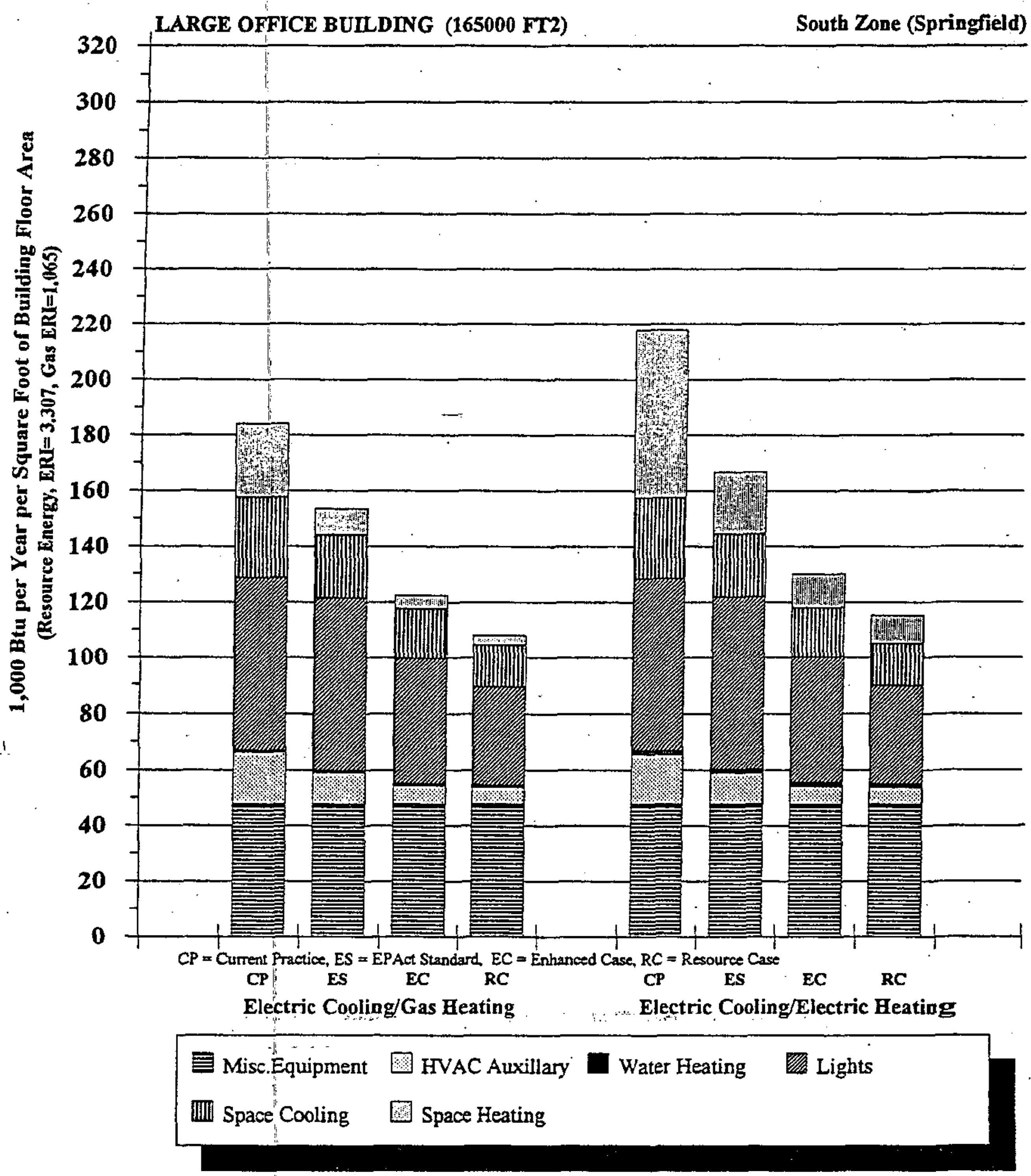
Resource Energy



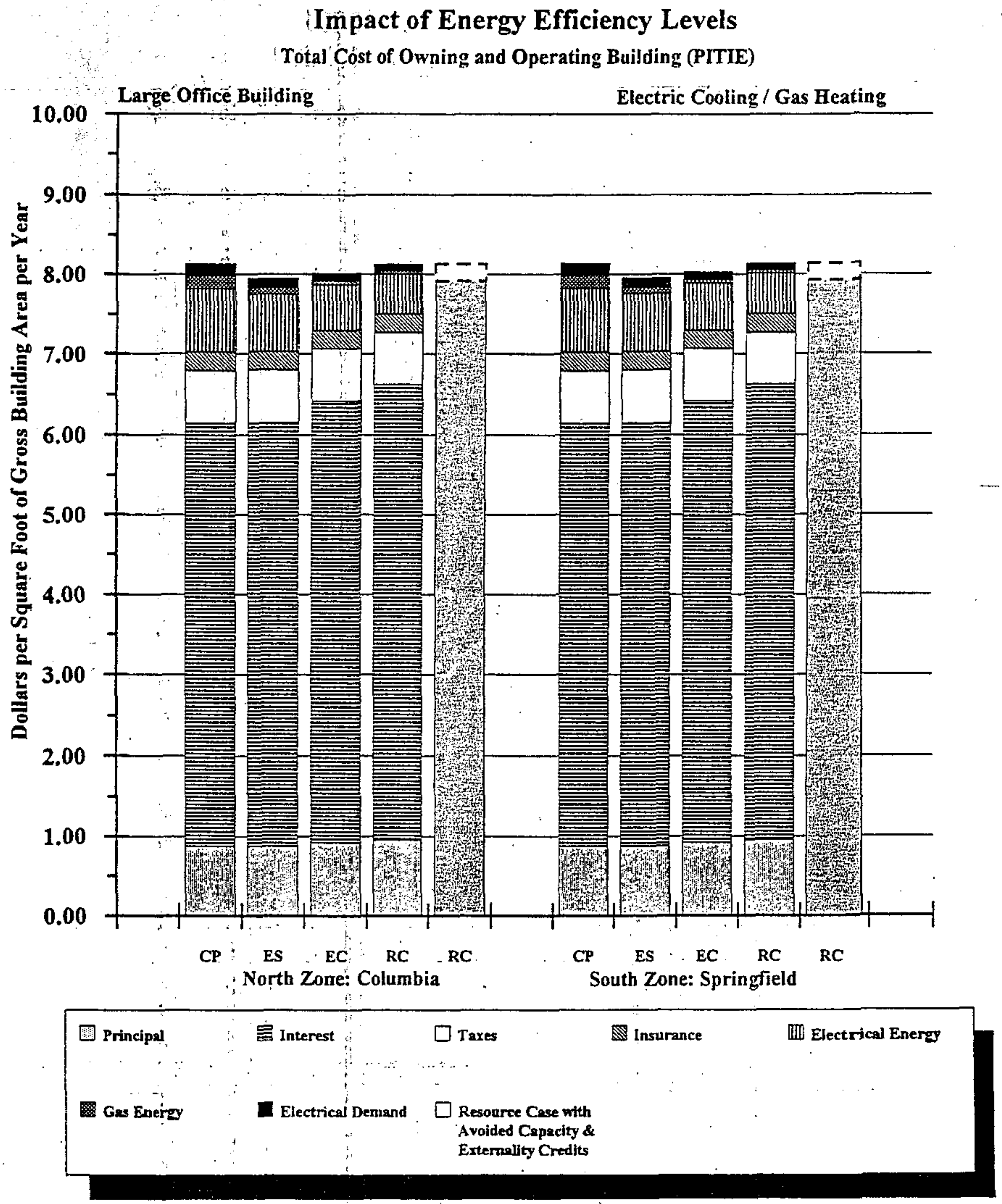
Large Office Building

Impact of Energy Effiency Levels

Resource Energy



Large Office Building



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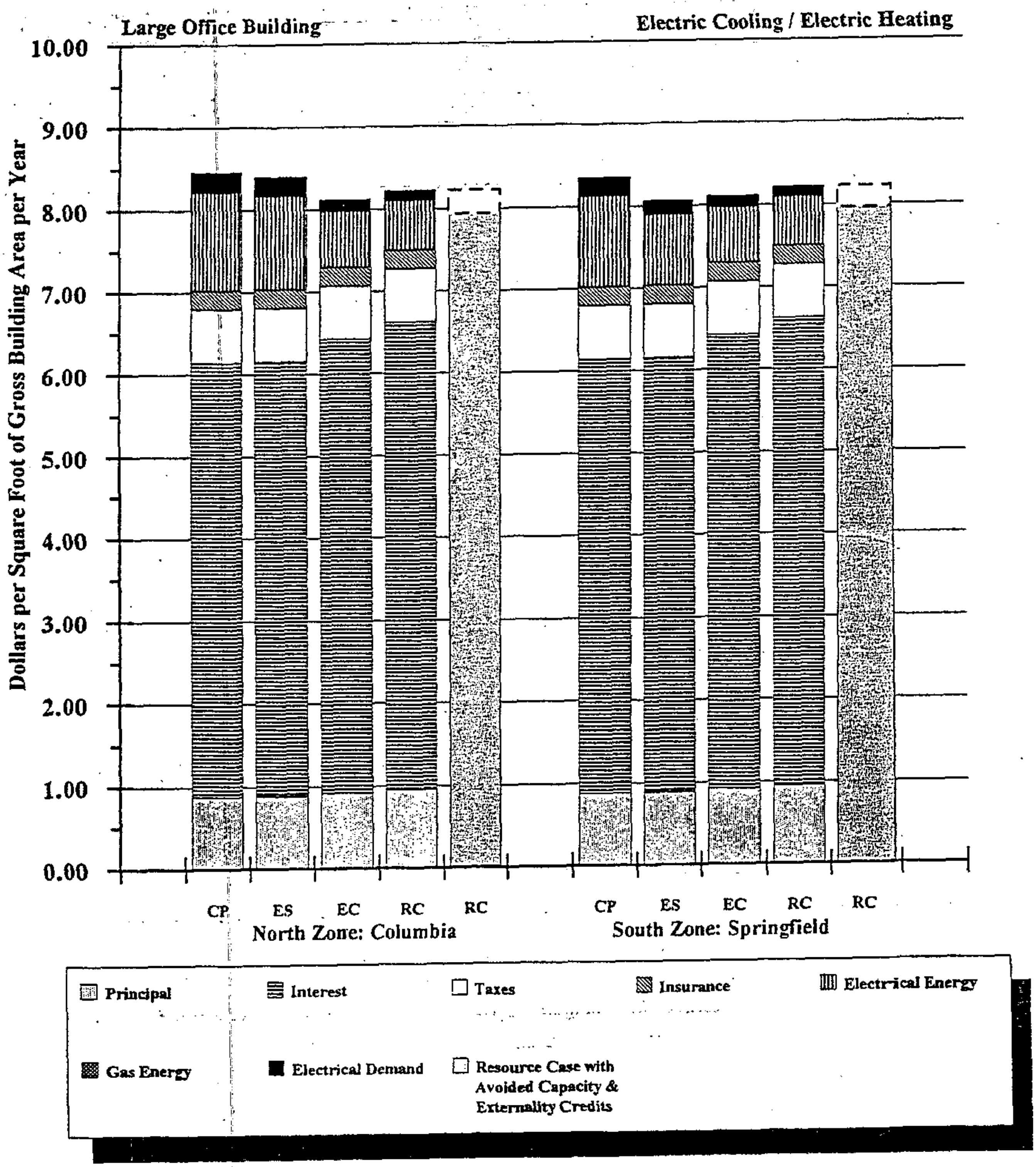
Large Office Building

Impact of Energy Efficiency Levels

Total Cost of Owning and Operating Building (PITIE)



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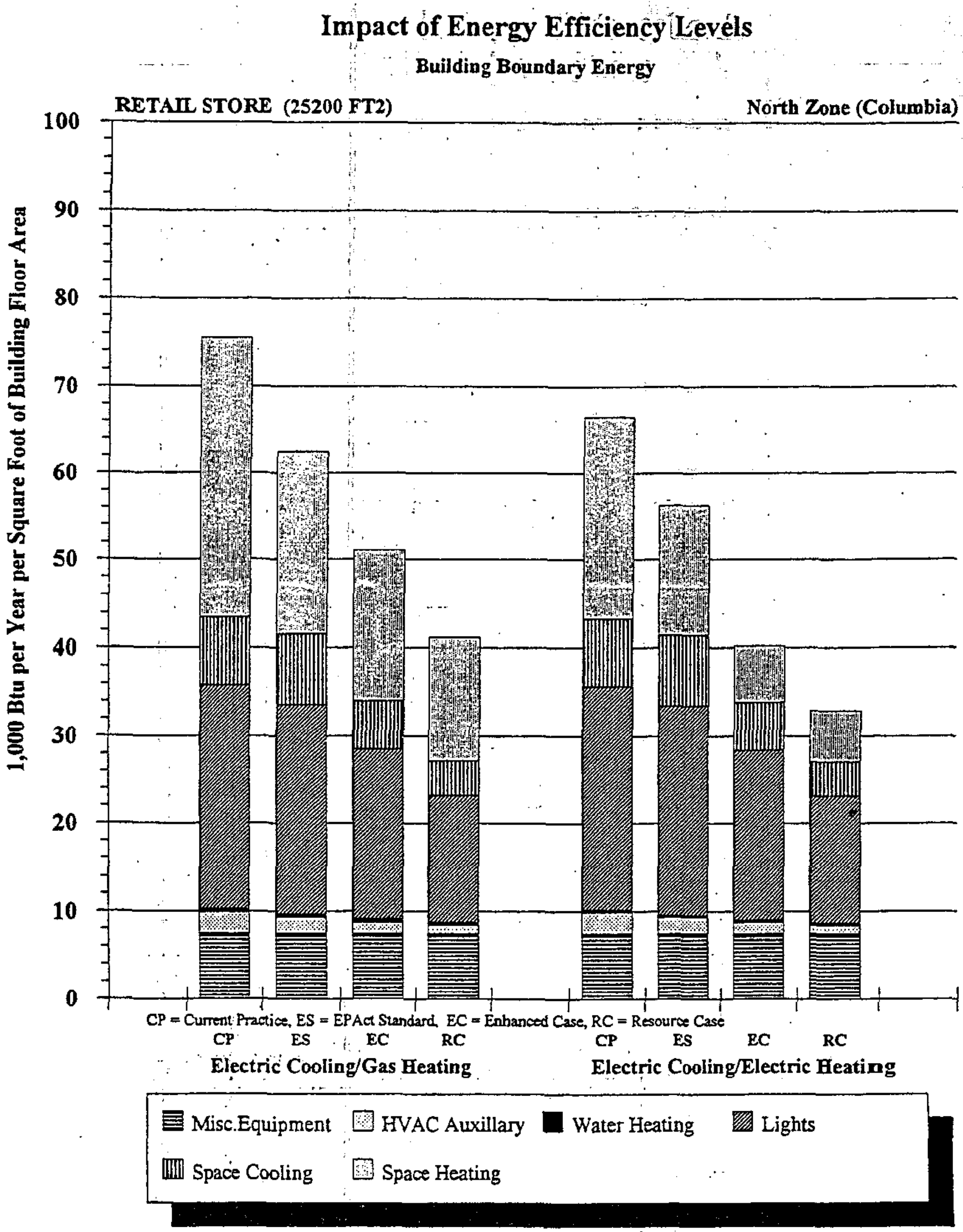
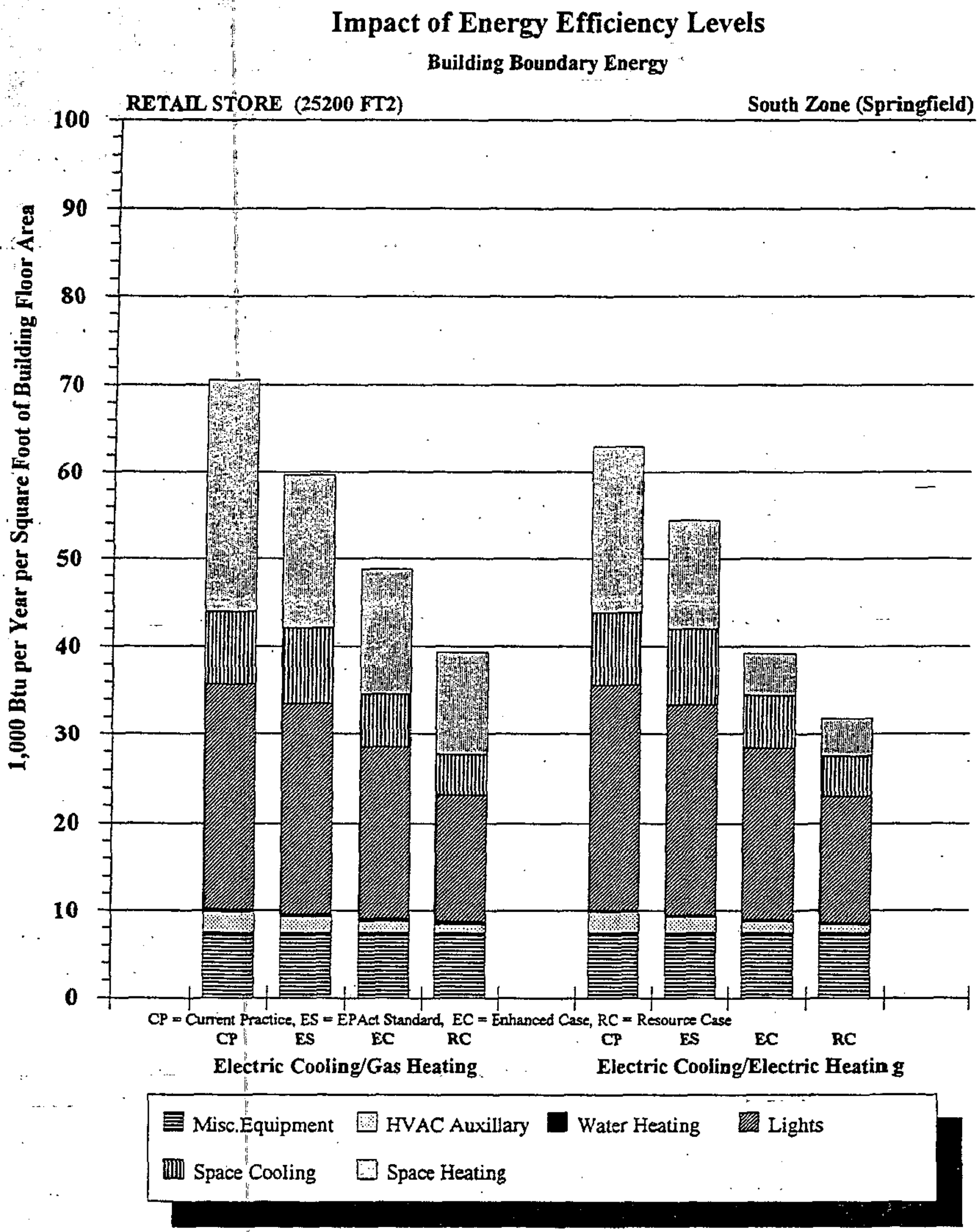
Retail Store



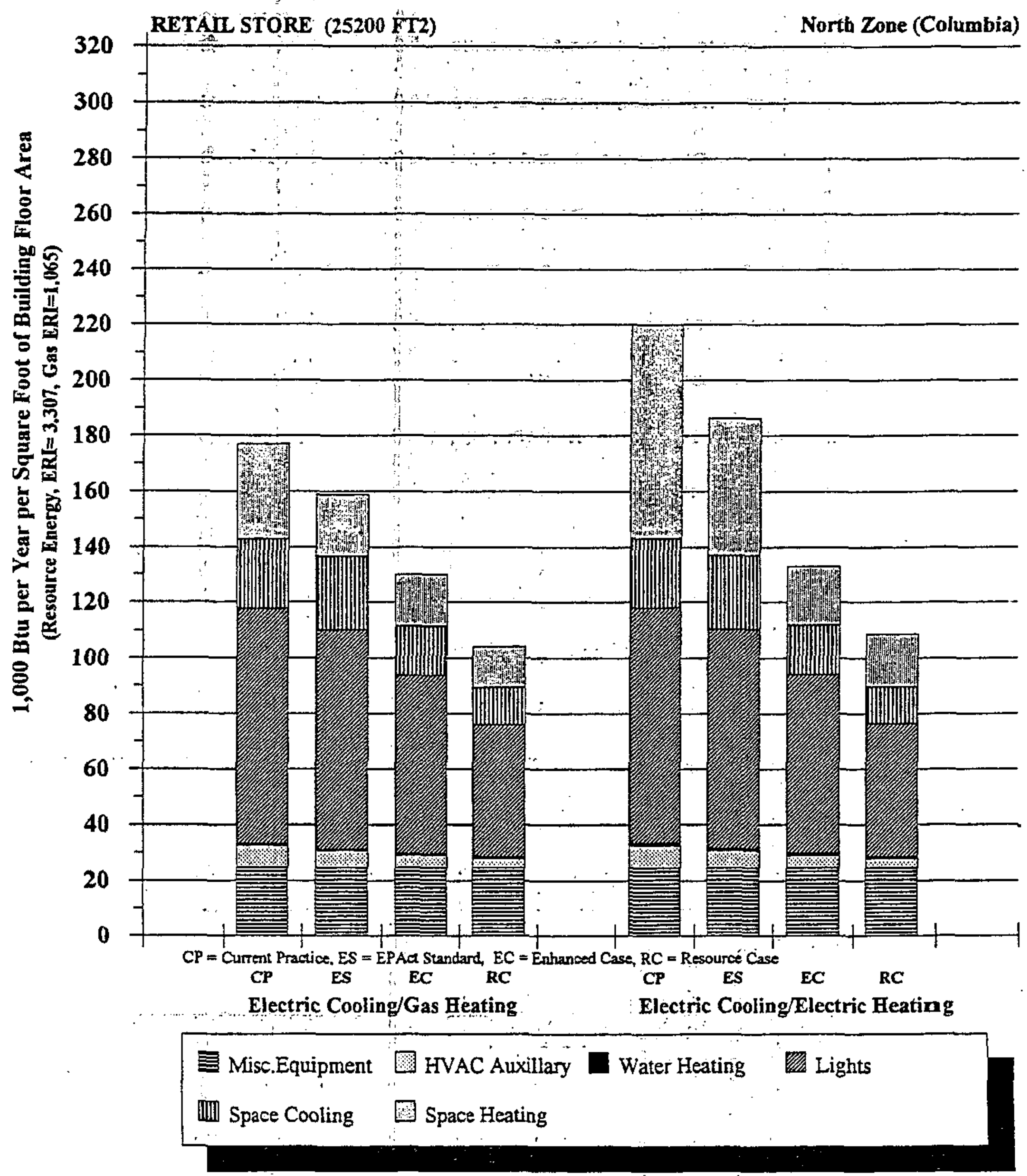
Retail Store



Retail Store

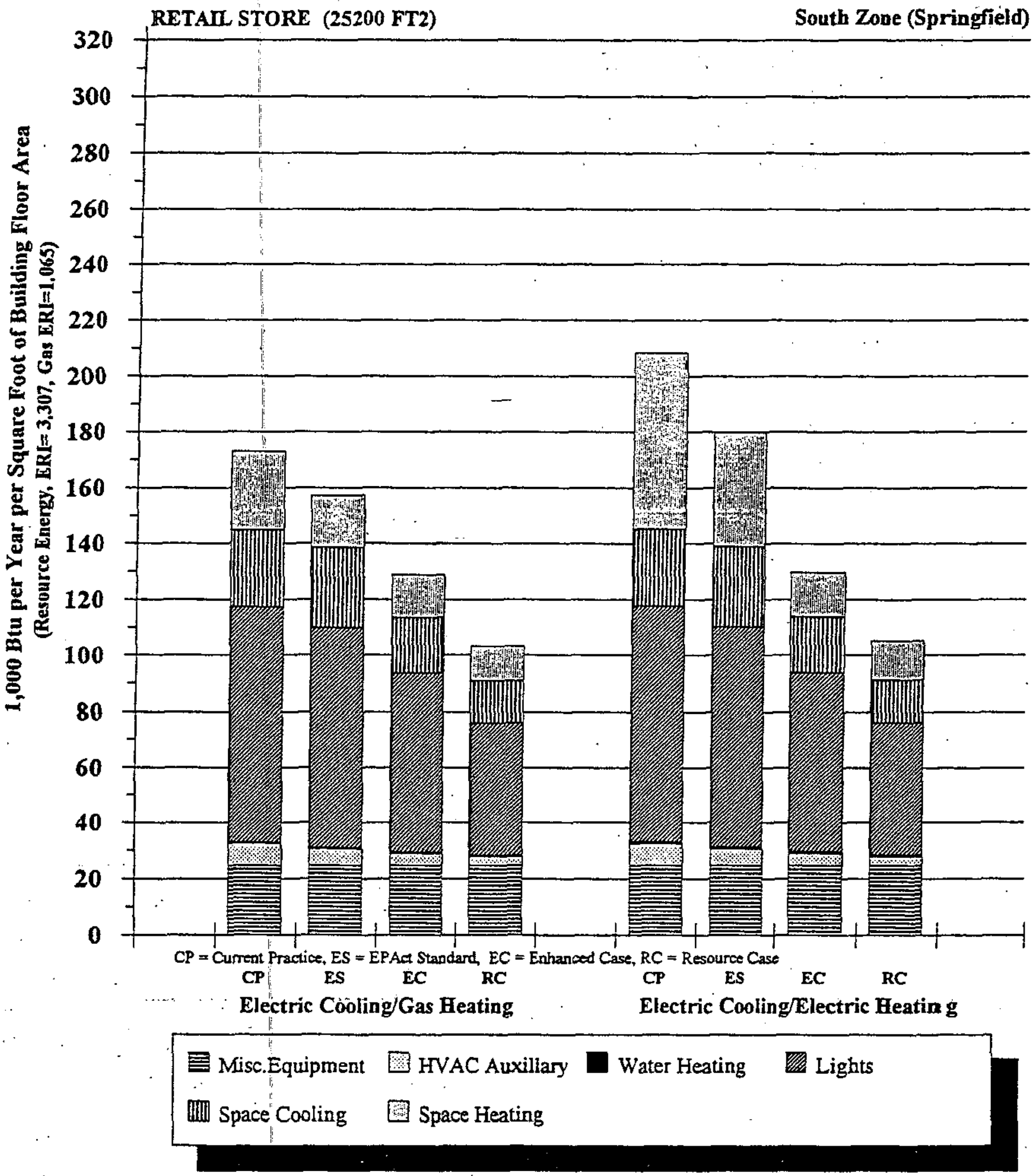
Impact of Energy Effiency Levels

Resource Energy

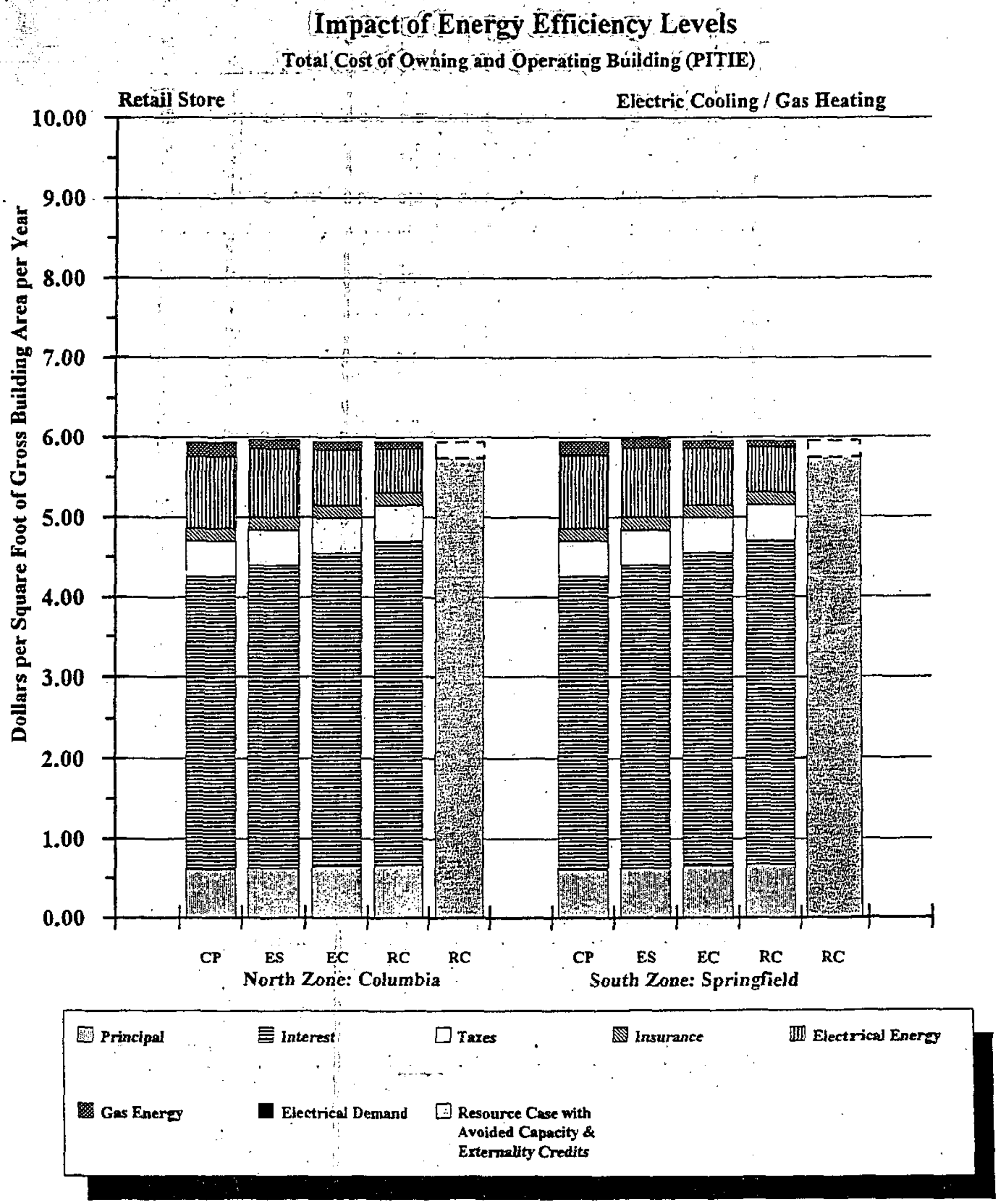


Impact of Energy Effiency Levels

Resource Energy



Retail Store



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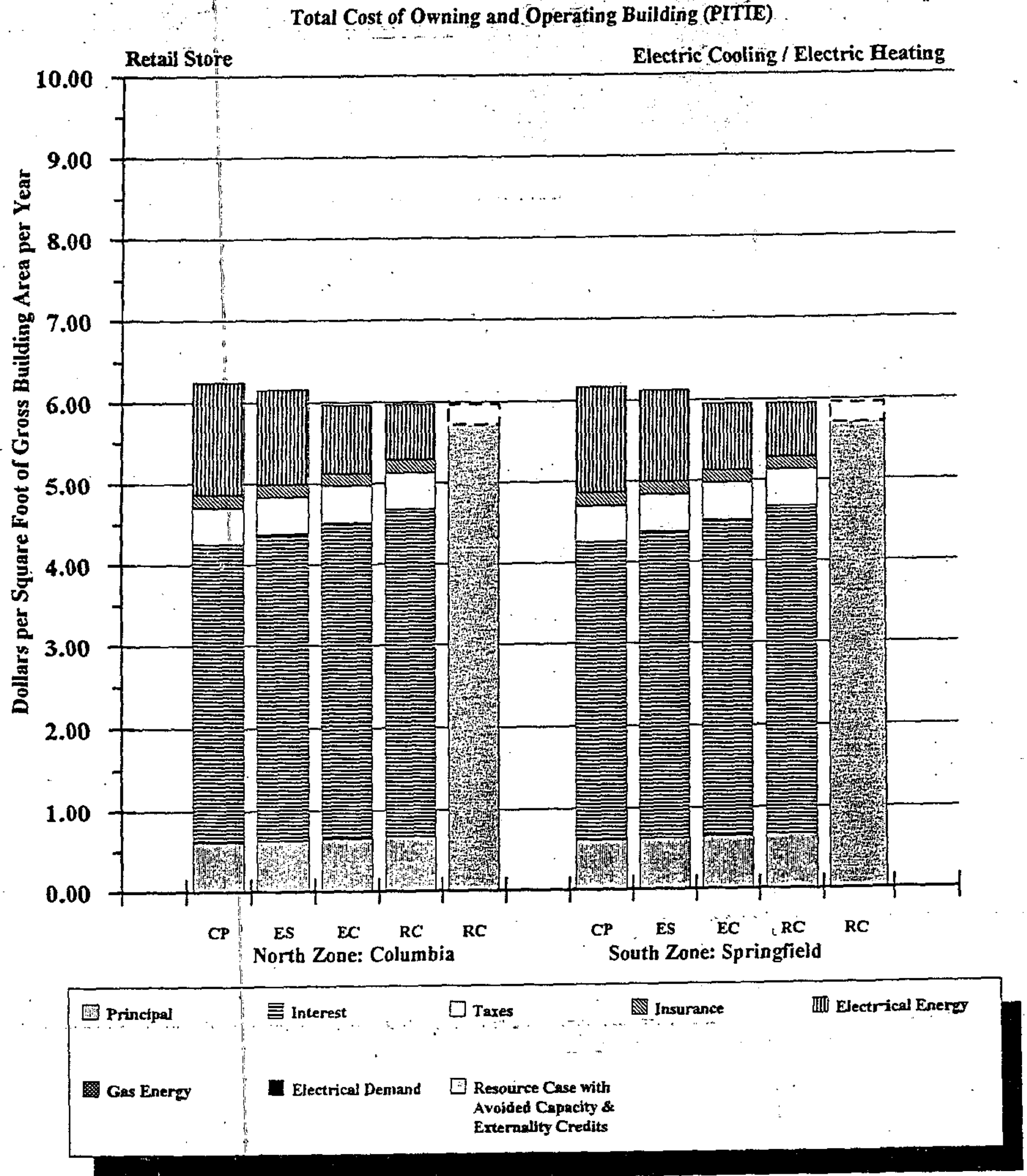
Impact of Energy Efficiency Levels



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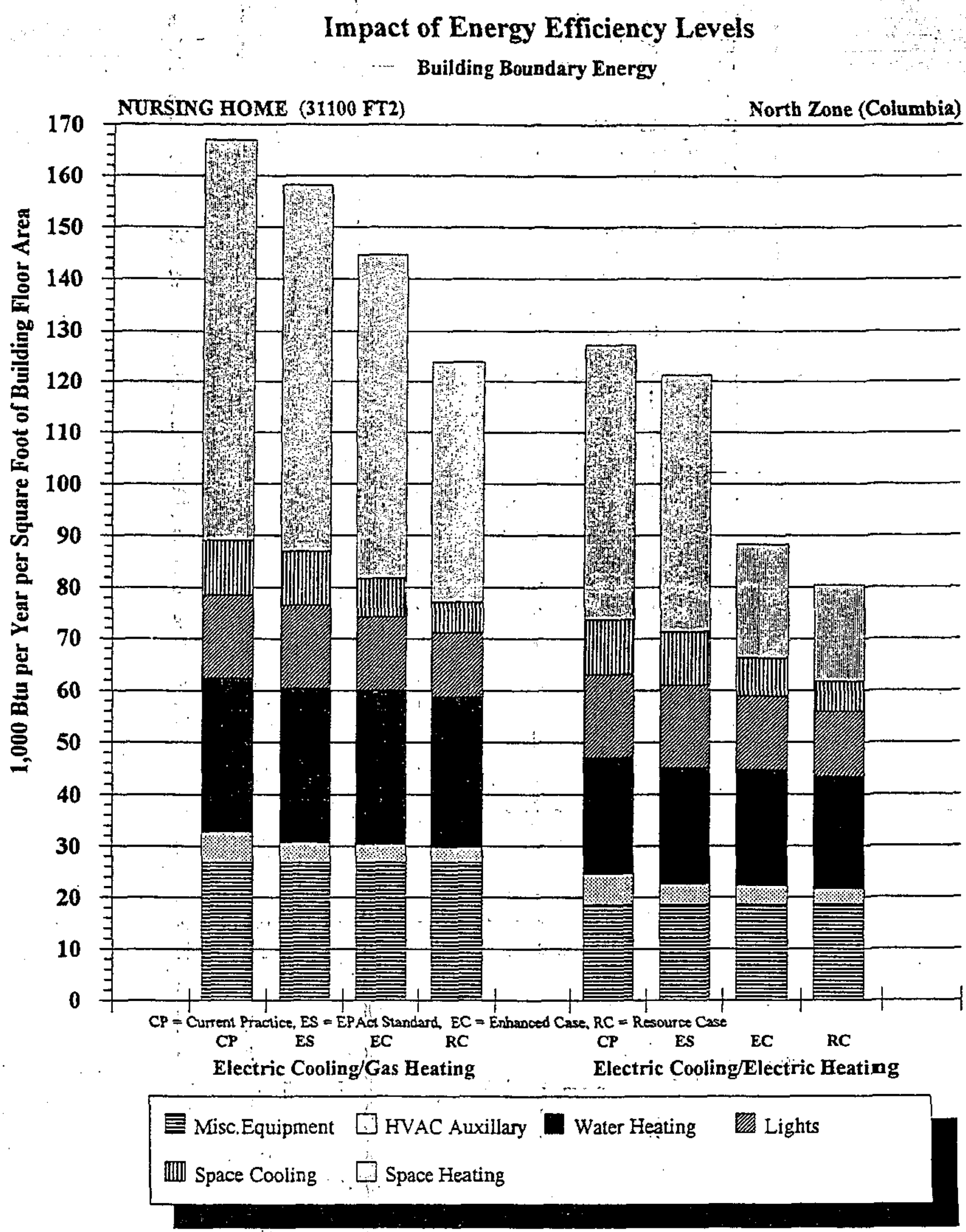
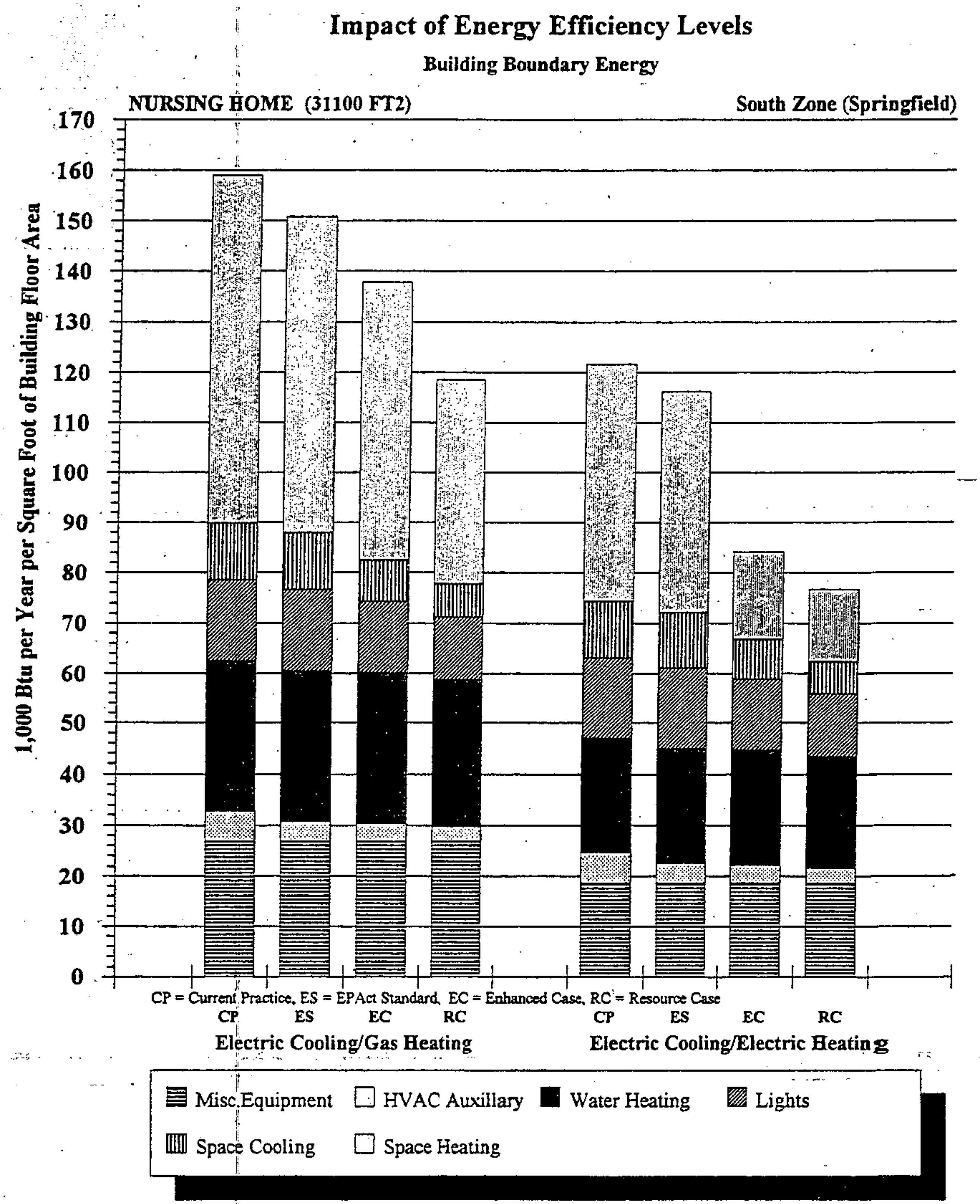
Nursing Home



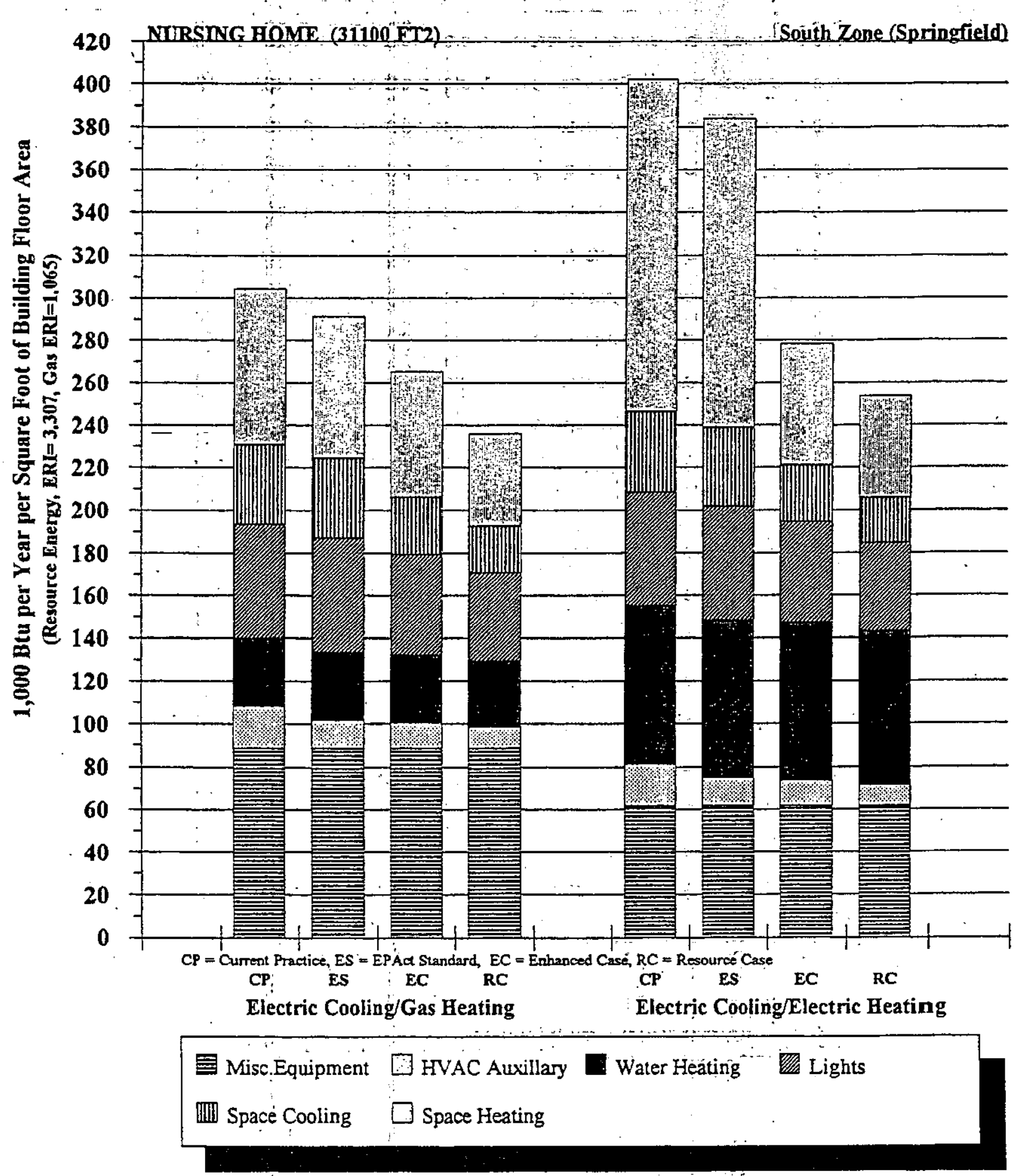
Nursing Home



Nursing Home

Impact of Energy Effiency Levels

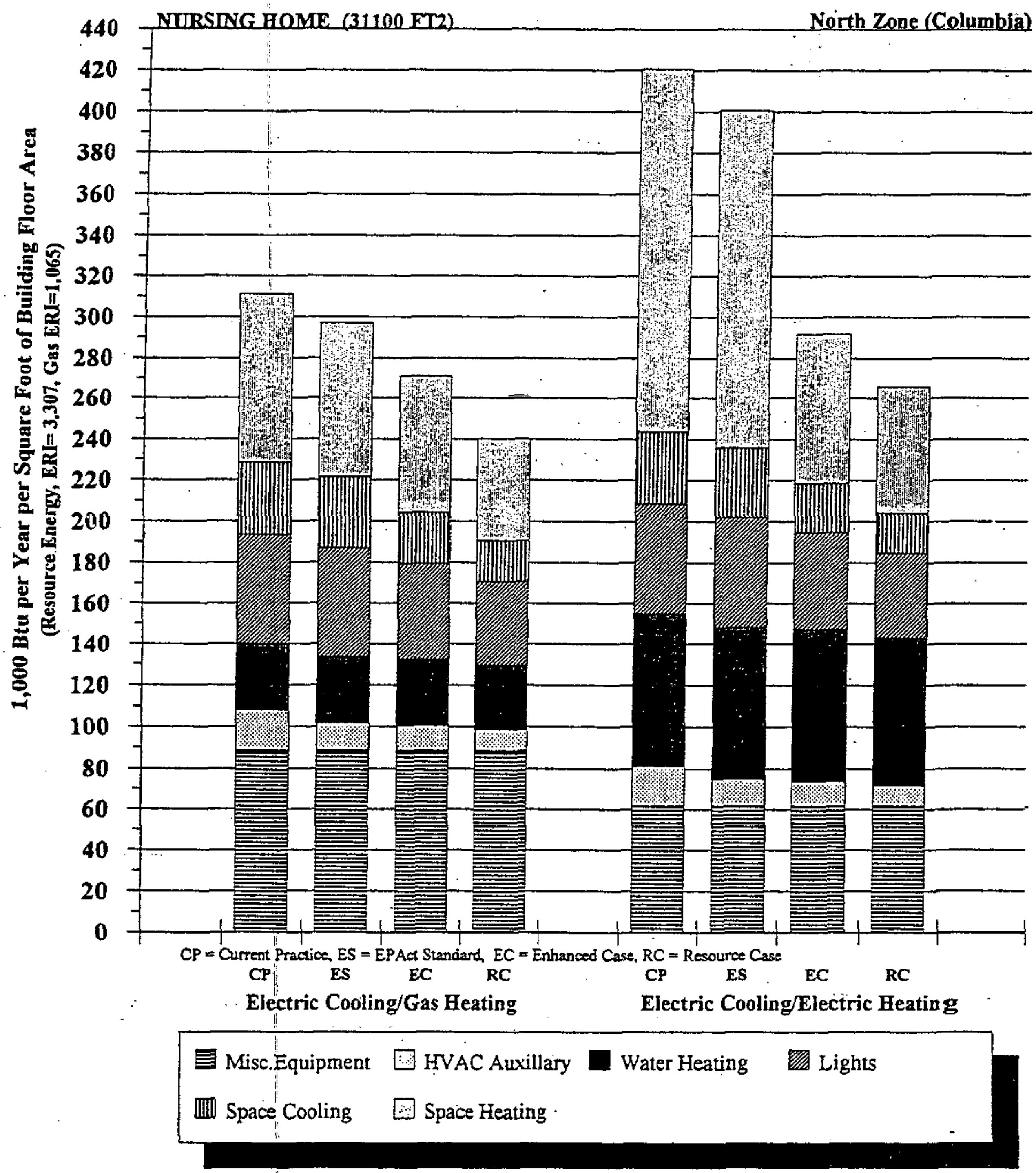
Resource Energy



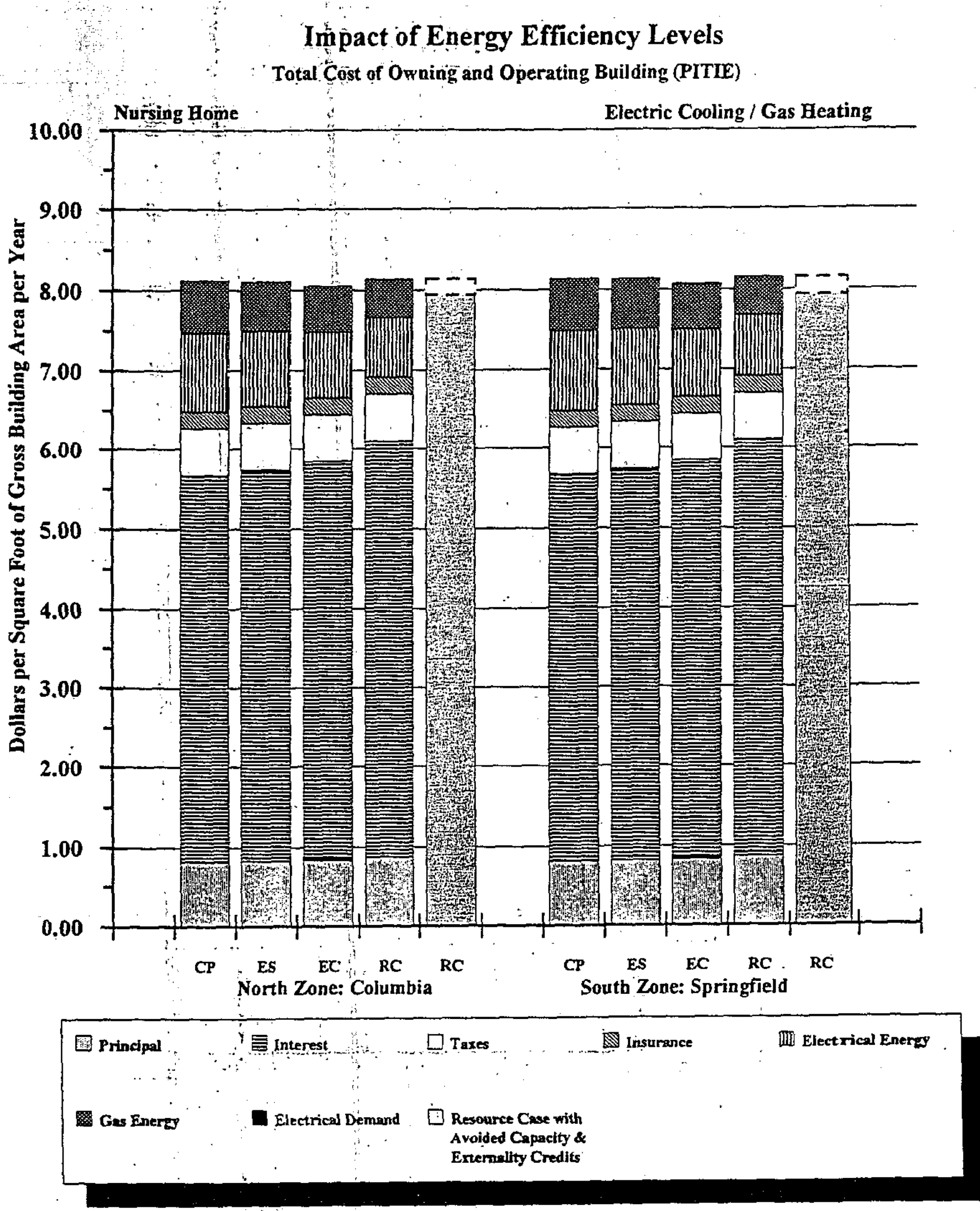
Nursing Home

Impact of Energy Effiency Levels

Resource Energy



Nursing Home



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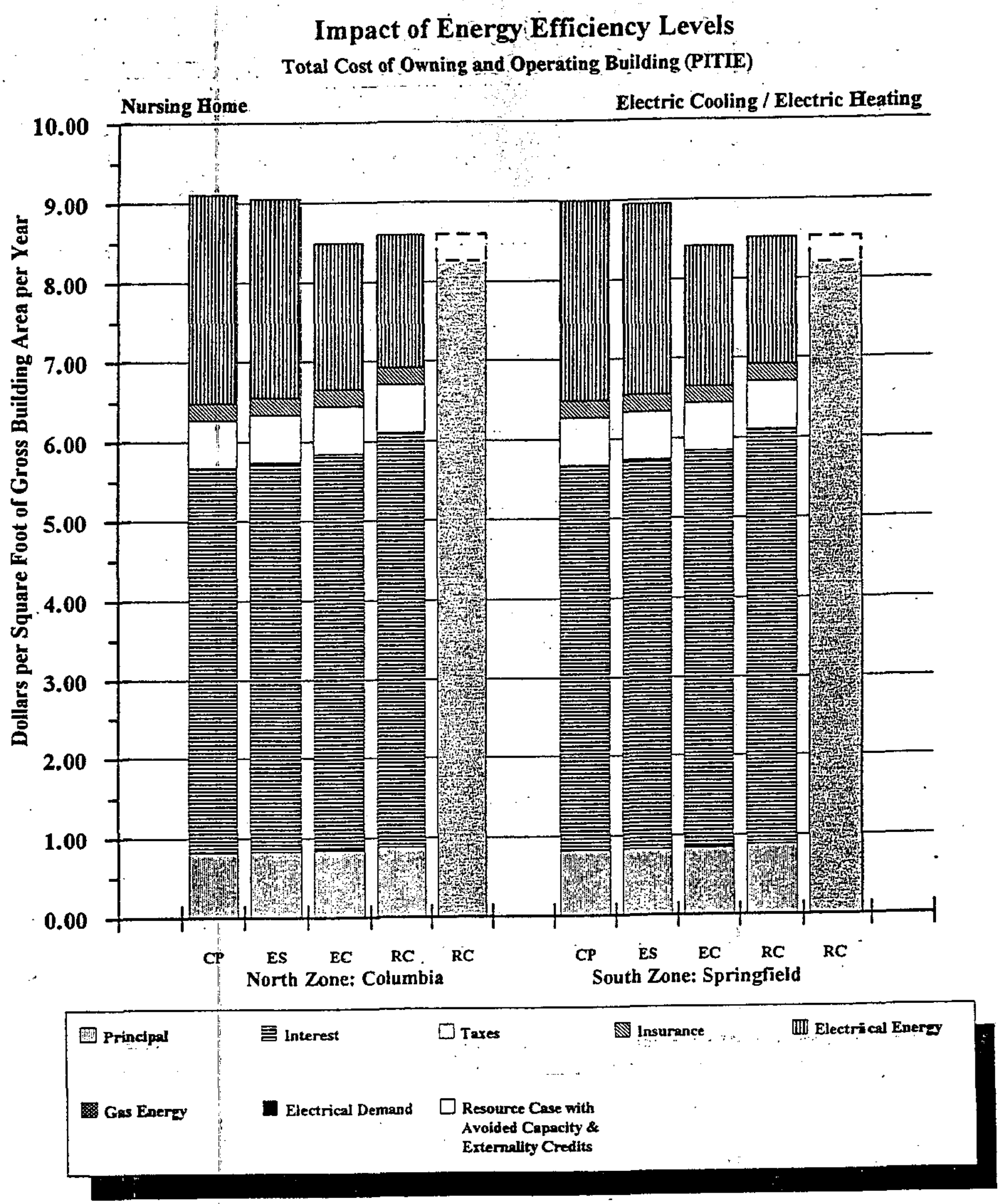
Nursing Home



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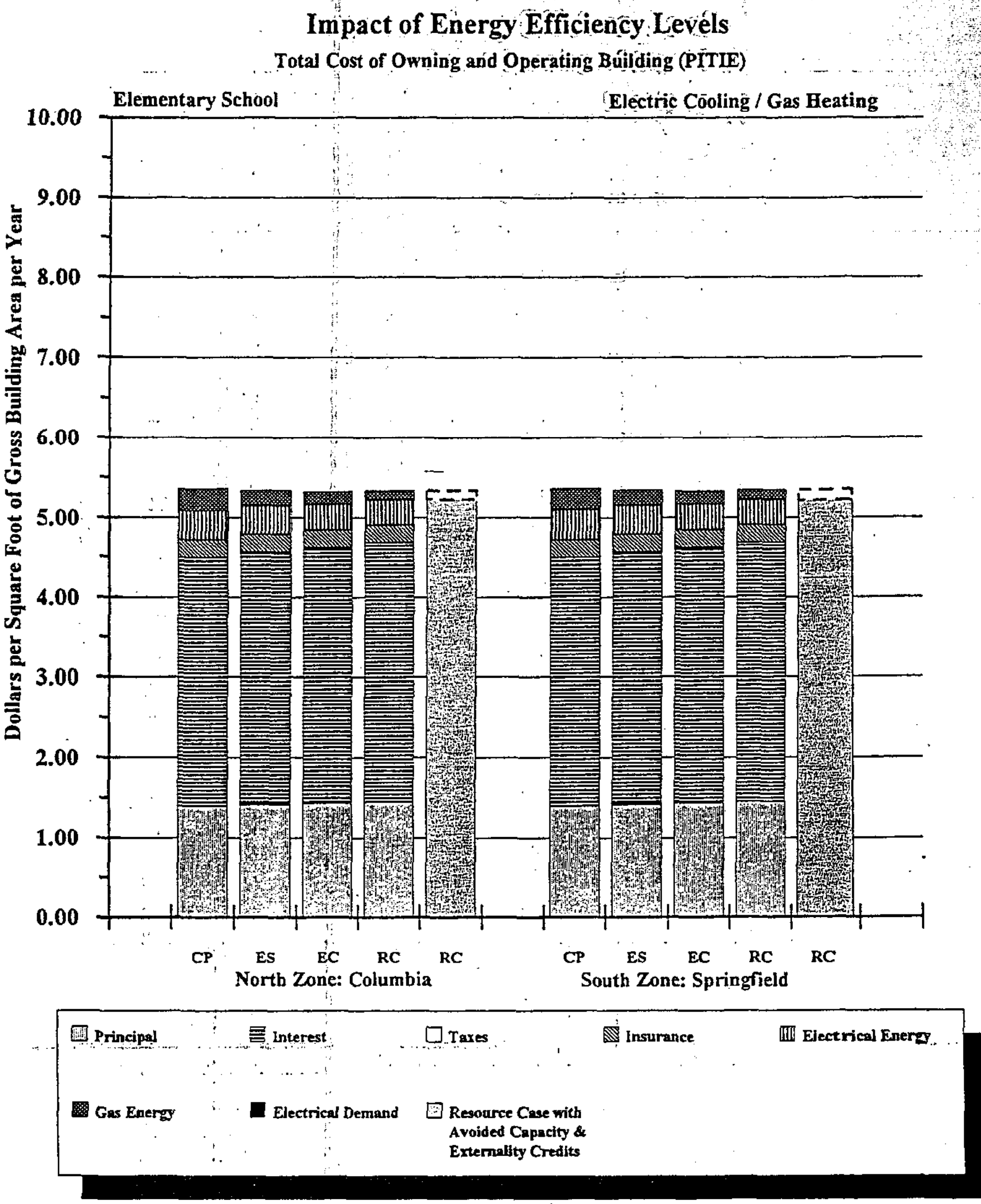
Elementary School



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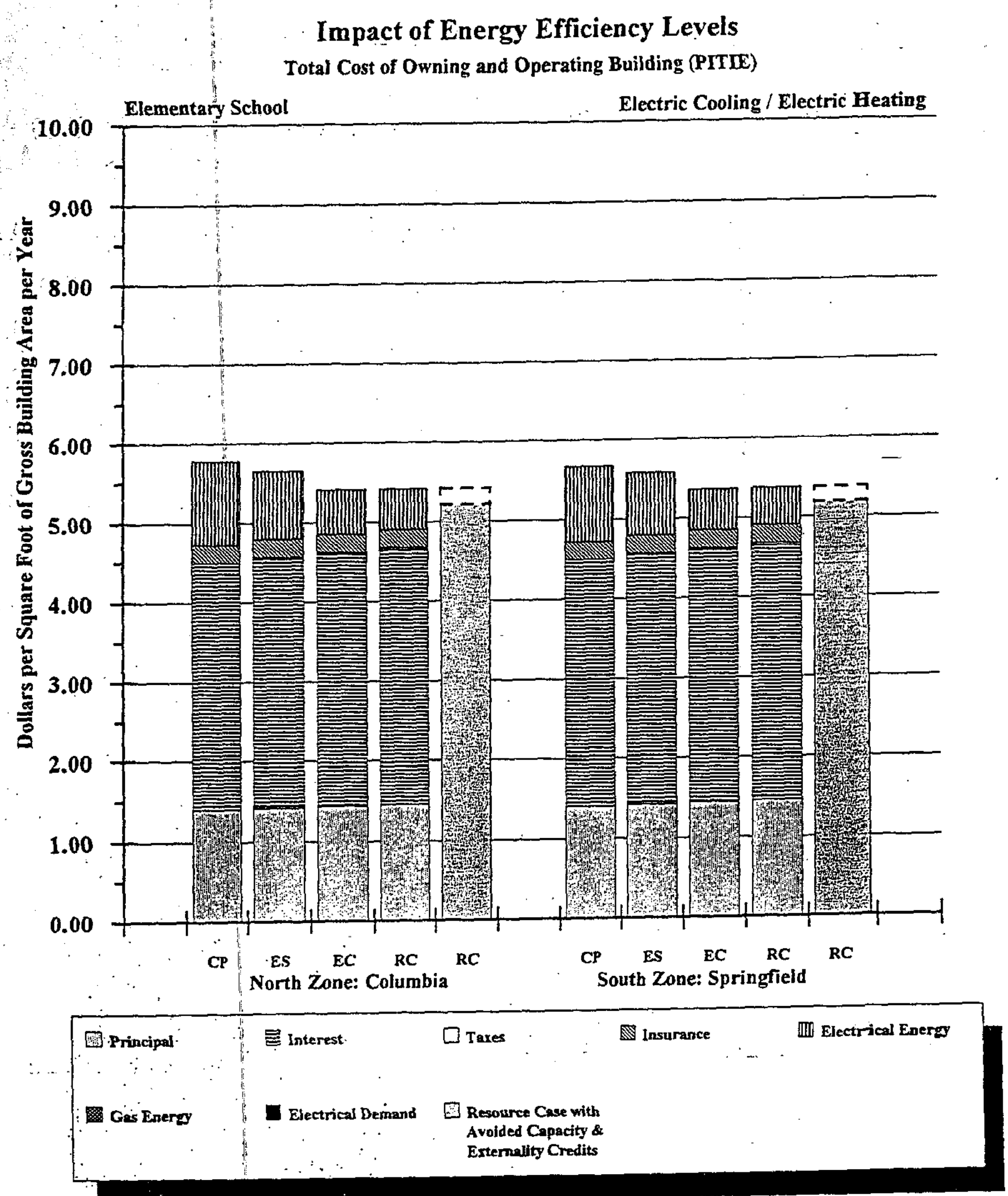
Elementary School



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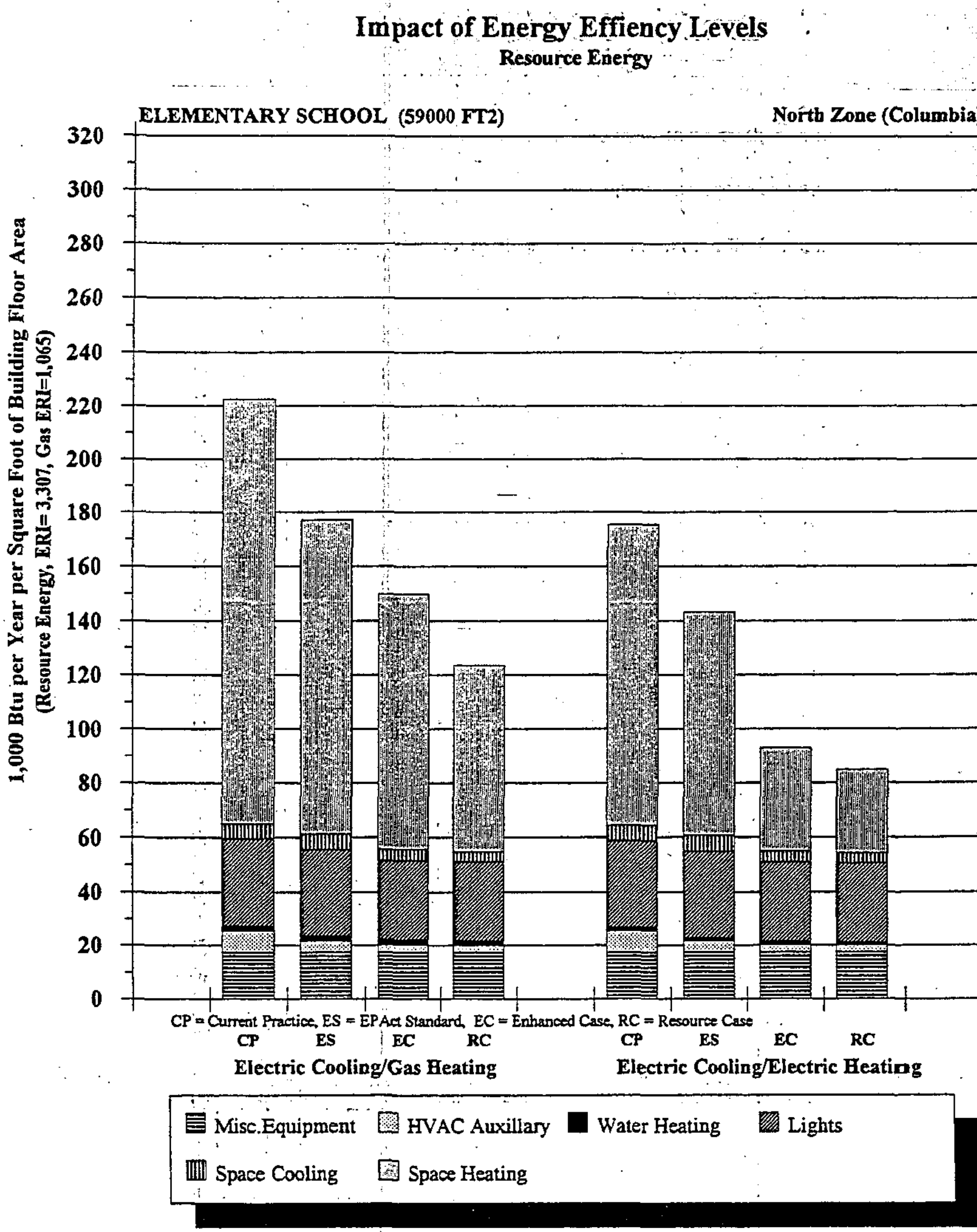
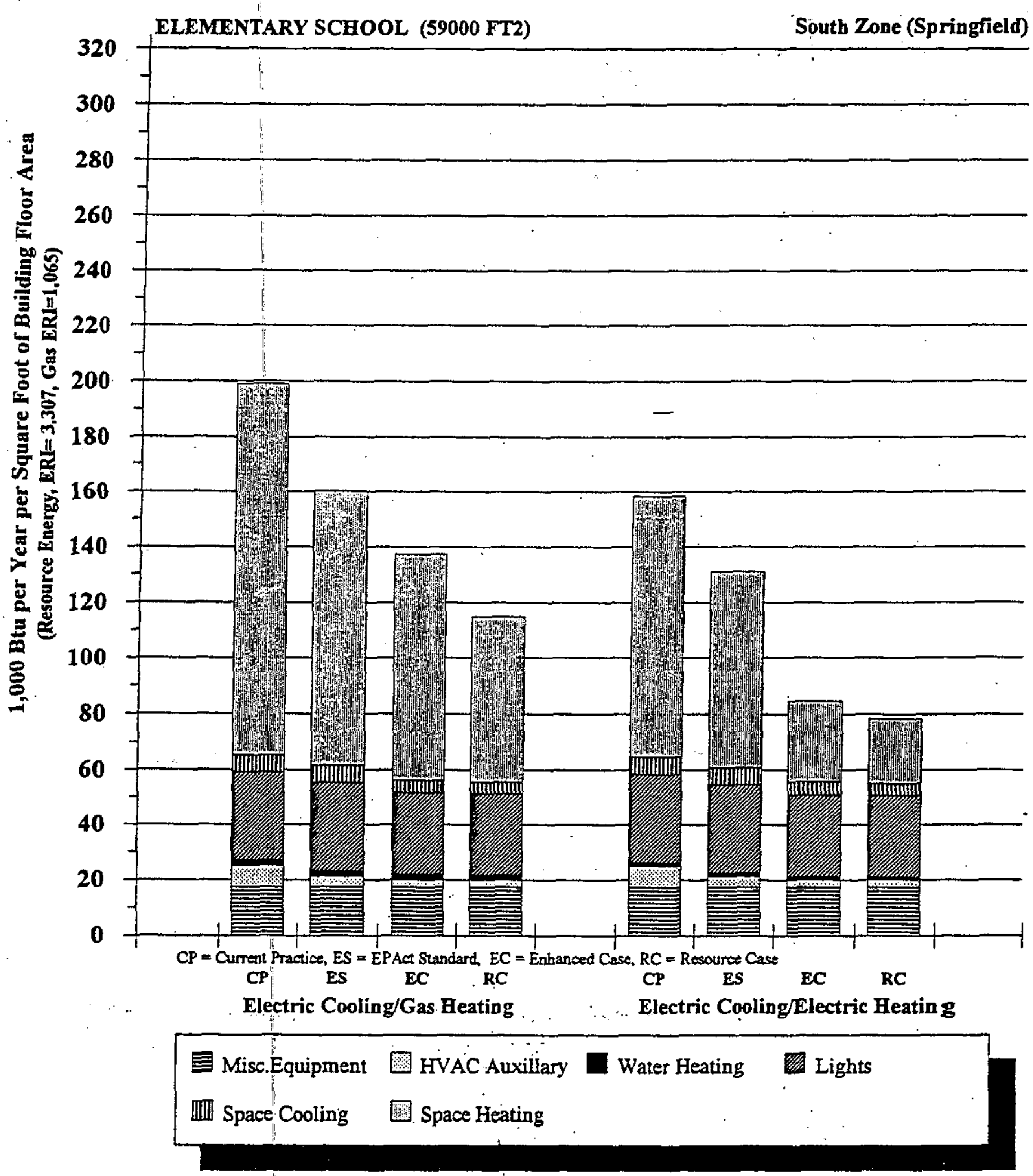
Elementary School



Elementary School

Impact of Energy Effiency Levels

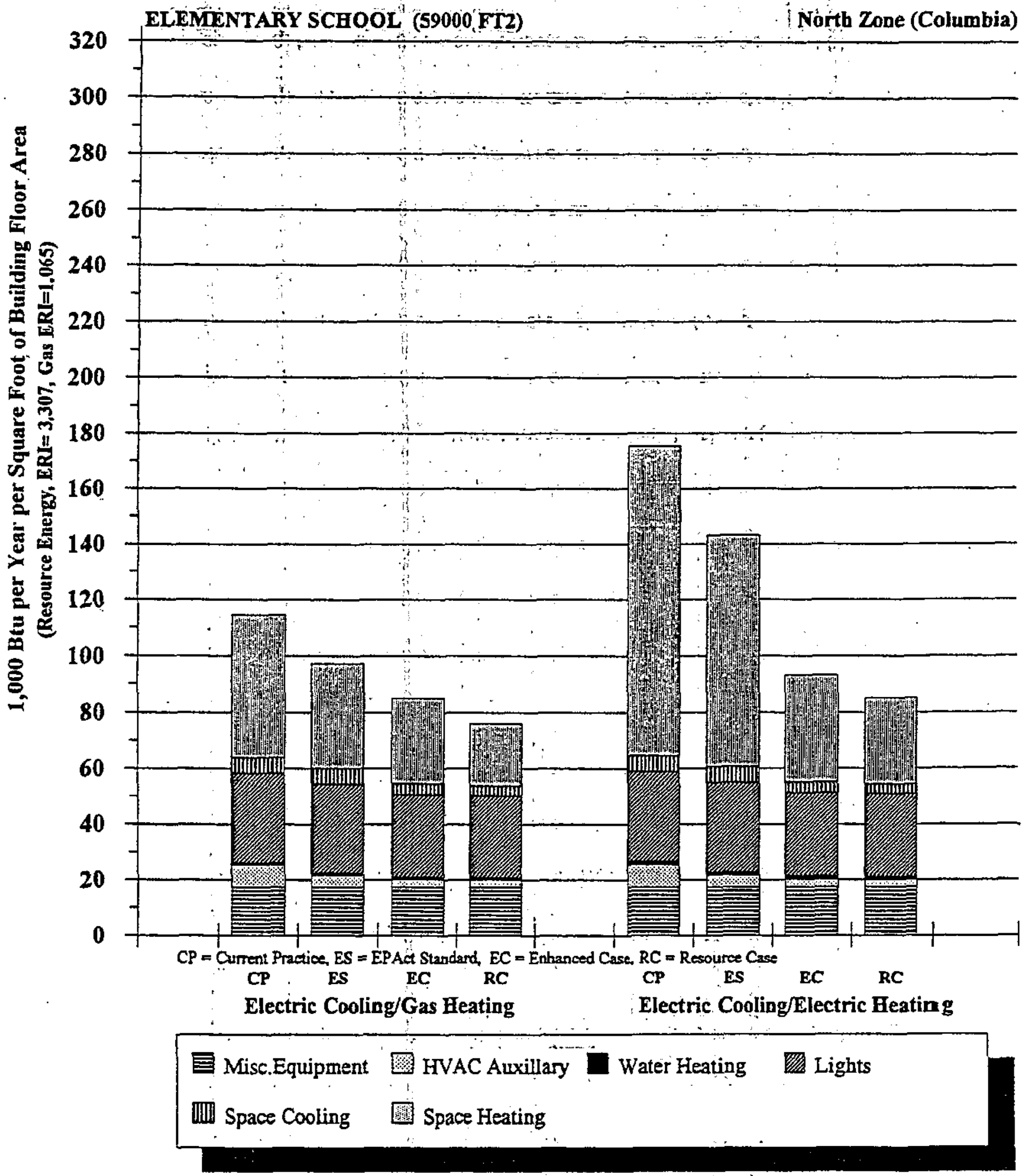
Resource Energy



Elementary School

Impact of Energy Effiency Levels

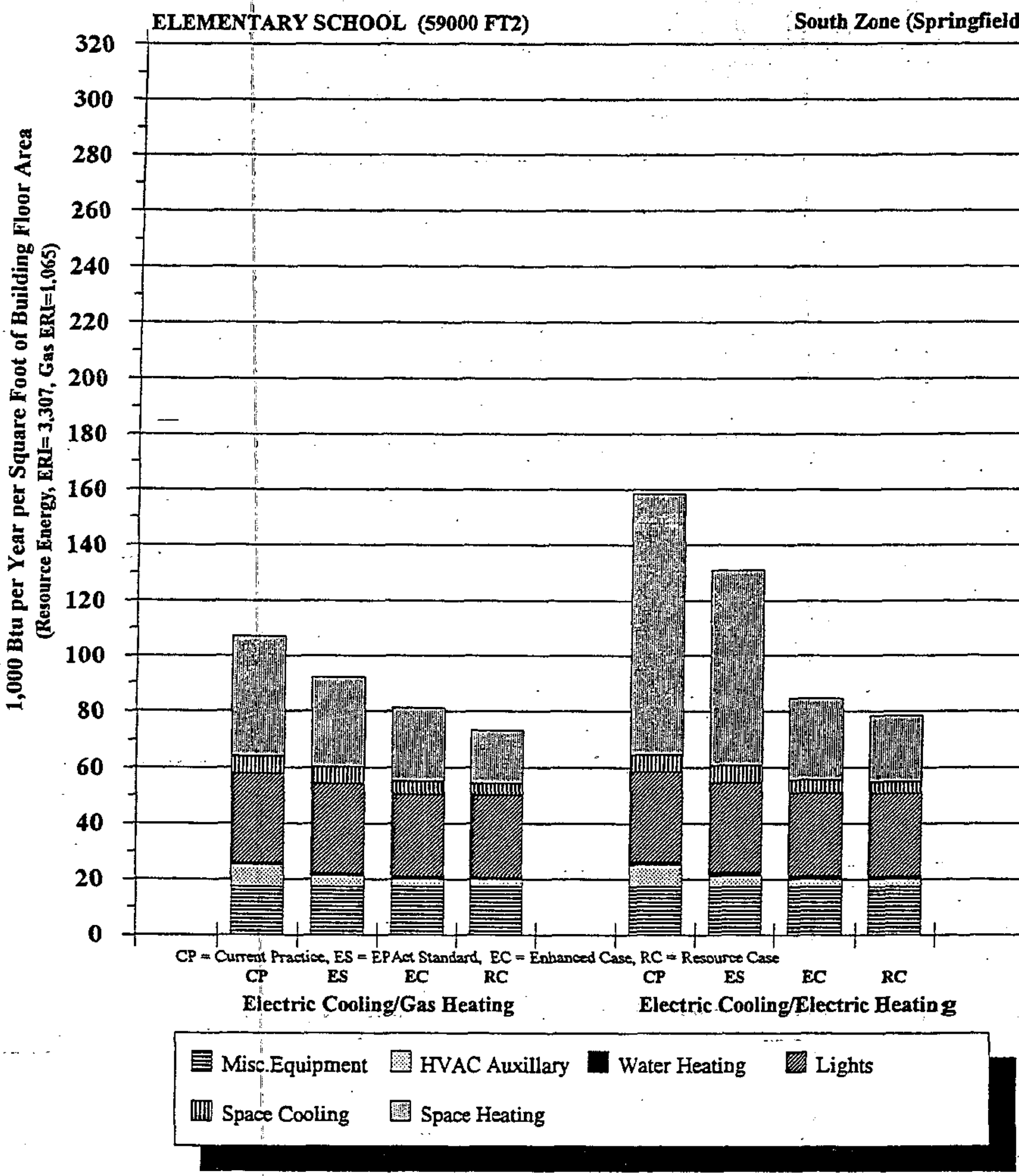
Resource Energy



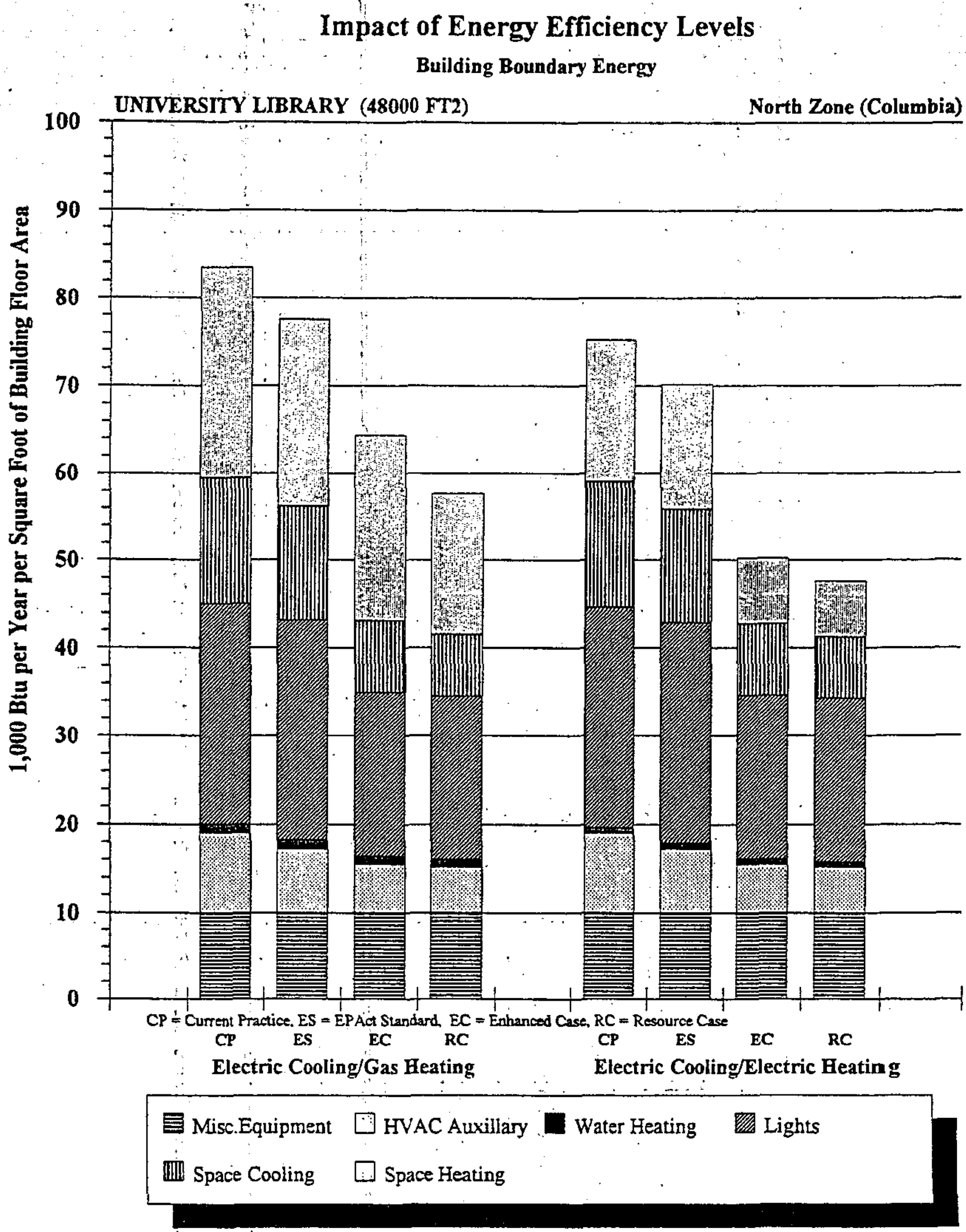
Elementary School

Impact of Energy Effiency Levels

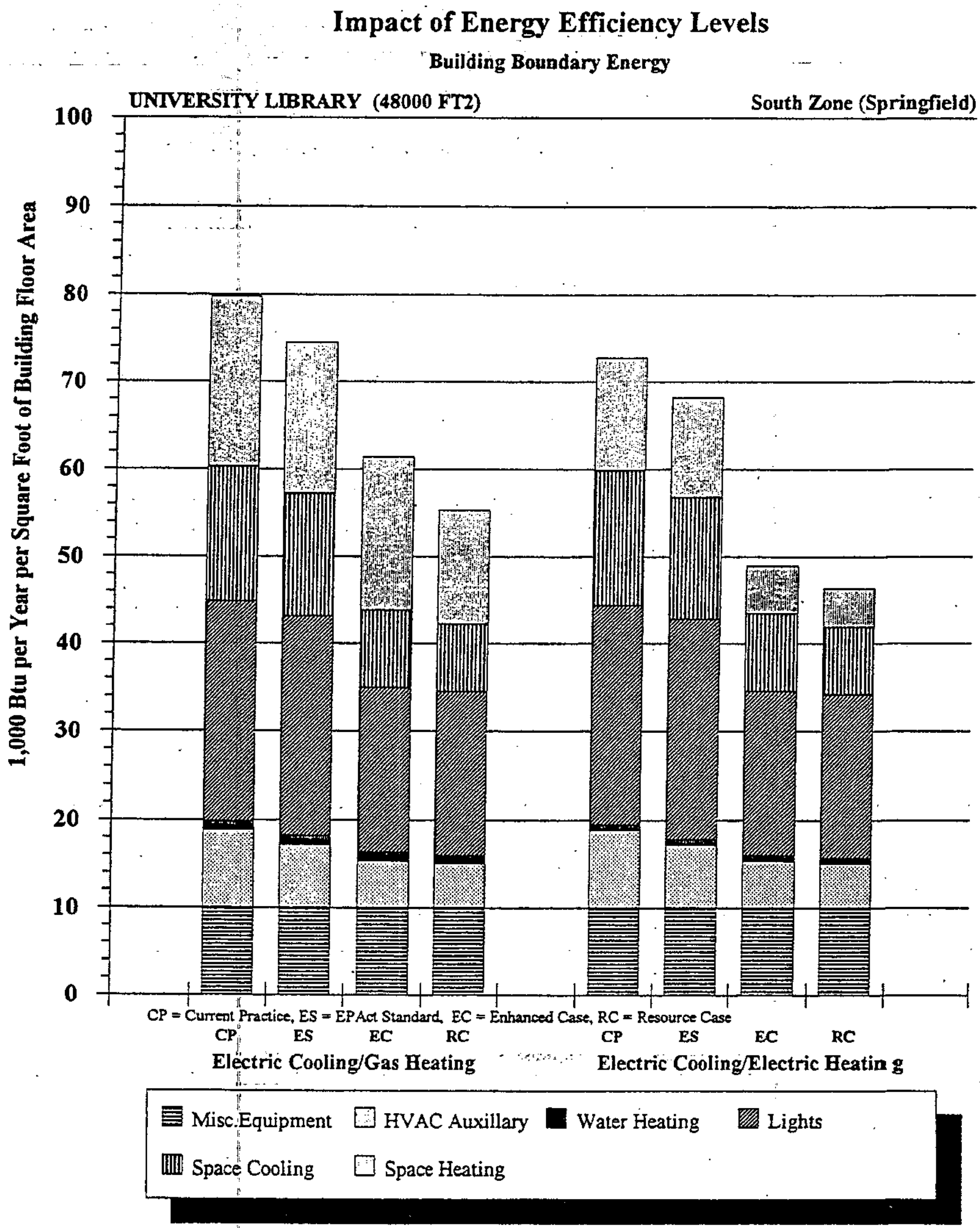
Resource Energy



University Library



University Library



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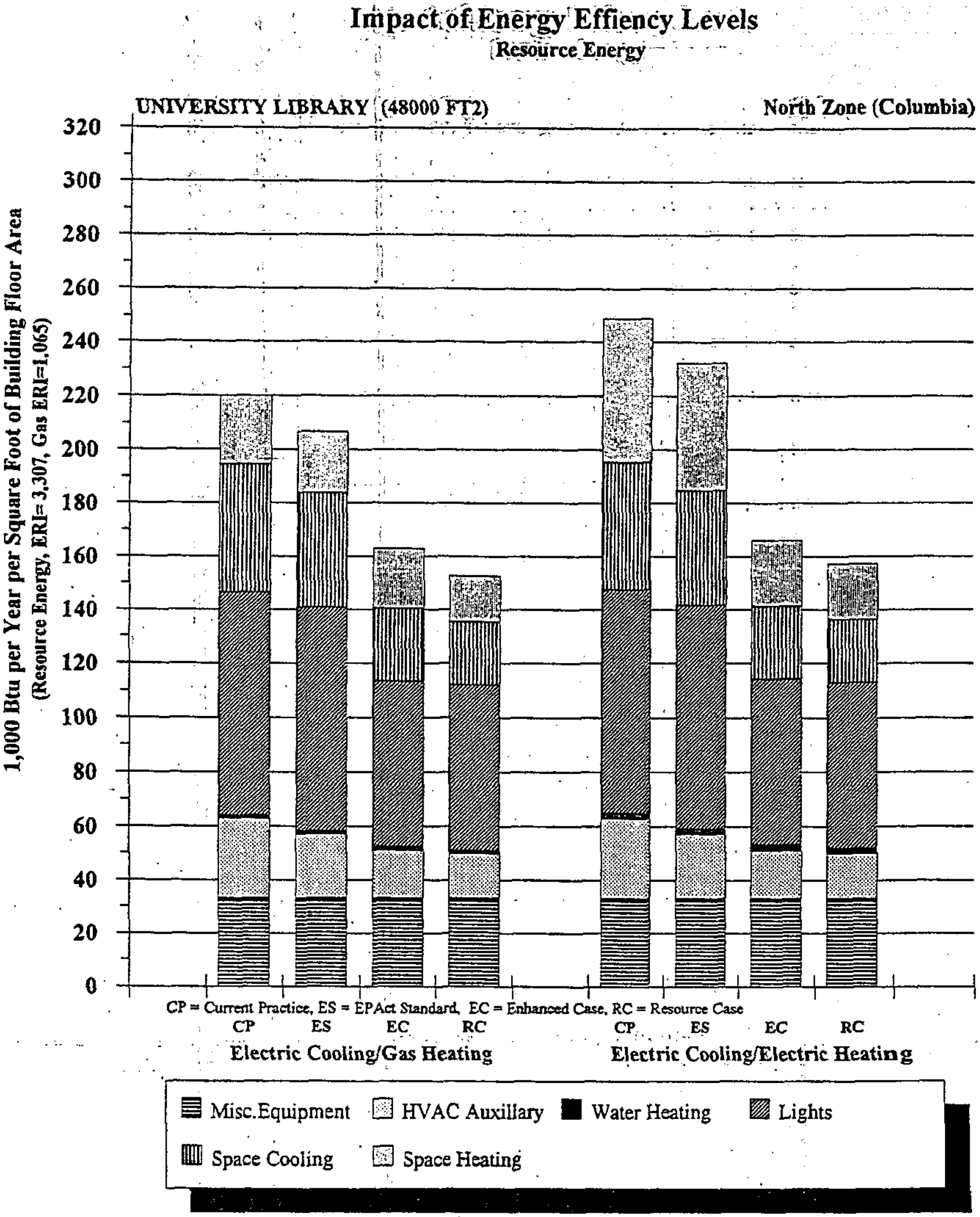
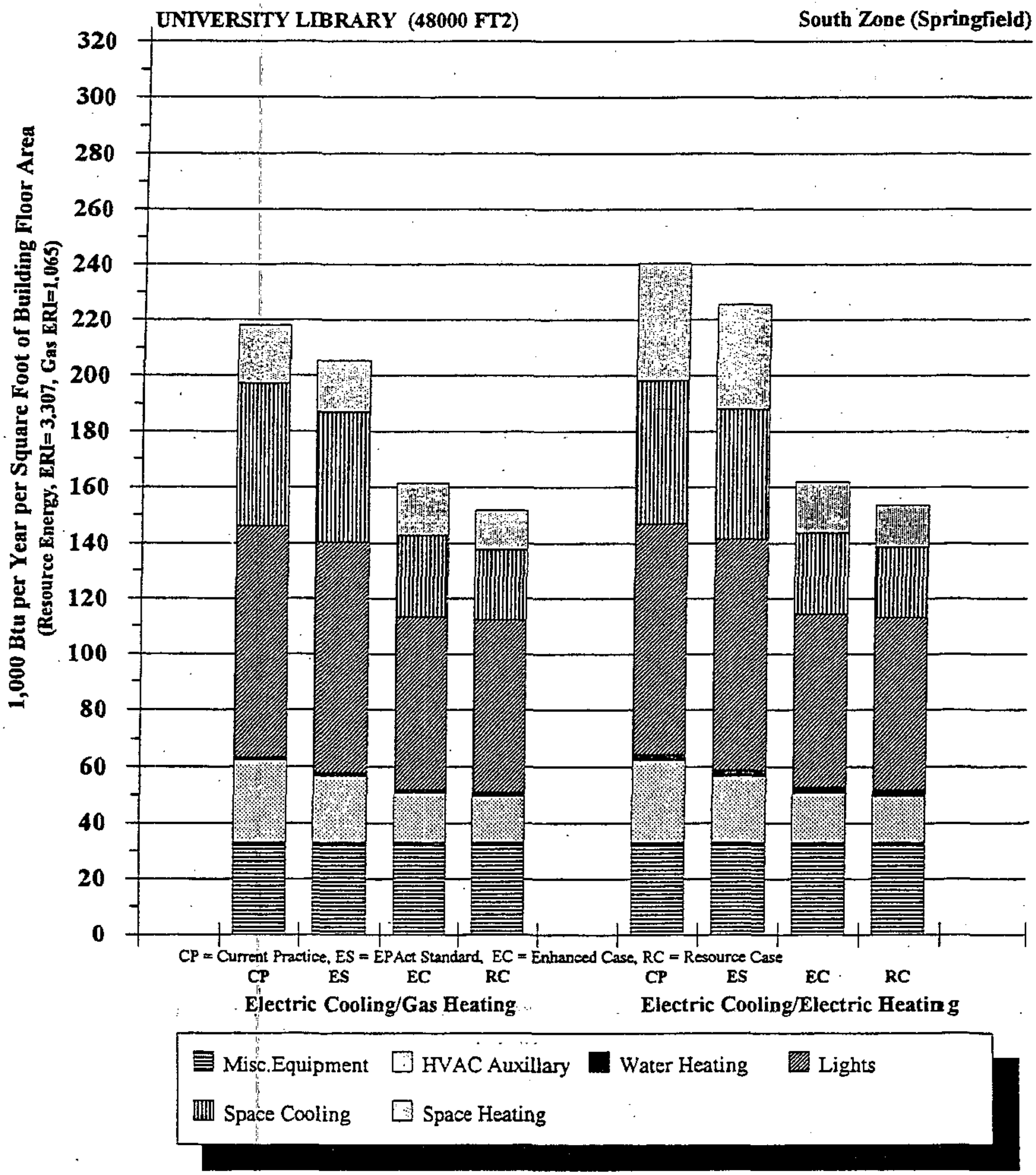


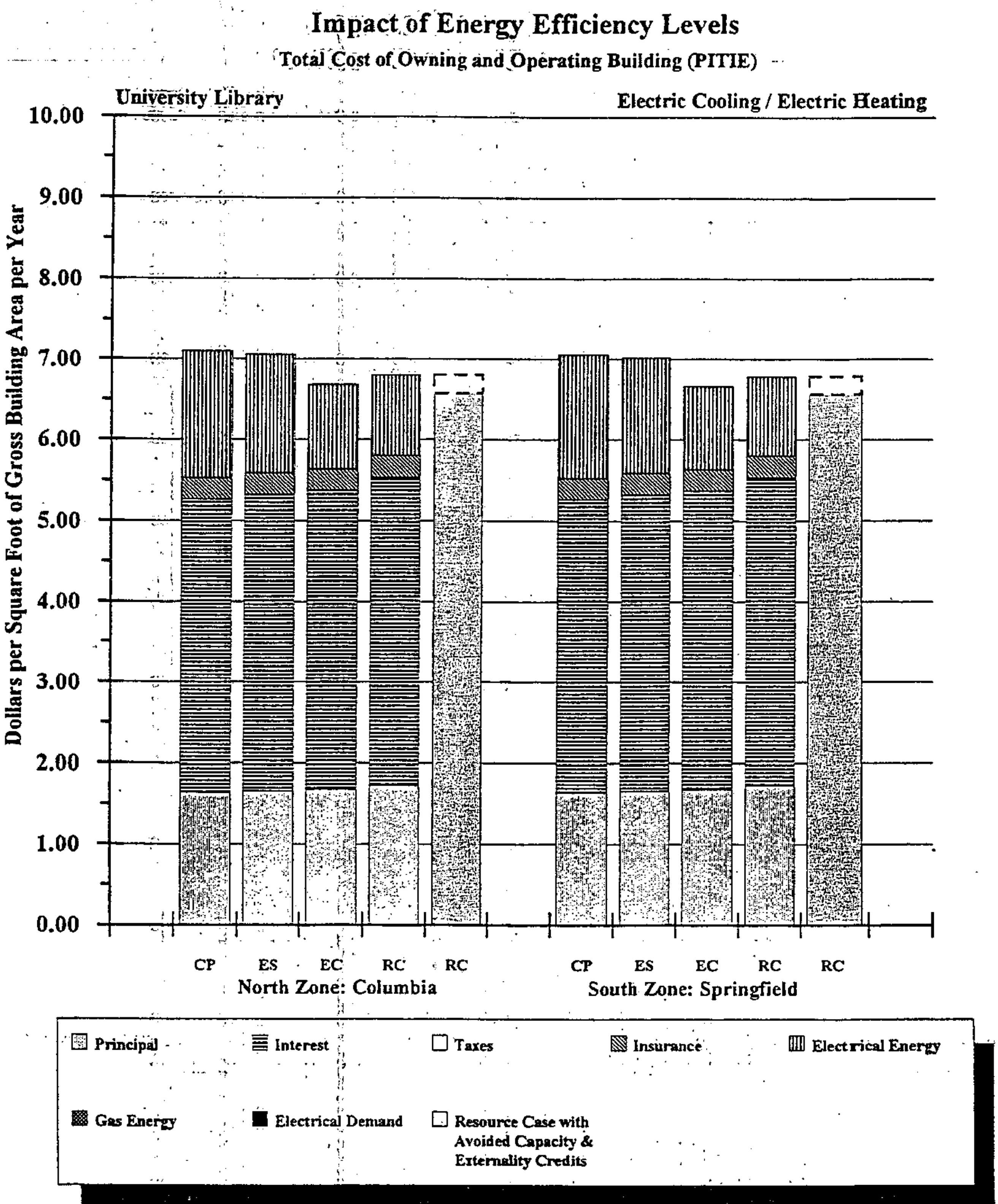
University Library

Impact of Energy Effiency Levels

Resource Energy



University Library



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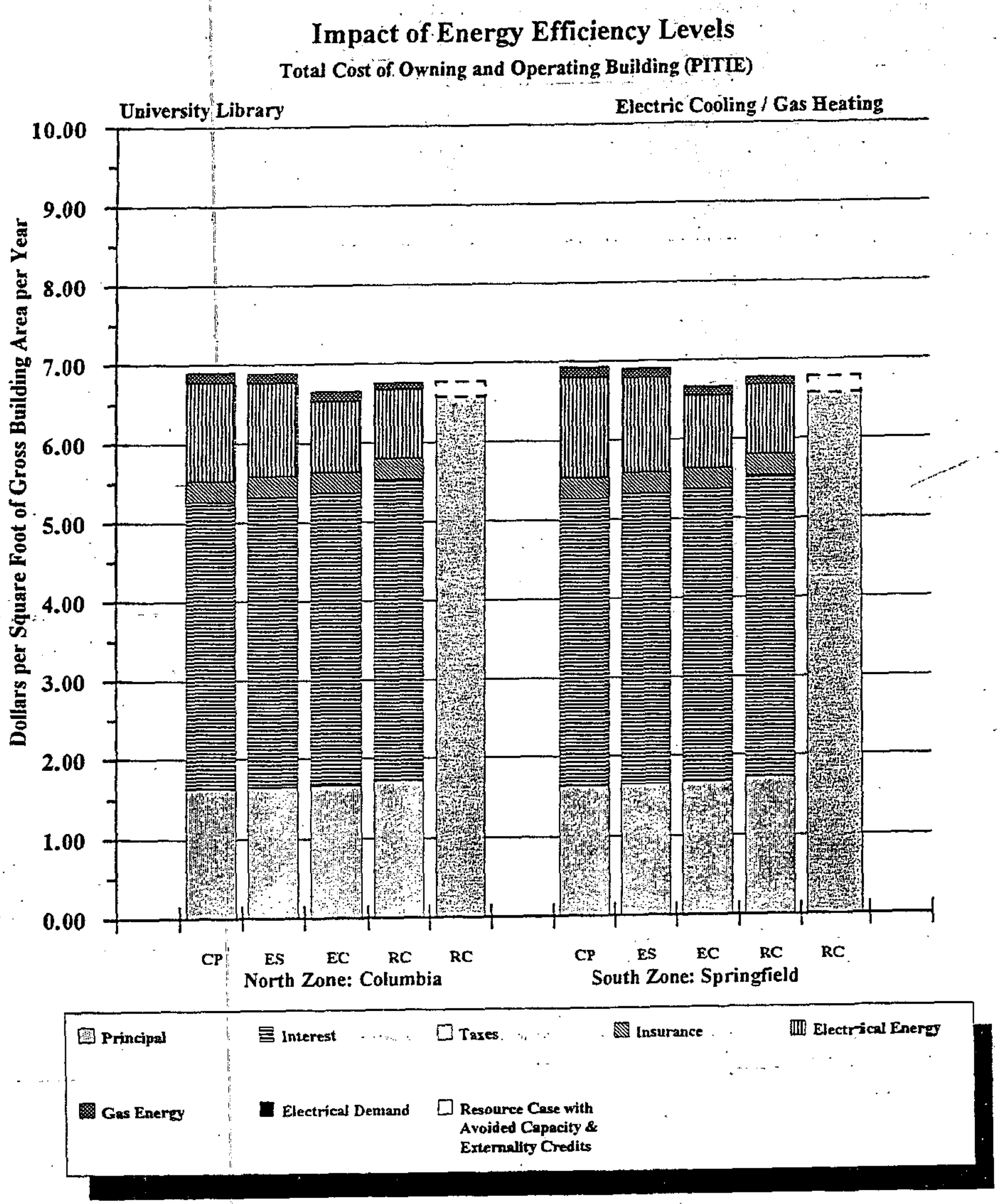

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