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.

APPENDIX

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Related Energy Policy

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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	7.195	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%	498.886	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%	3153.486	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%	3546.658	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%	51.396	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.

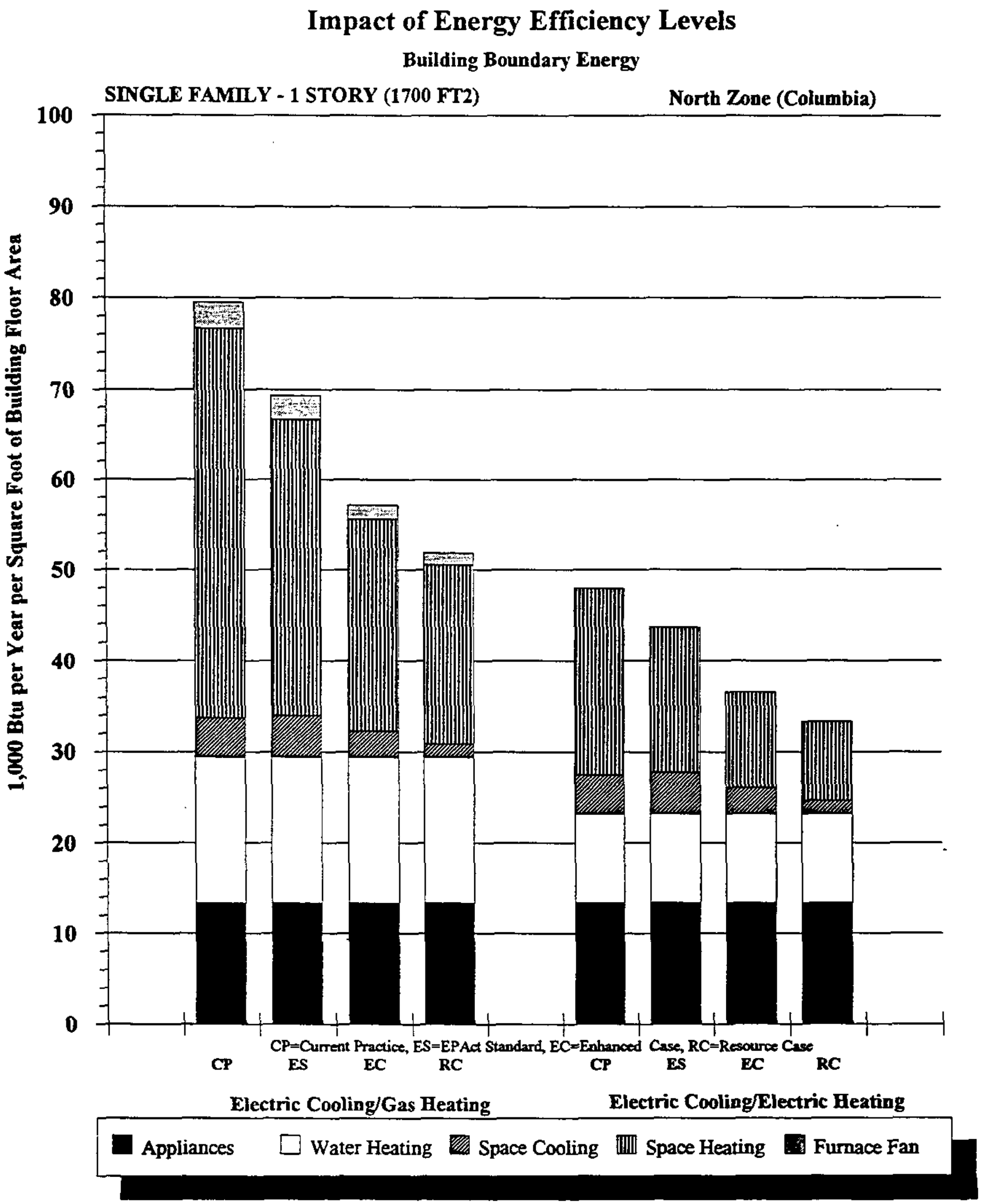
All fossil fuel use in new residential buildings after 1995 is assumed to be gas.

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.

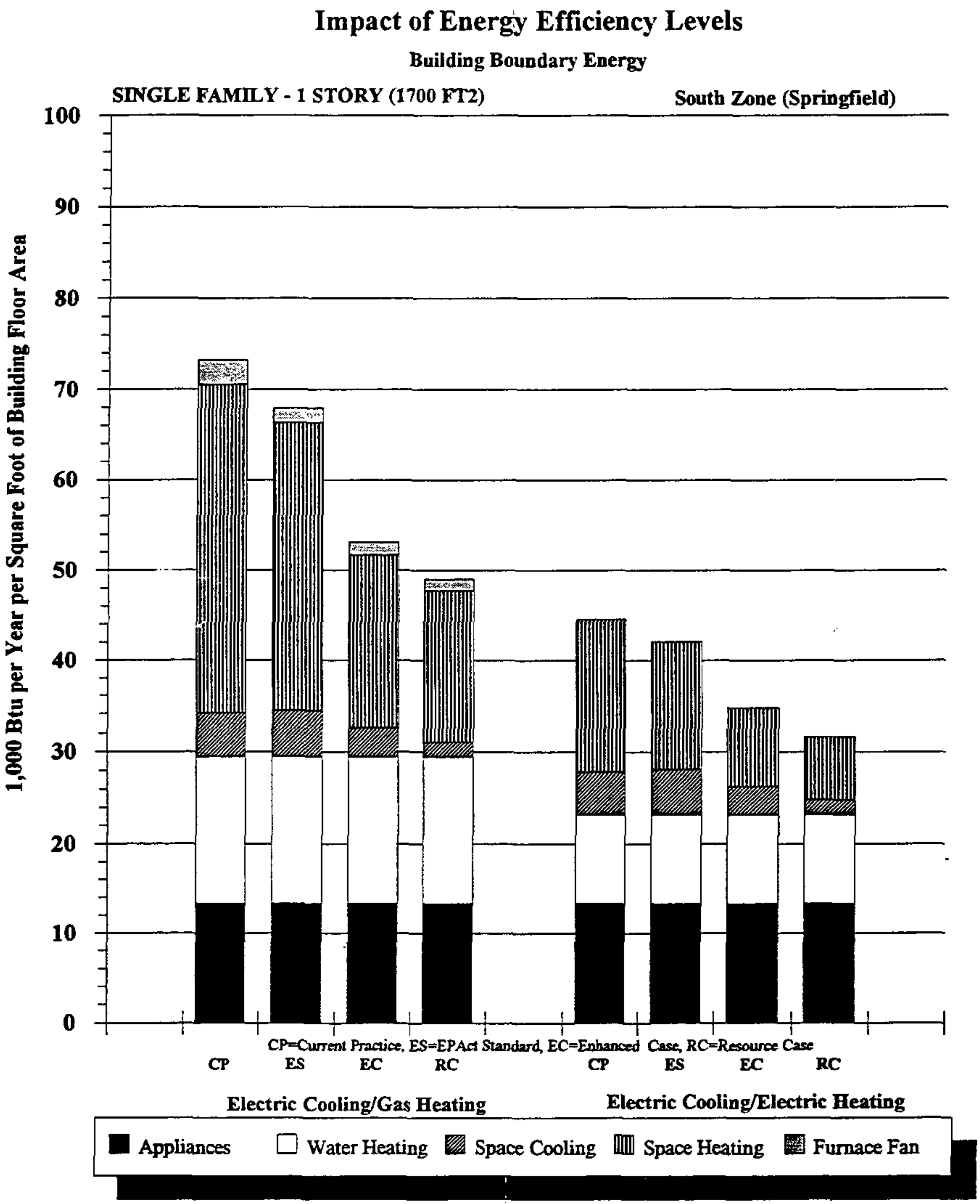
Natural gas prices include inflation, plus a 4.4% annual real price increase.

Single Family - One Story



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

Single Family - One Story



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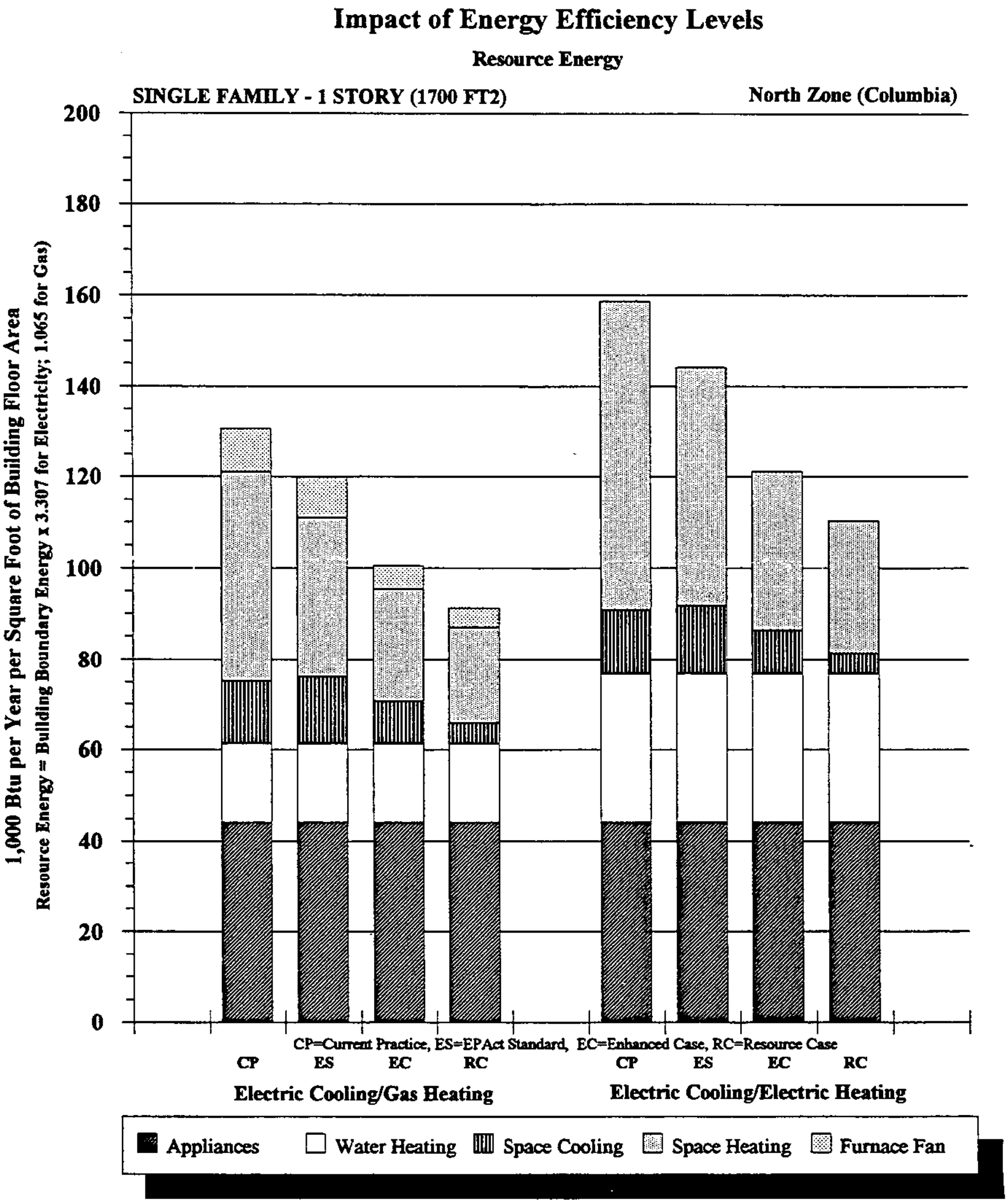
Single Family - One Story



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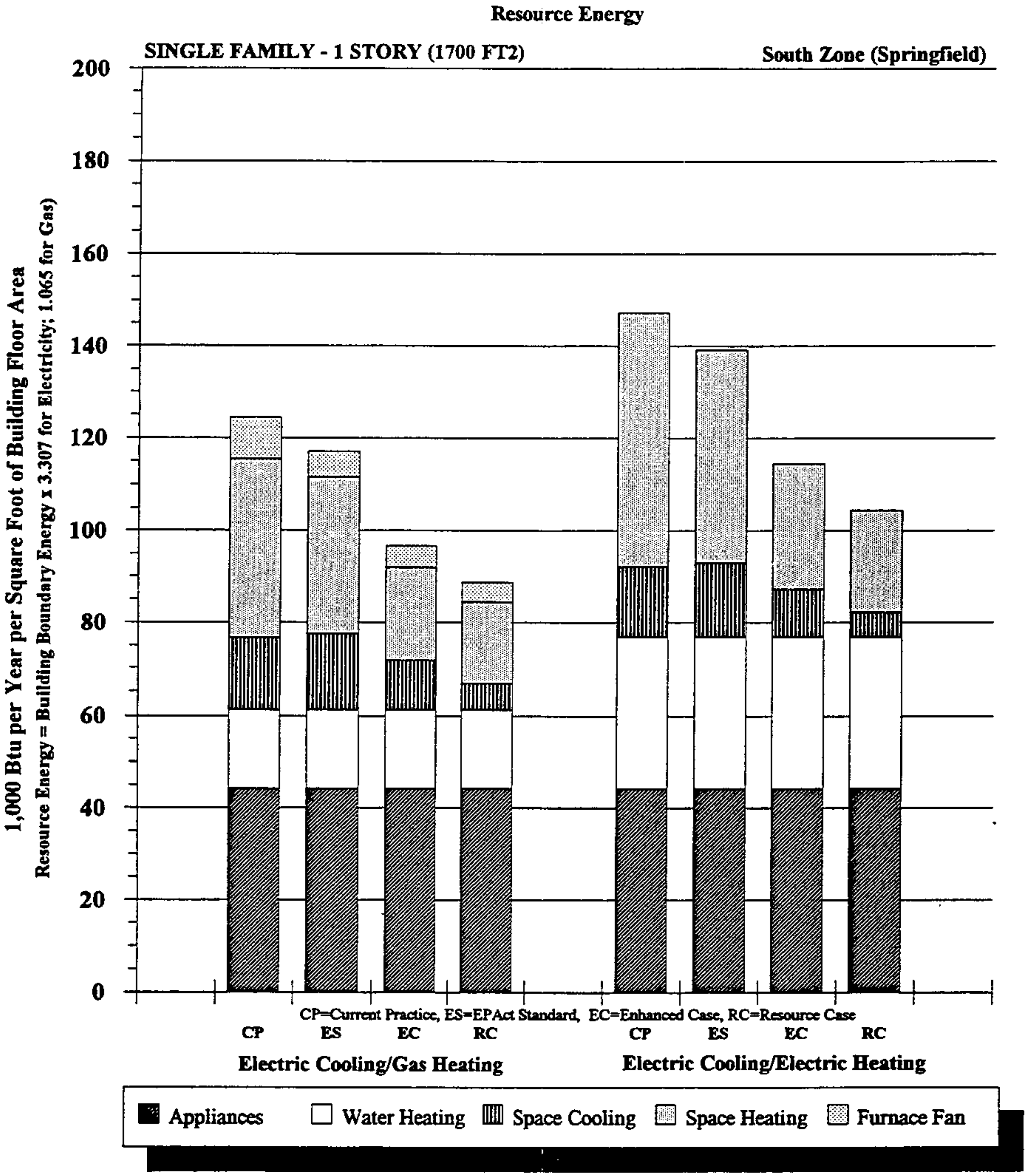
Single Family - One Story

Impact of Energy Efficiency Levels



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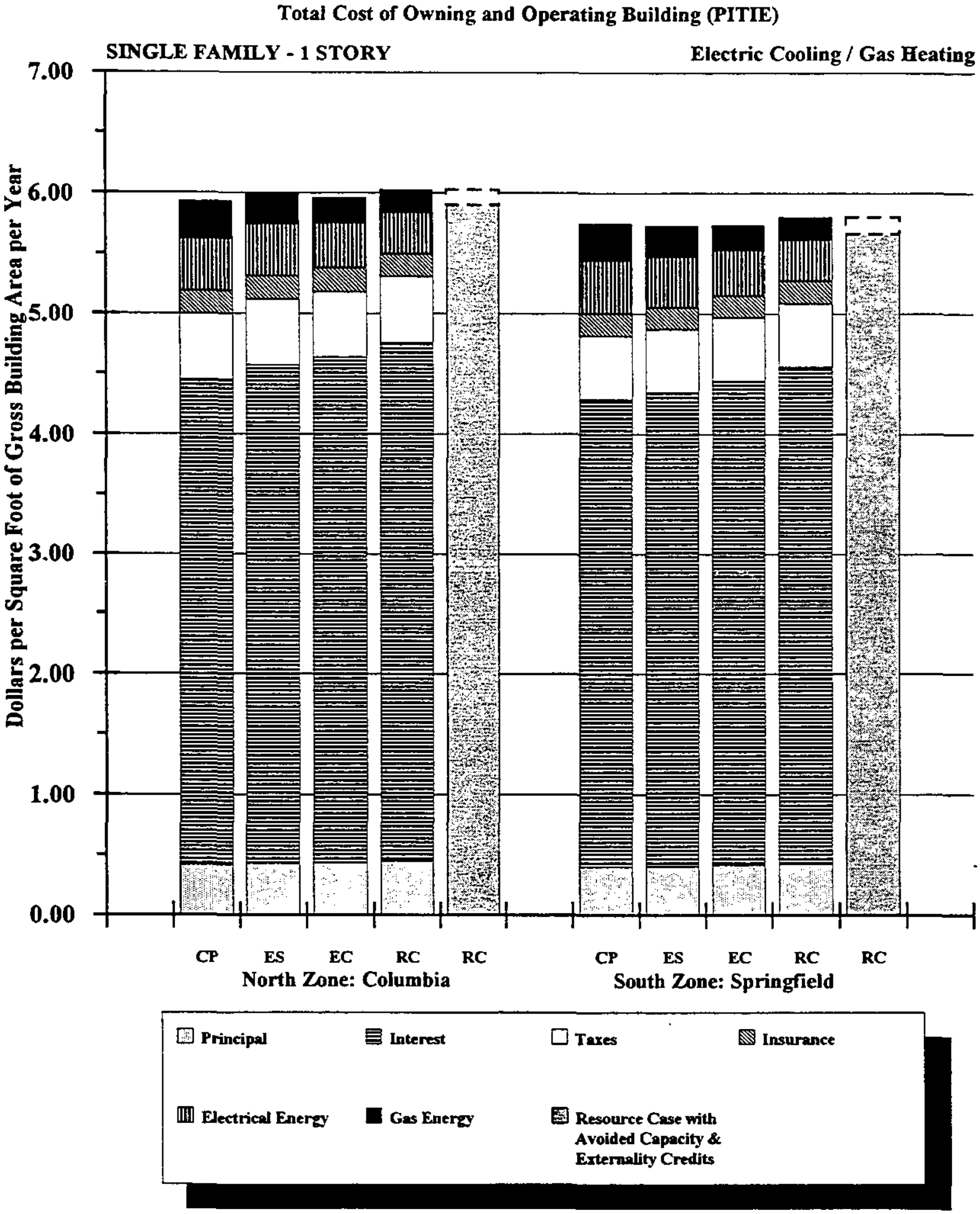
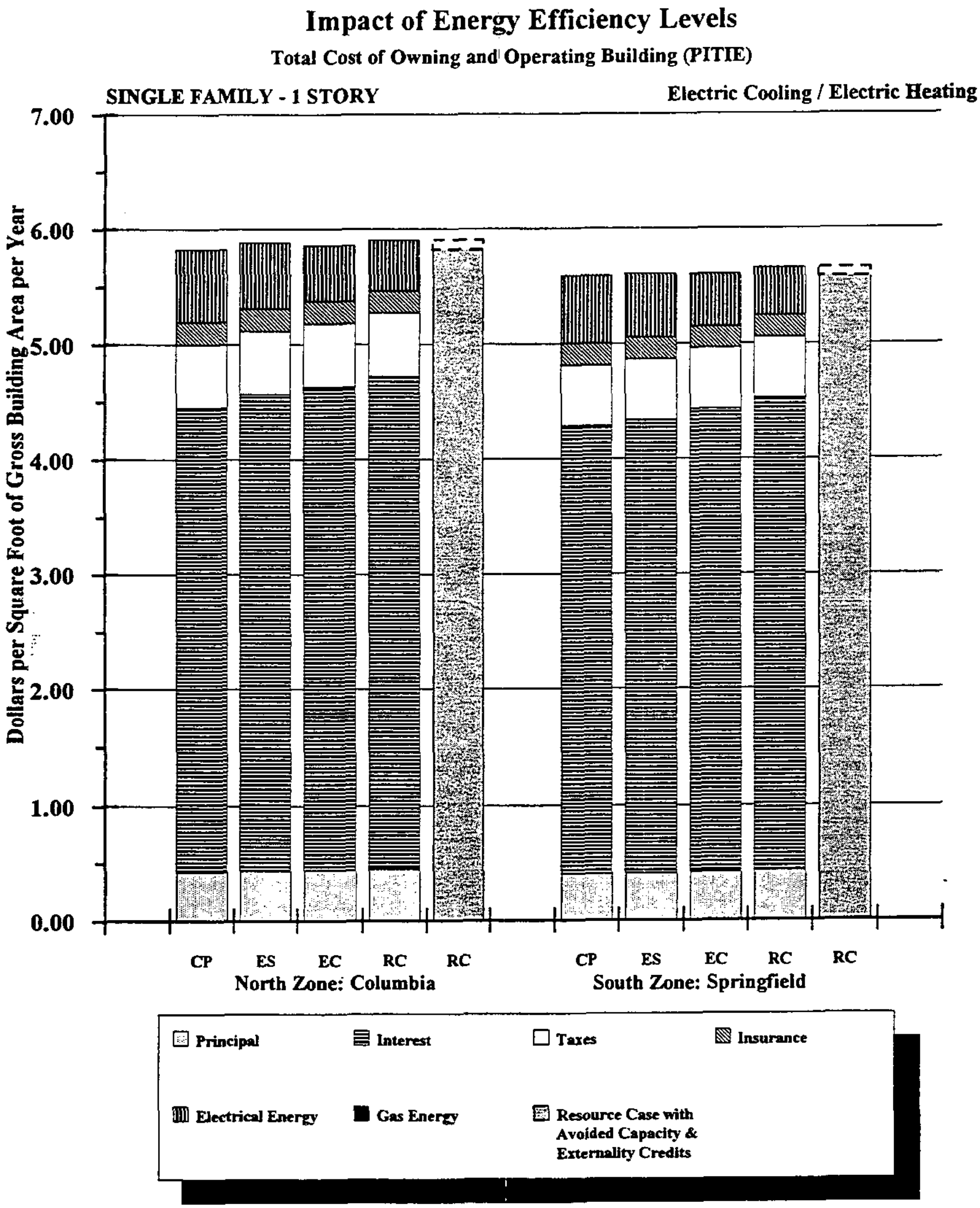
Single Family - One Story

Impact of Energy Efficiency Levels



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

Single Family - One Story



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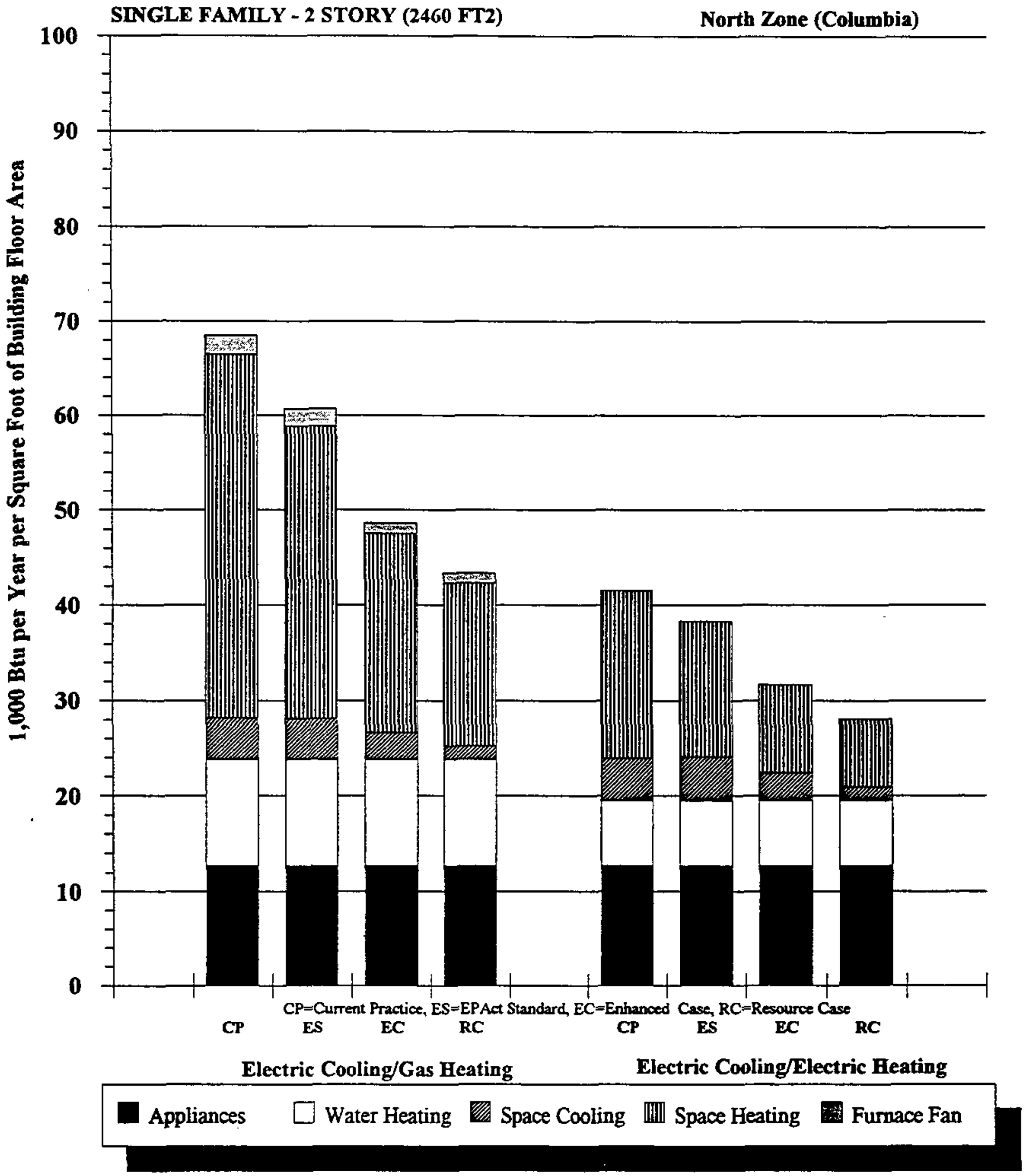
Single Family - Two Story

Impact of Energy Efficiency Levels

Building Boundary Energy



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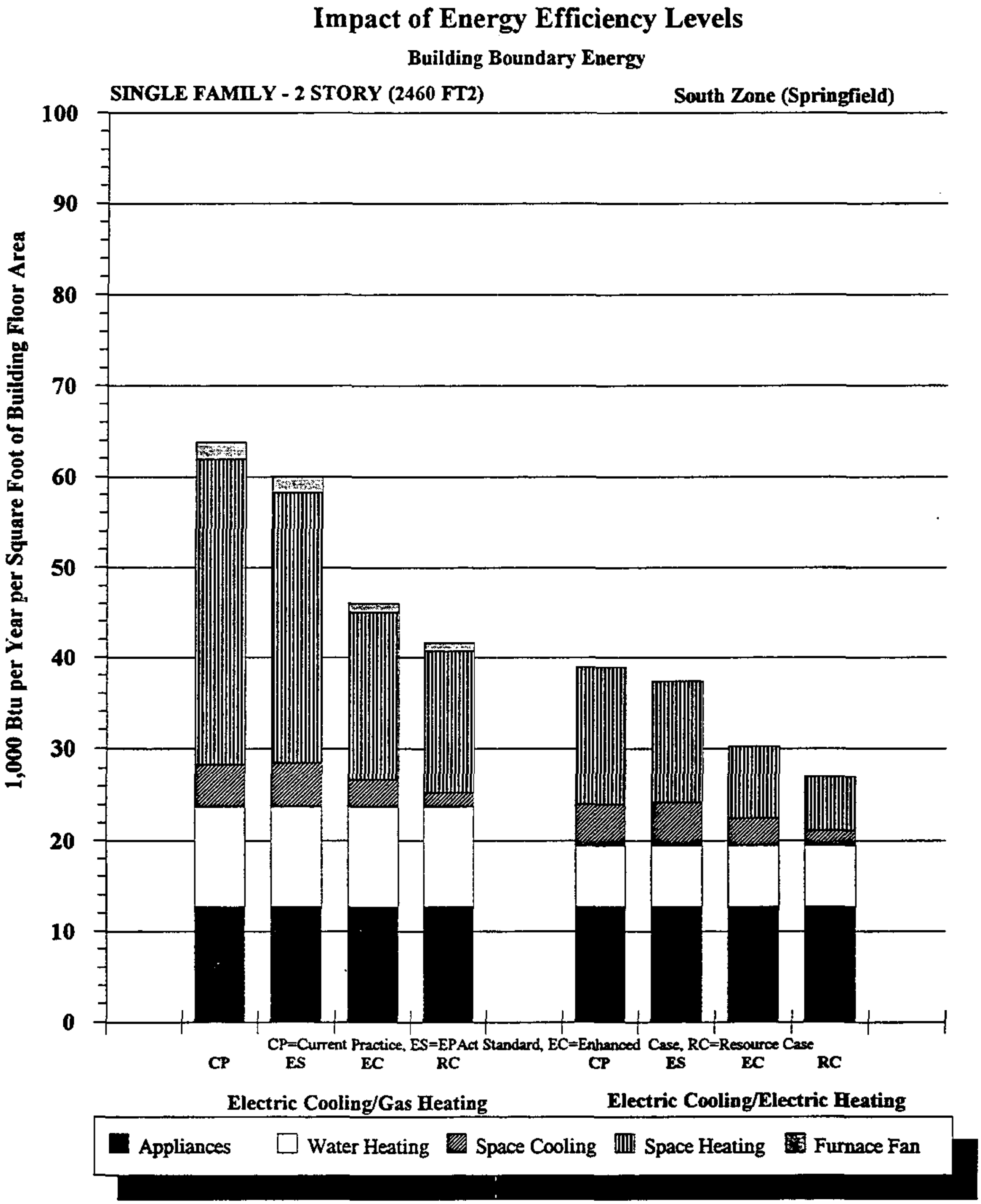
Single Family - Two Story



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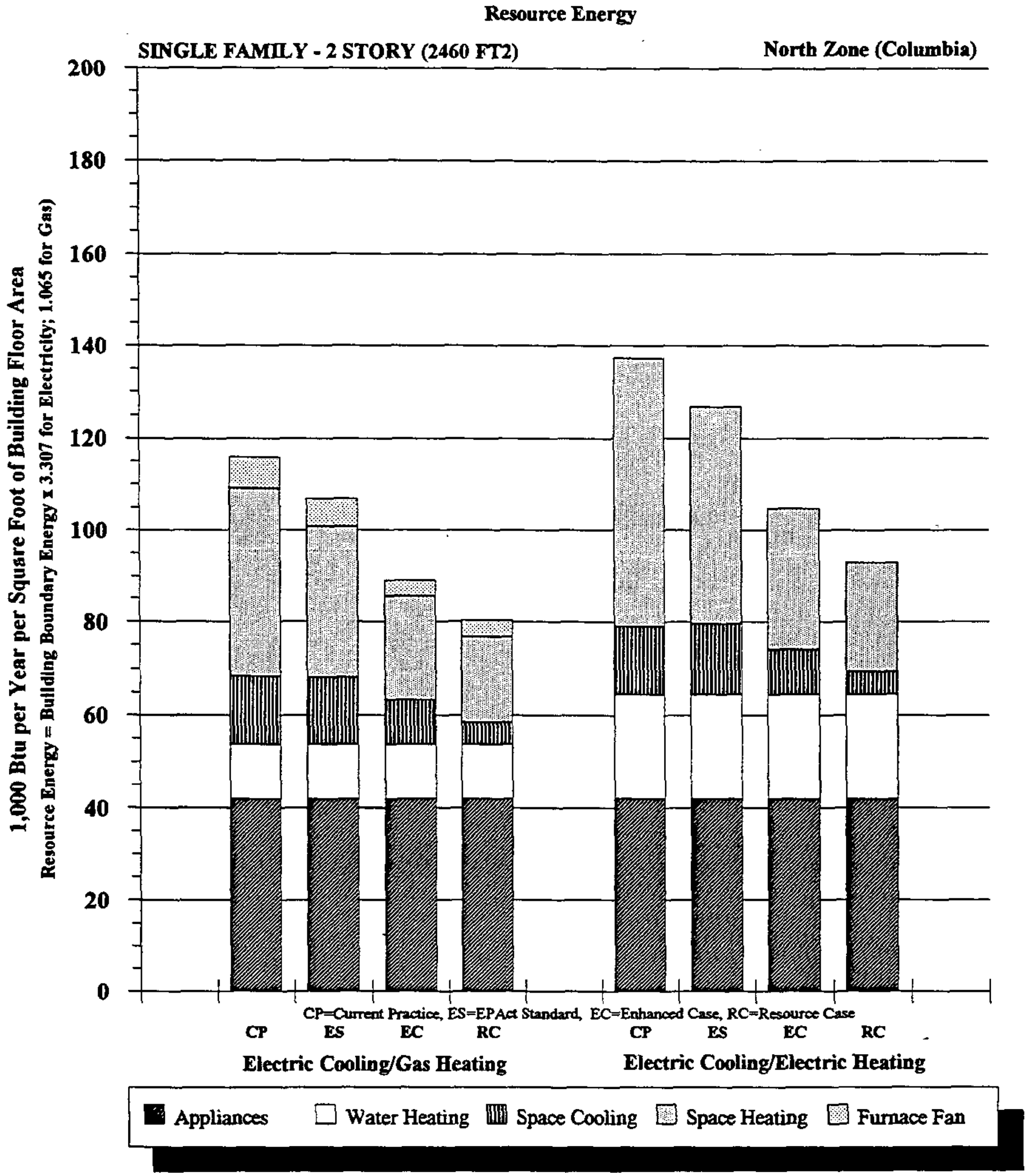
Single Family - Two Story

Impact of Energy Efficiency Levels



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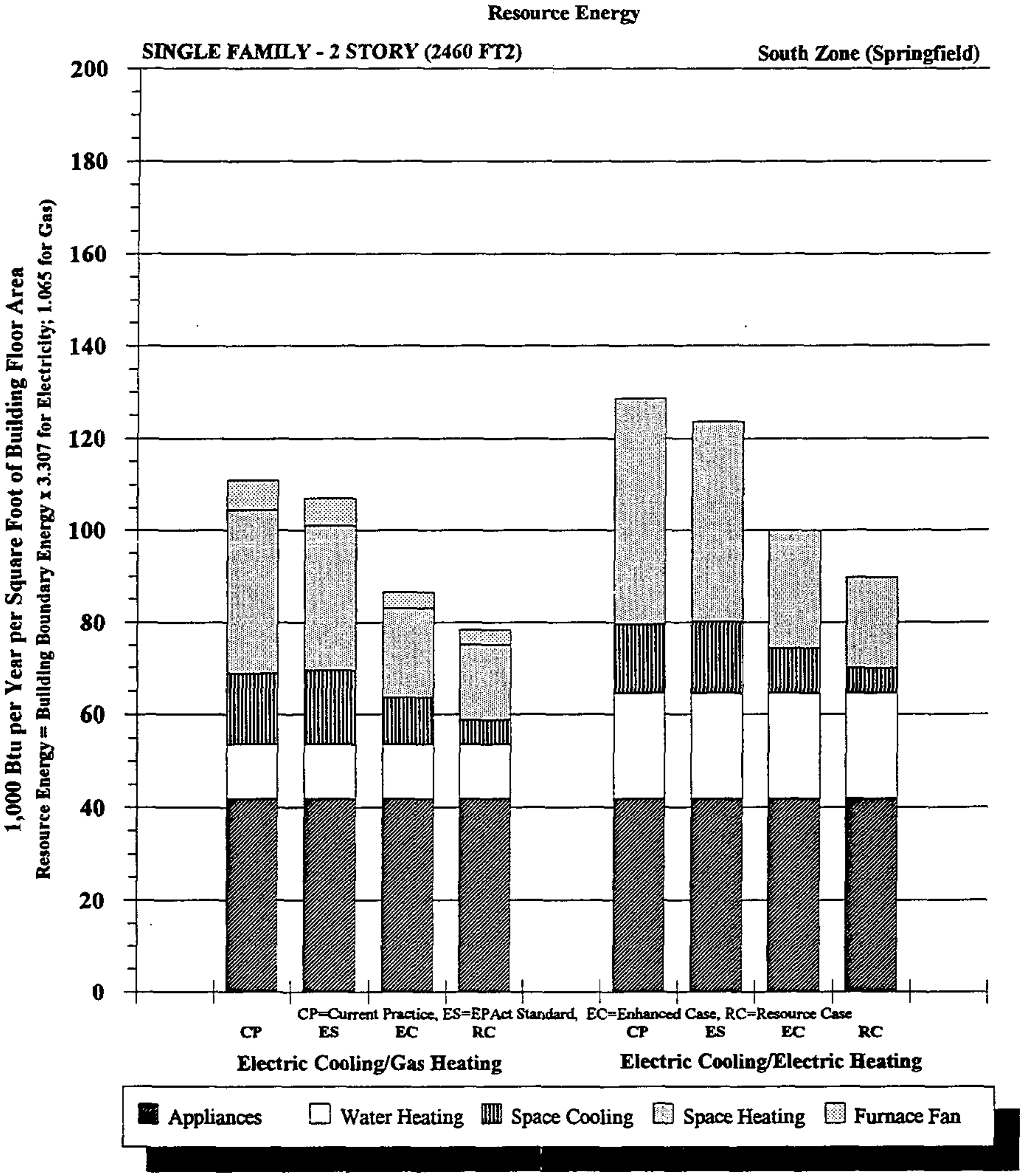
Single Family - Two Story

Impact of Energy Efficiency Levels



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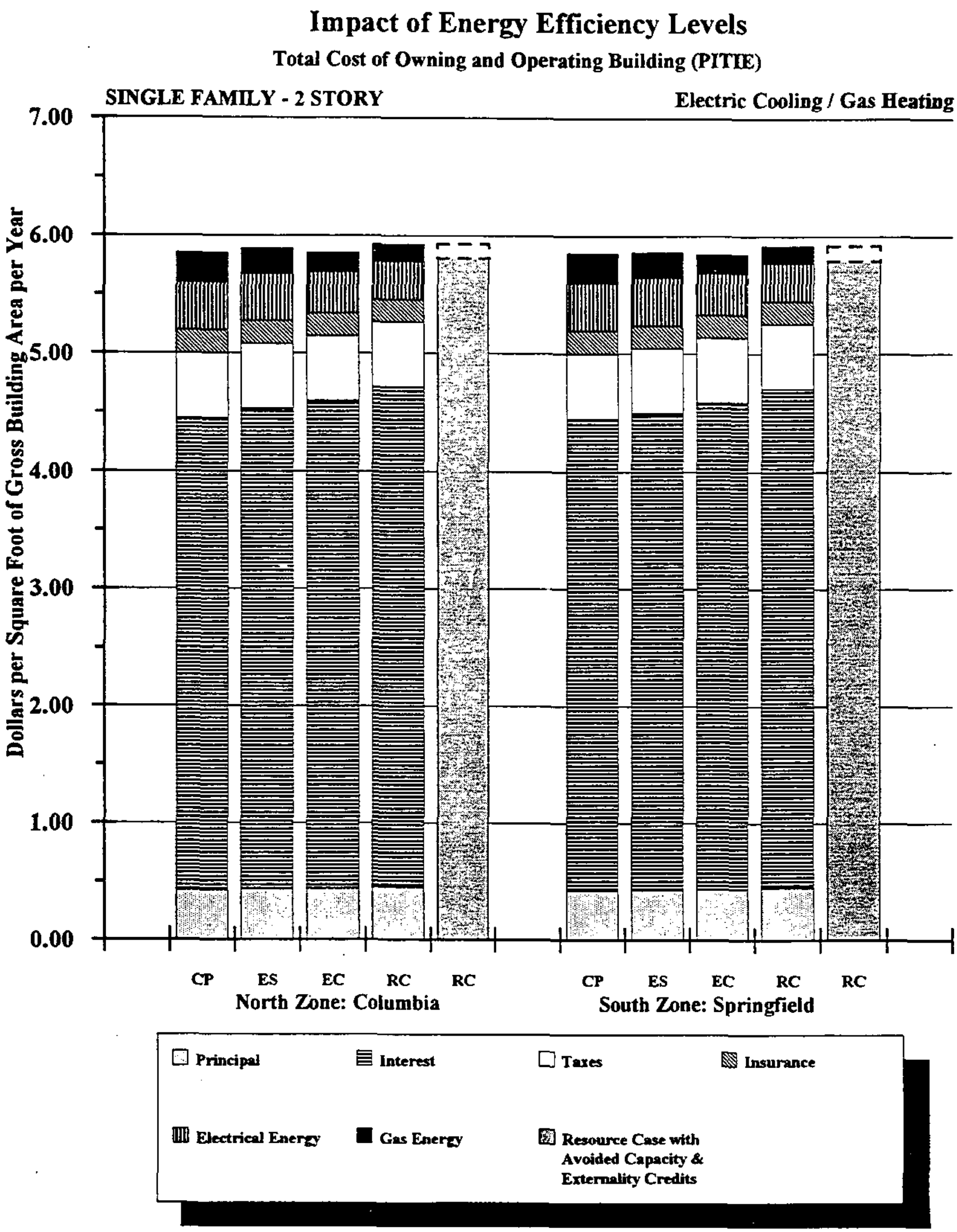
Single Family - Two Story



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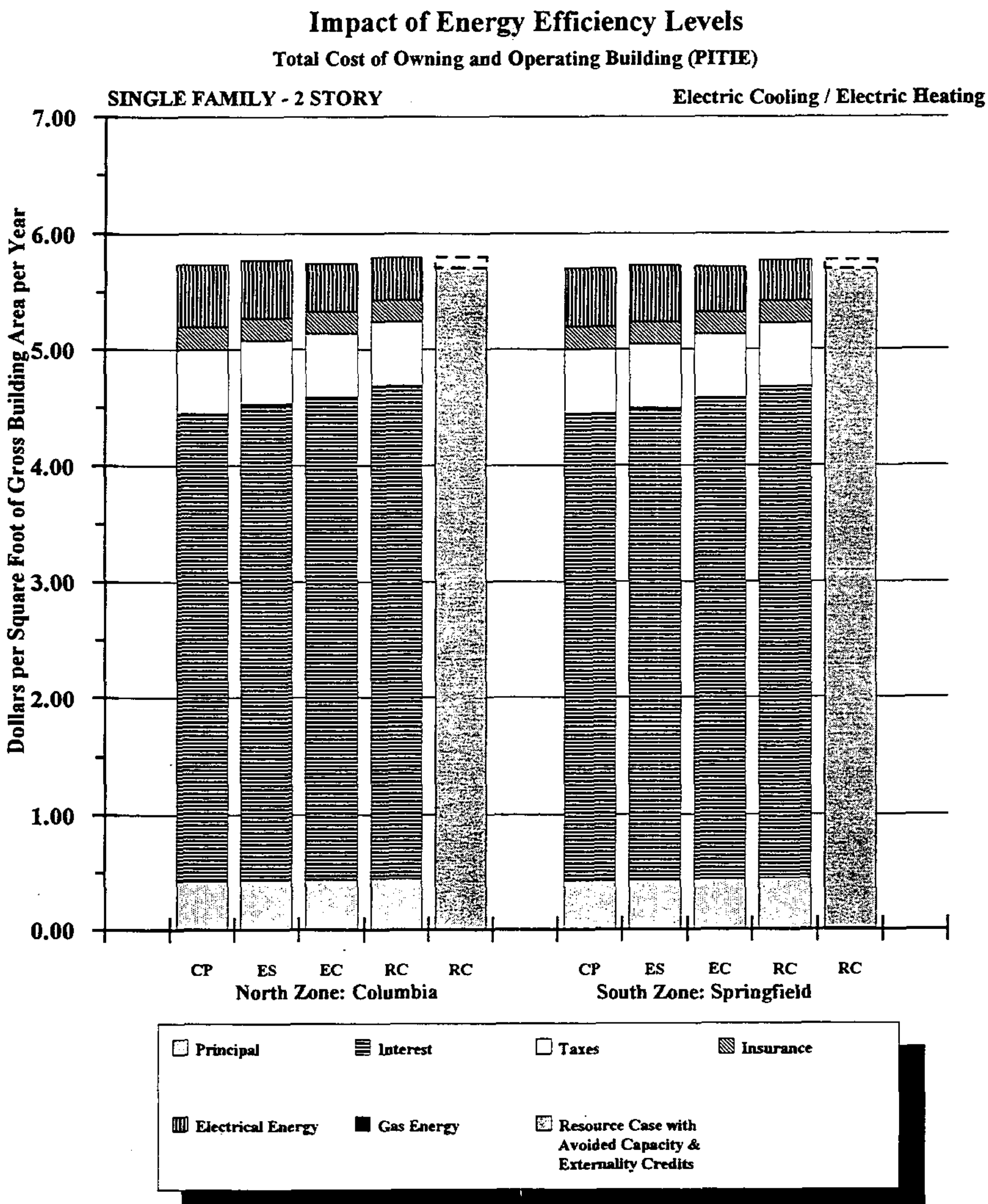
Single Family - Two Story



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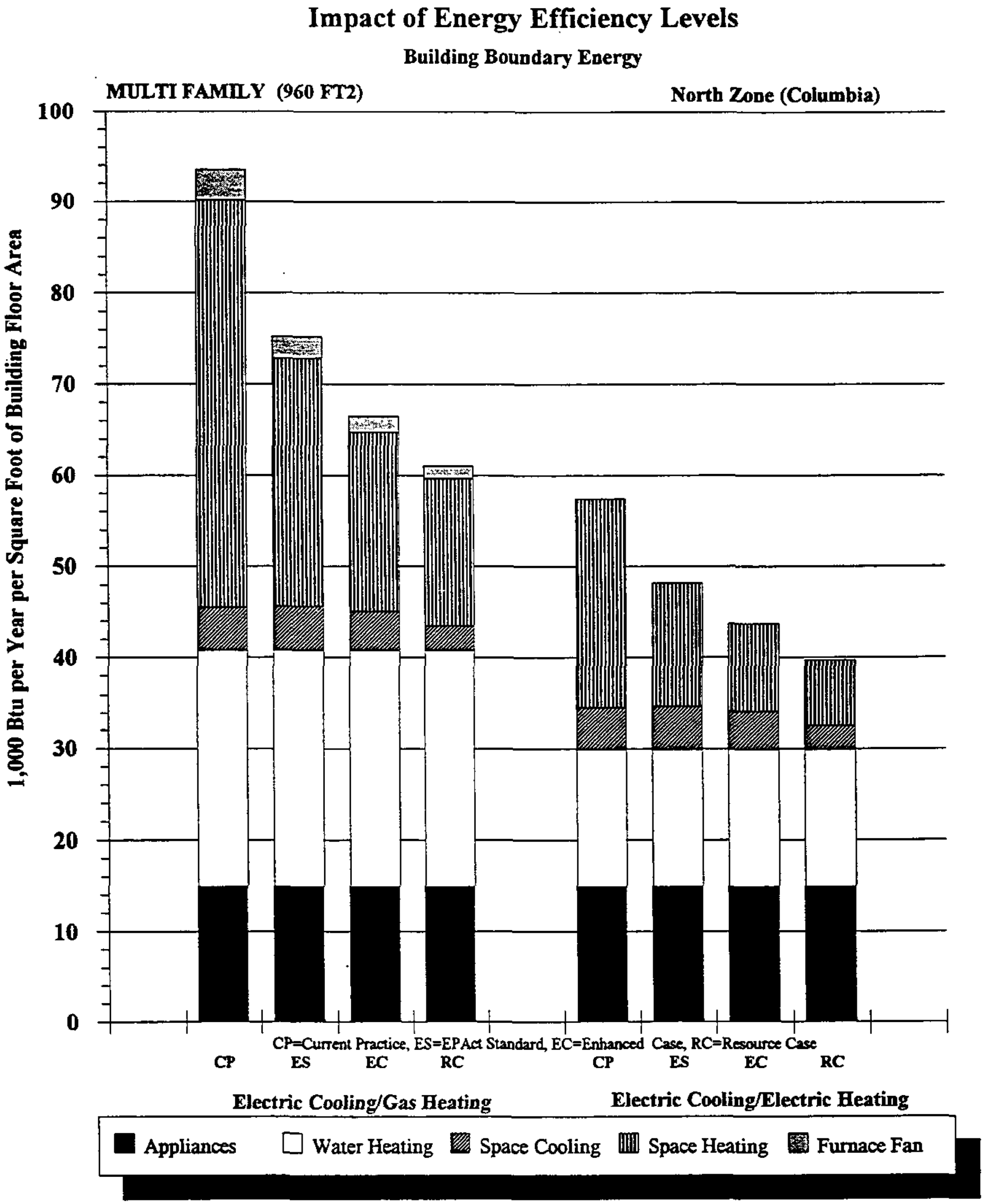
Multi Family



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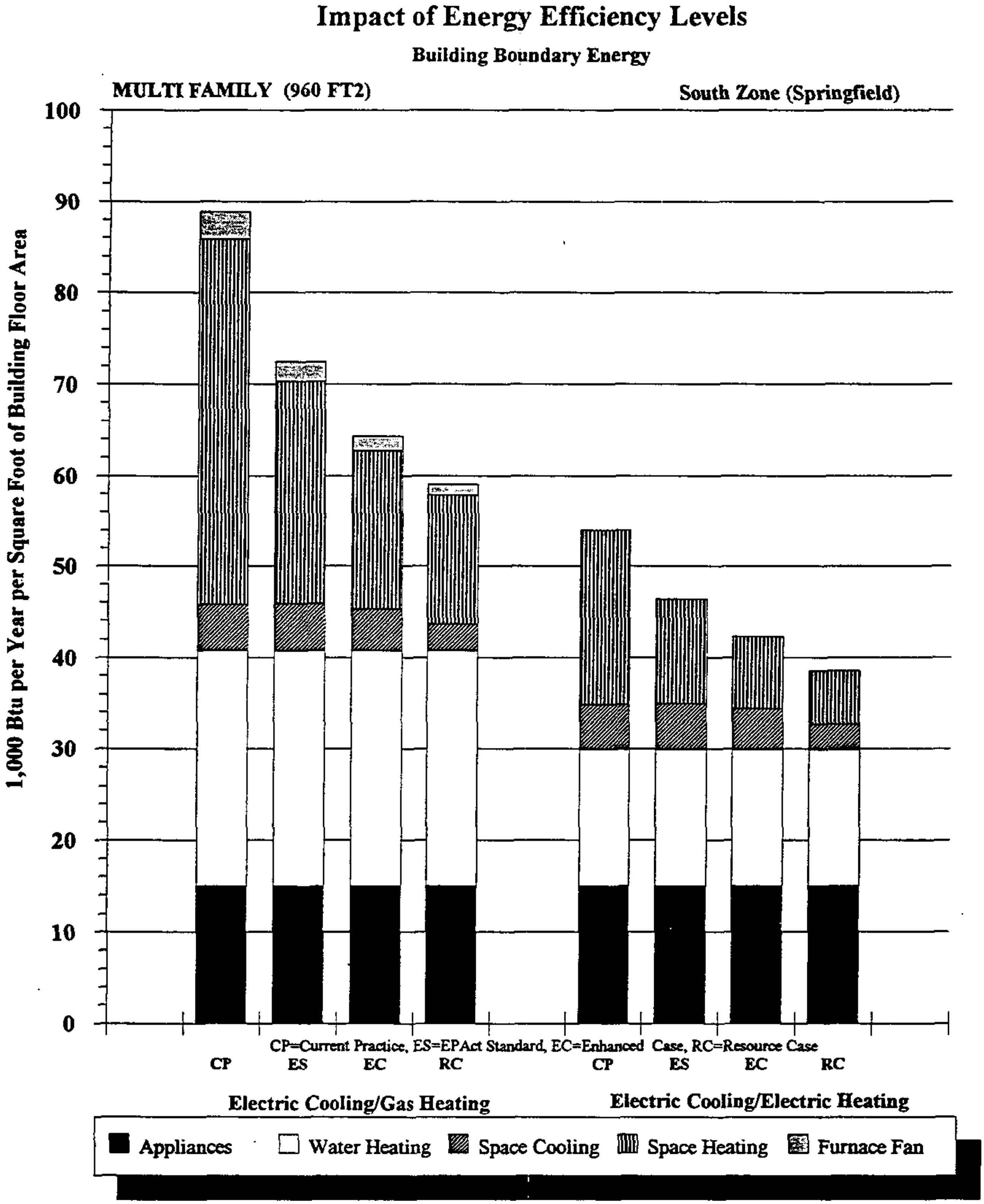
Multi Family



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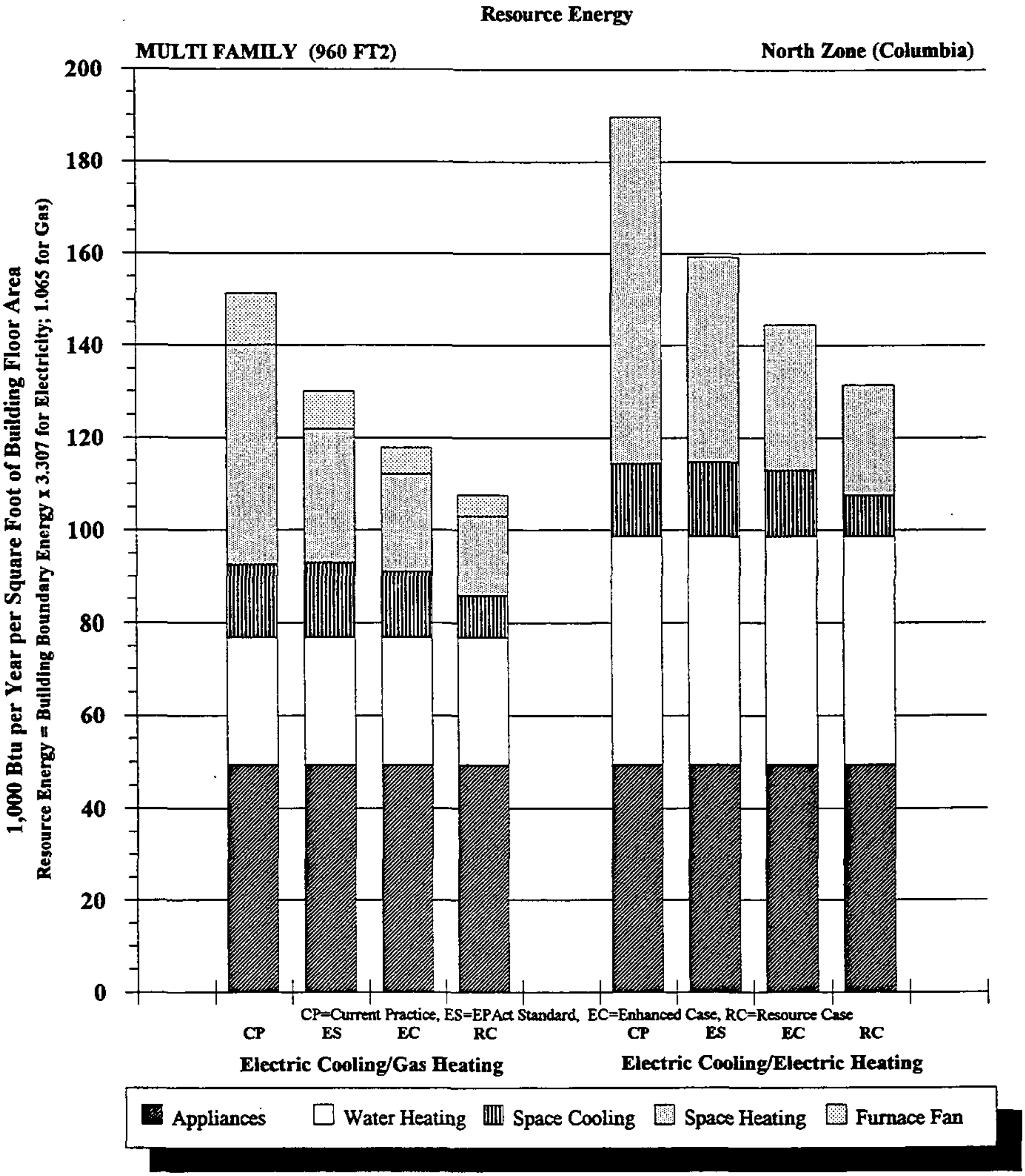
Multi Family

Impact of Energy Efficiency Levels



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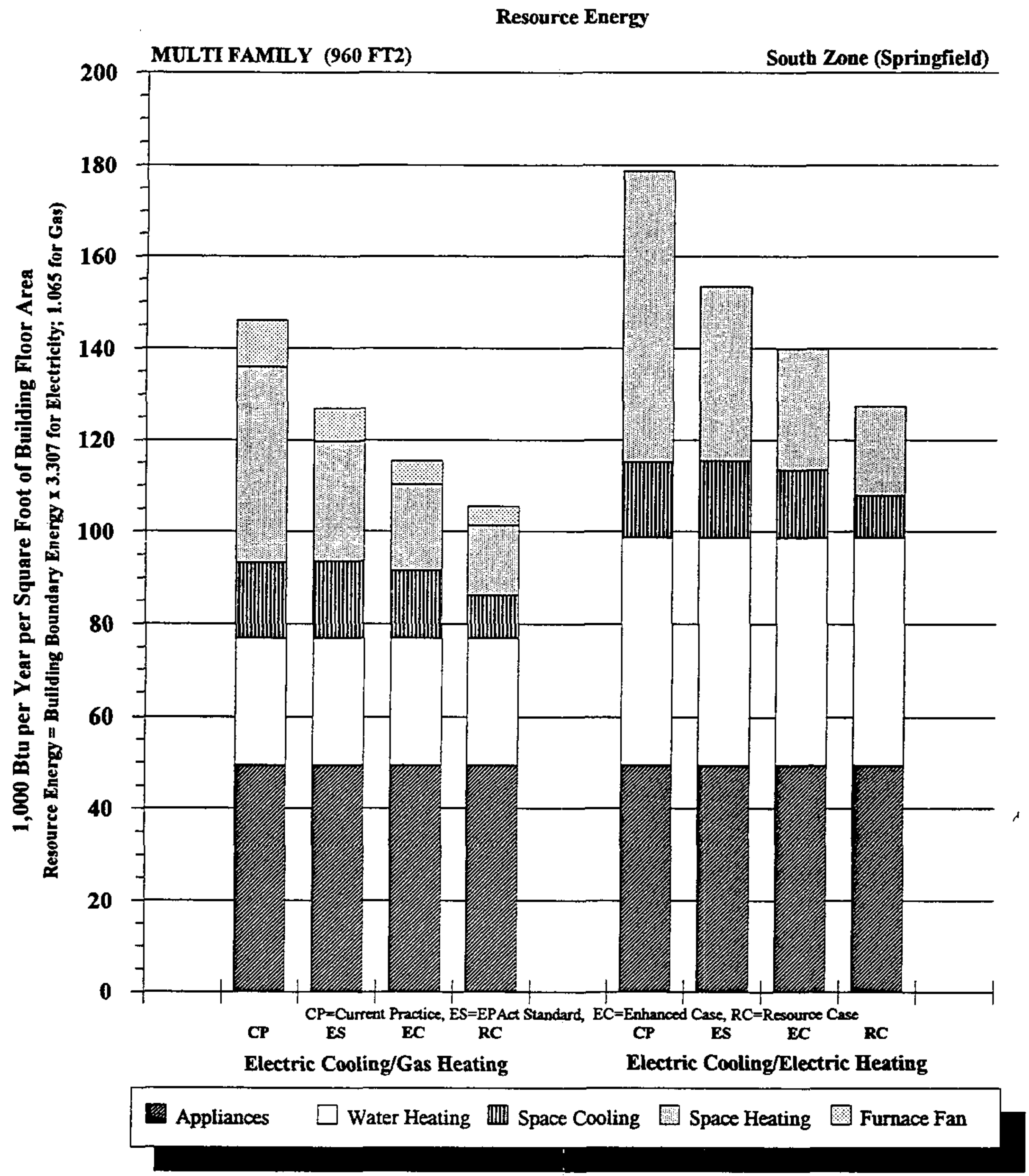
Multi Family

Impact of Energy Efficiency Levels



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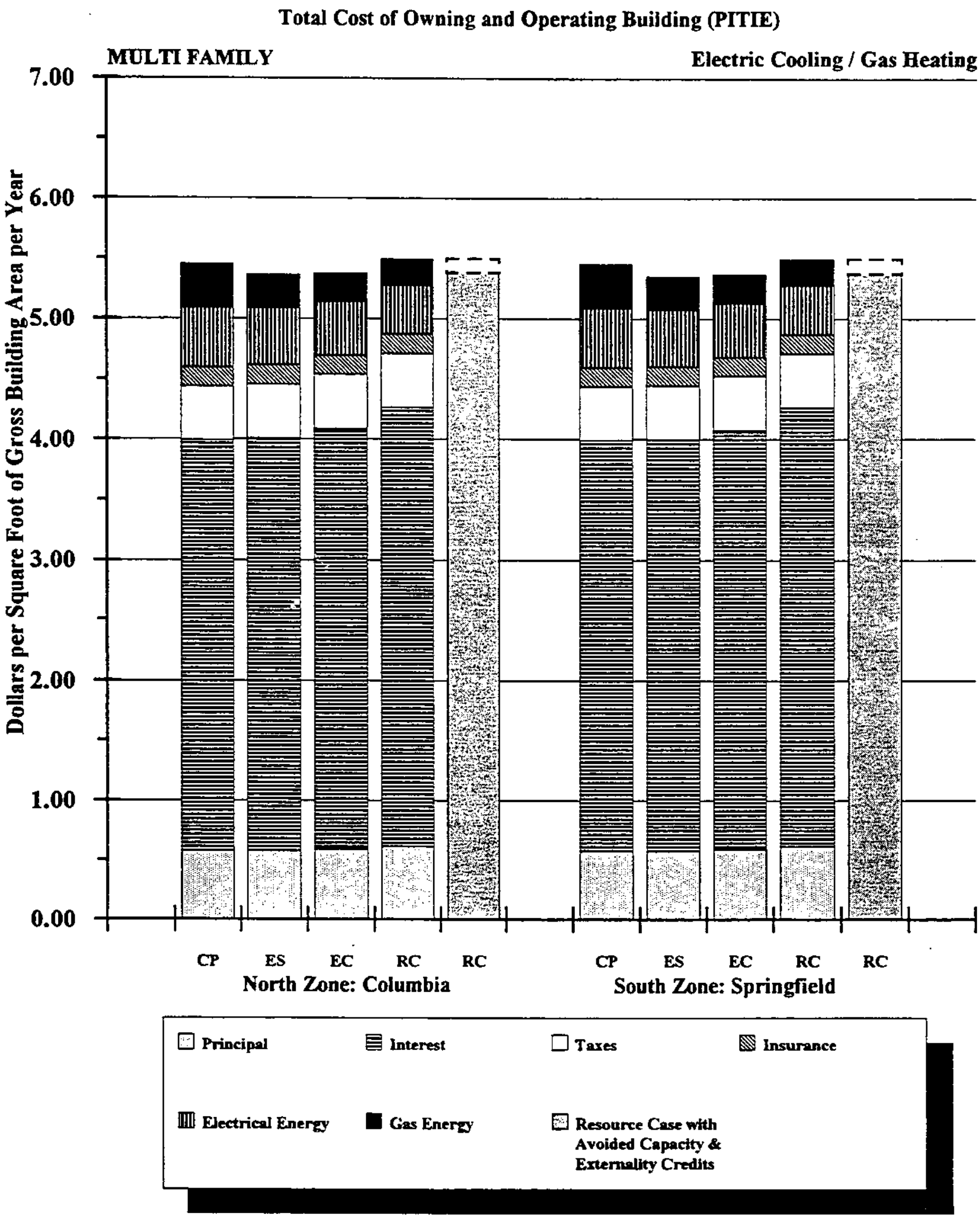
Multi Family

Impact of Energy Efficiency Levels



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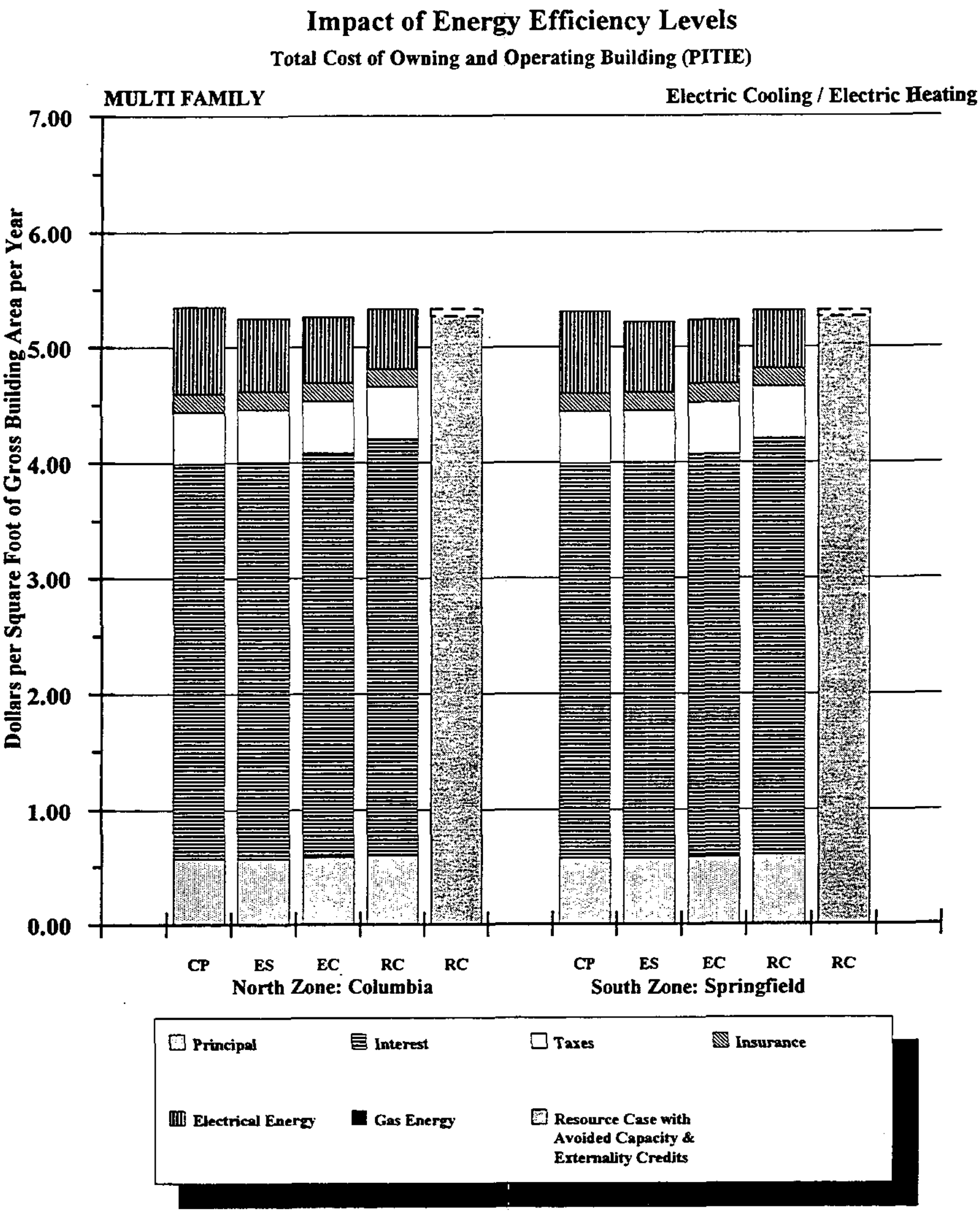

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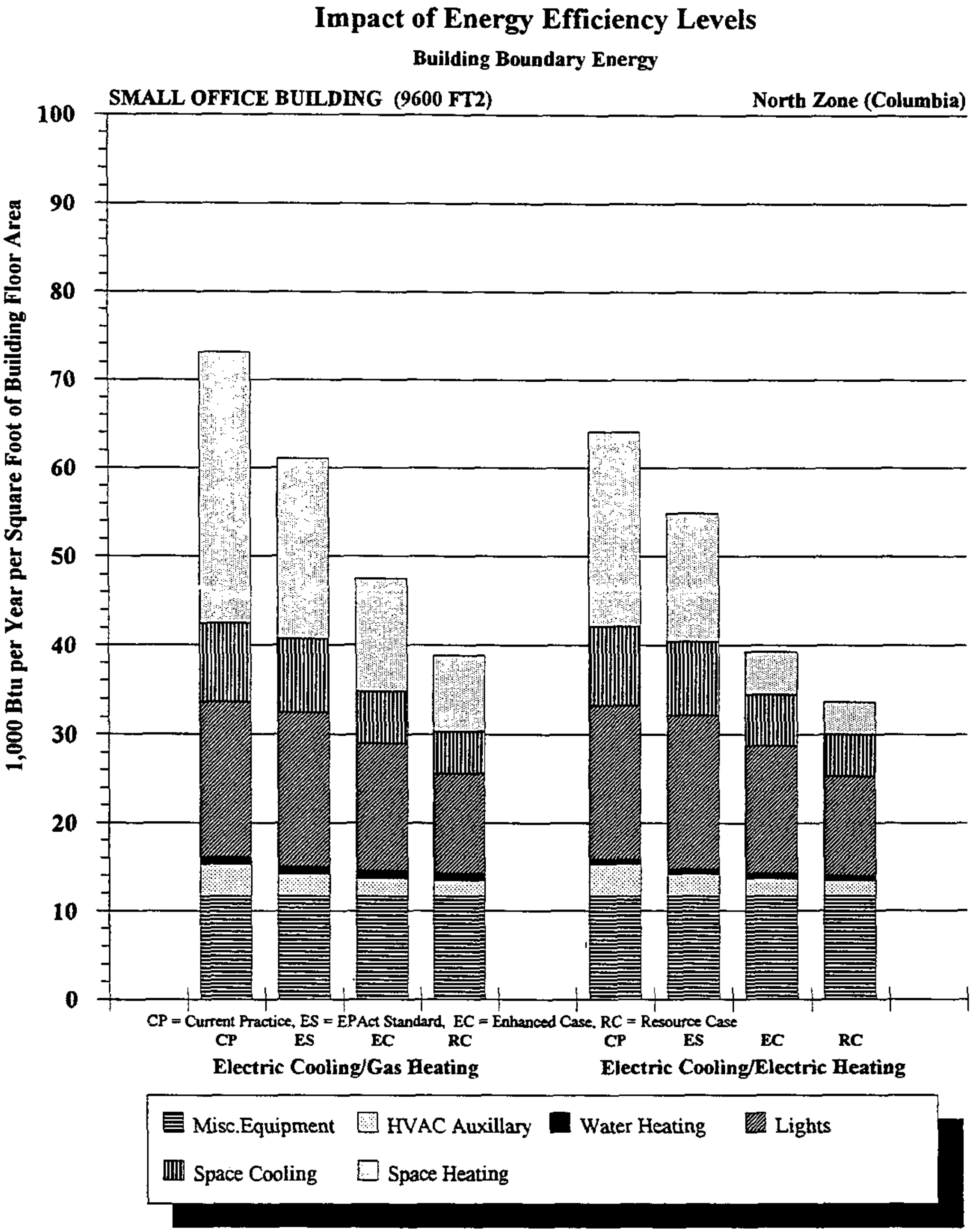
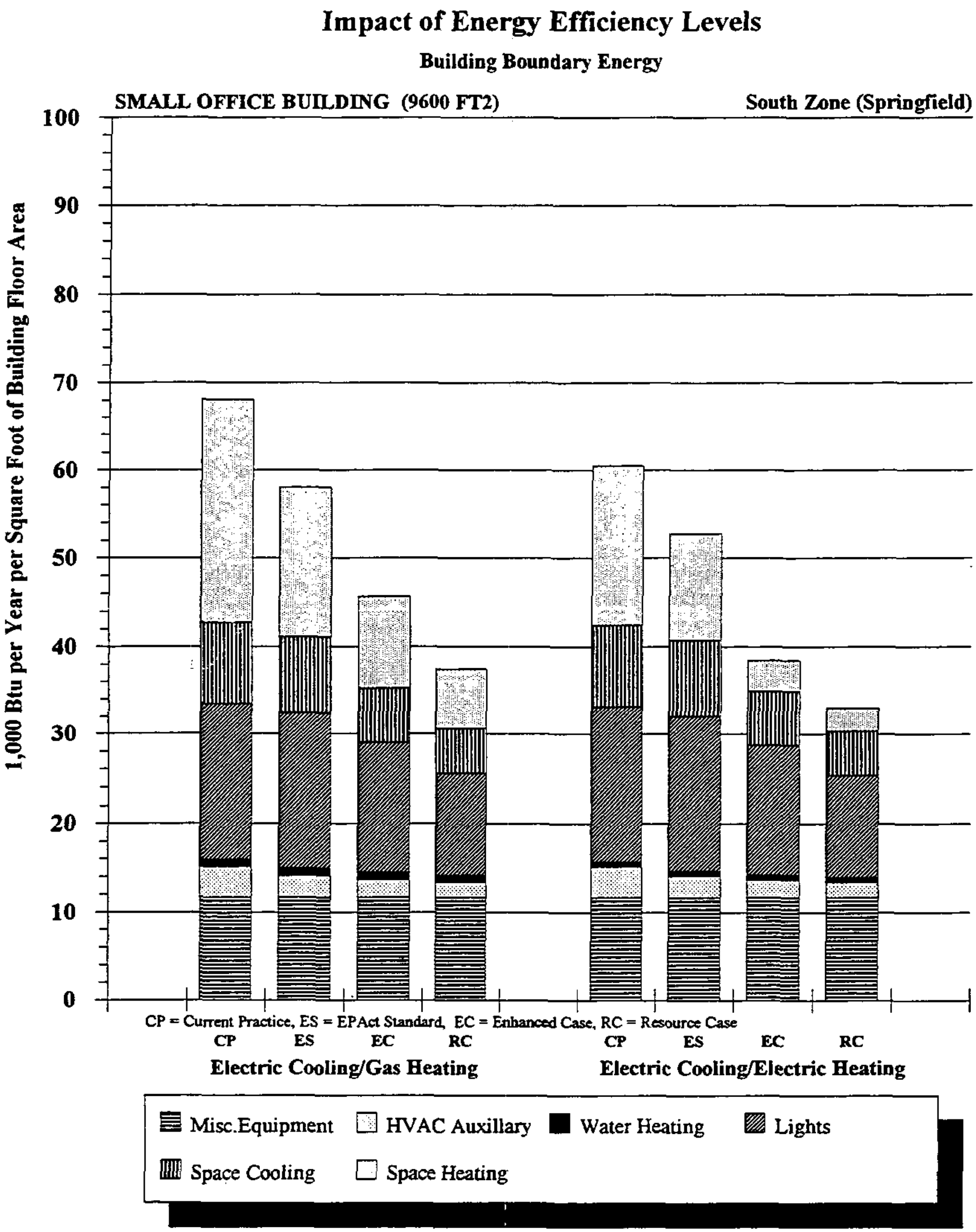
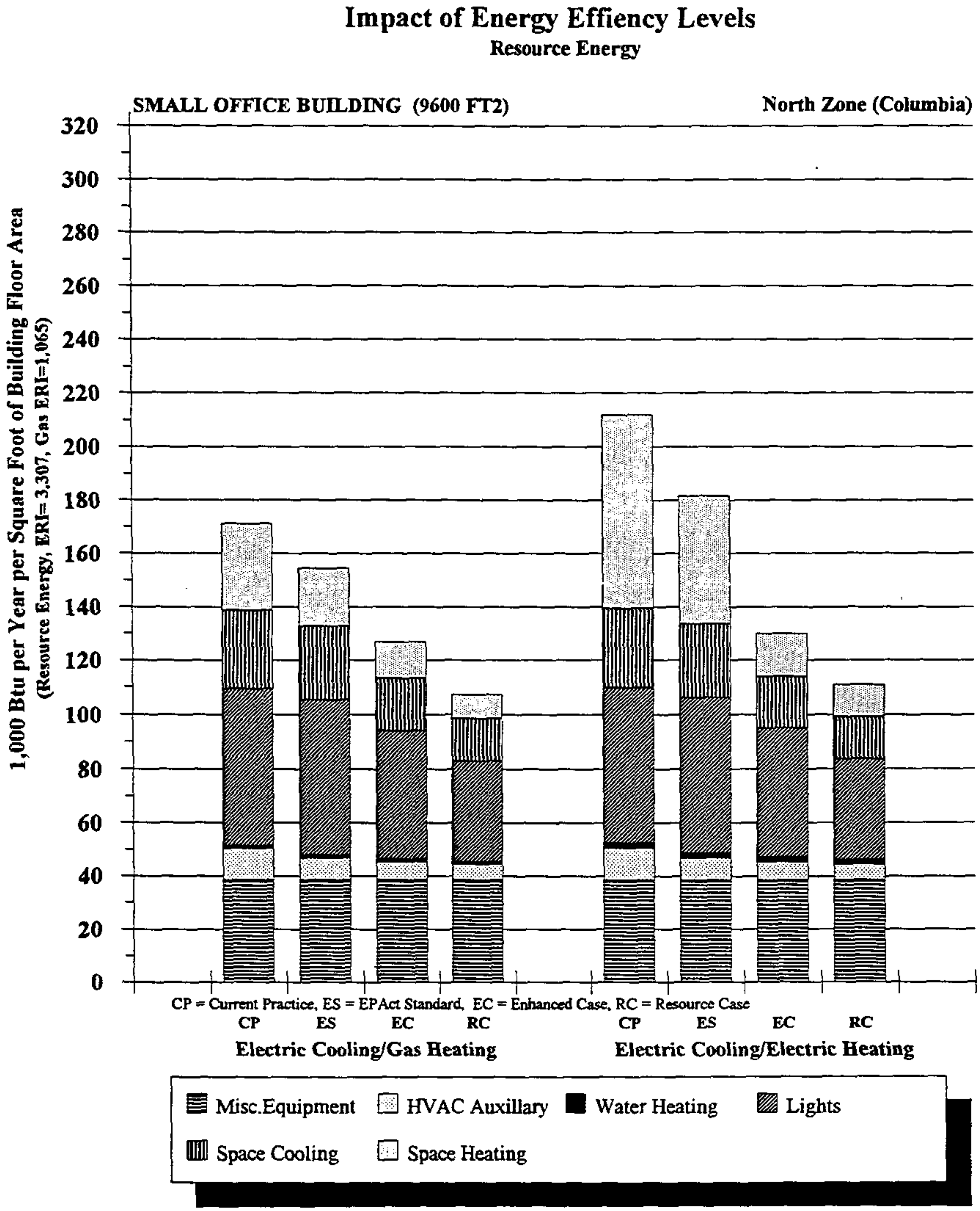
Small Office Building



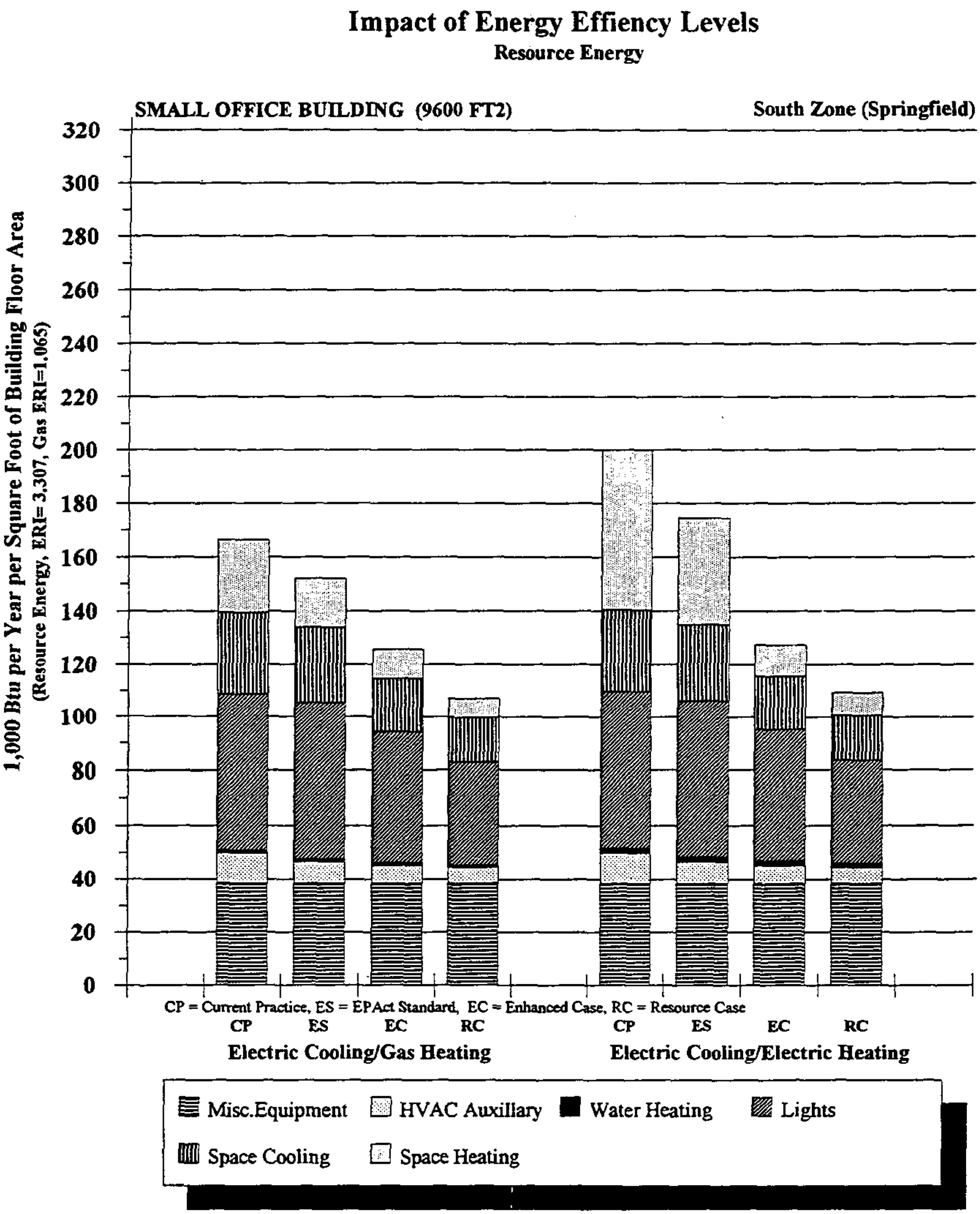
Small Office Building



Small Office Building



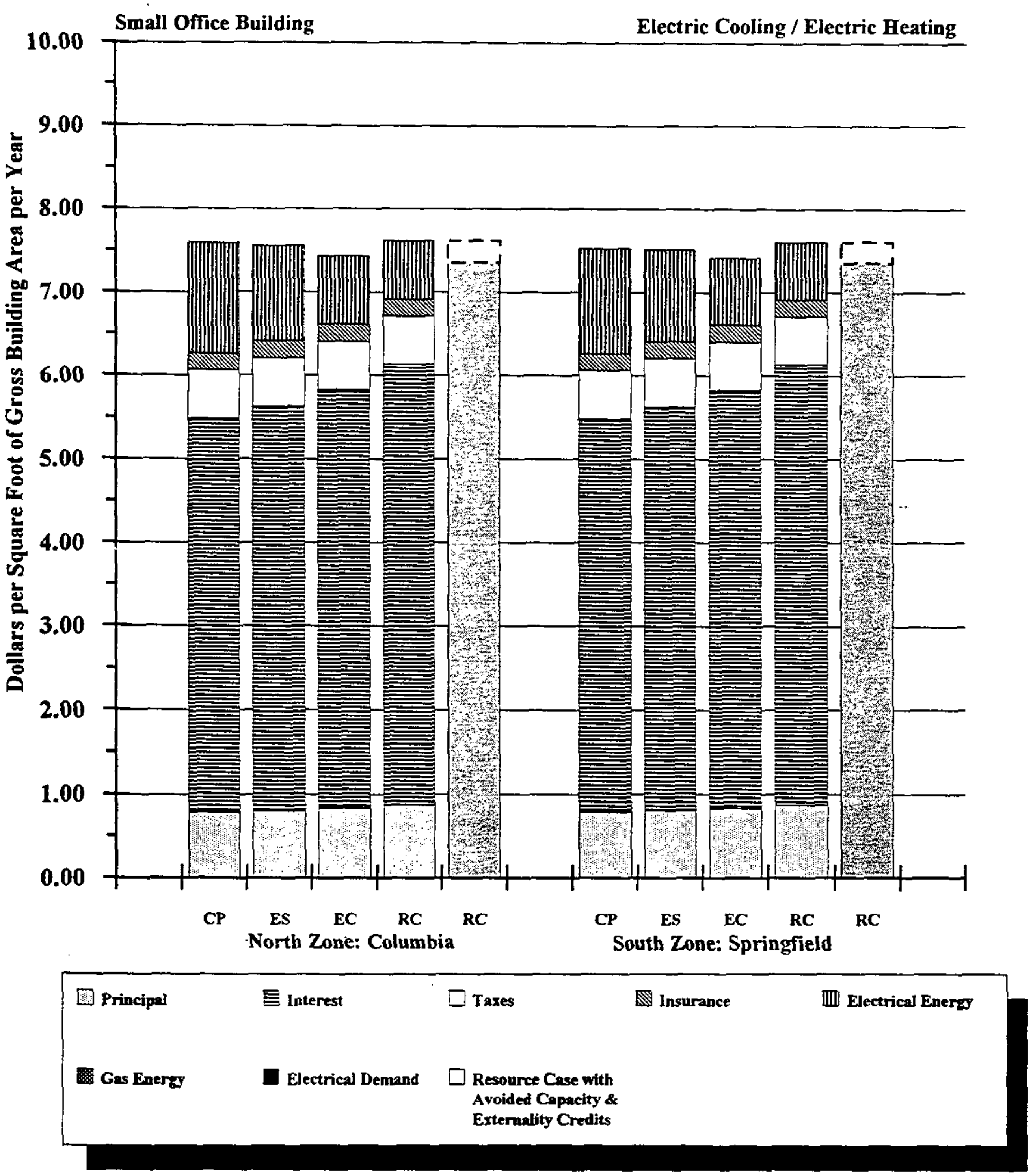
Small Office Building



Small Office Building

Impact of Energy Efficiency Levels

Total Cost of Owning and Operating Building (PITIE)



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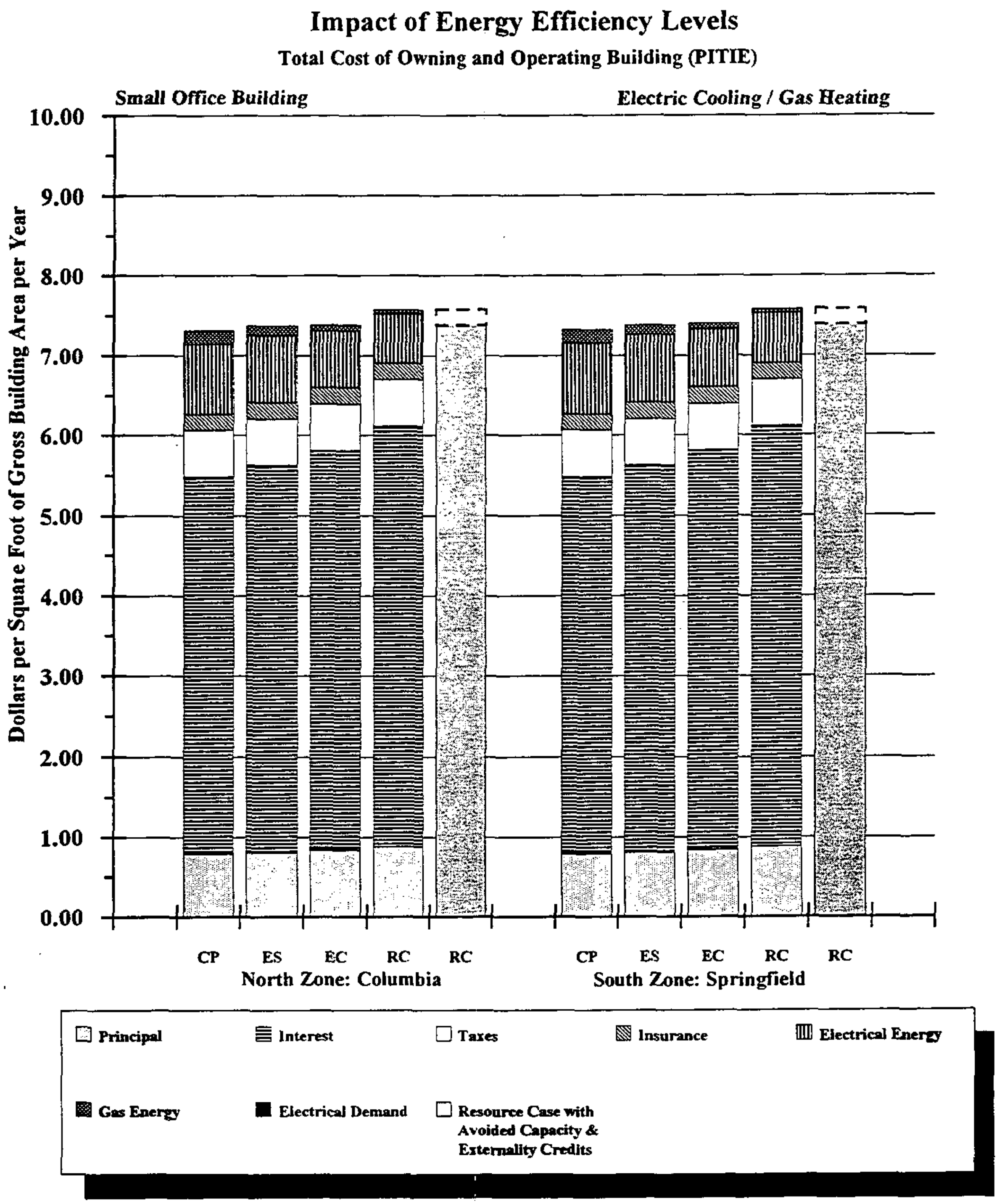
Small Office Building



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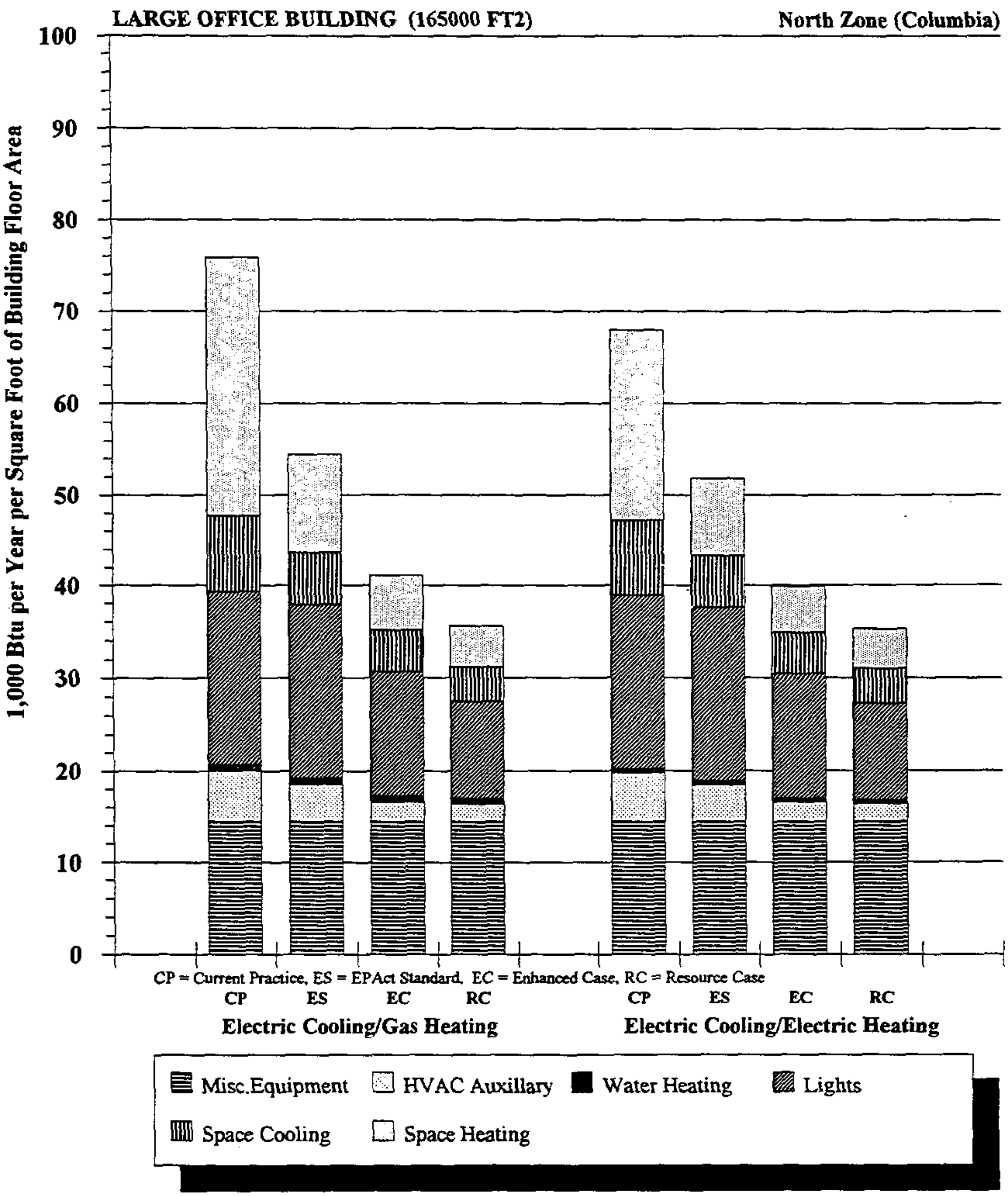
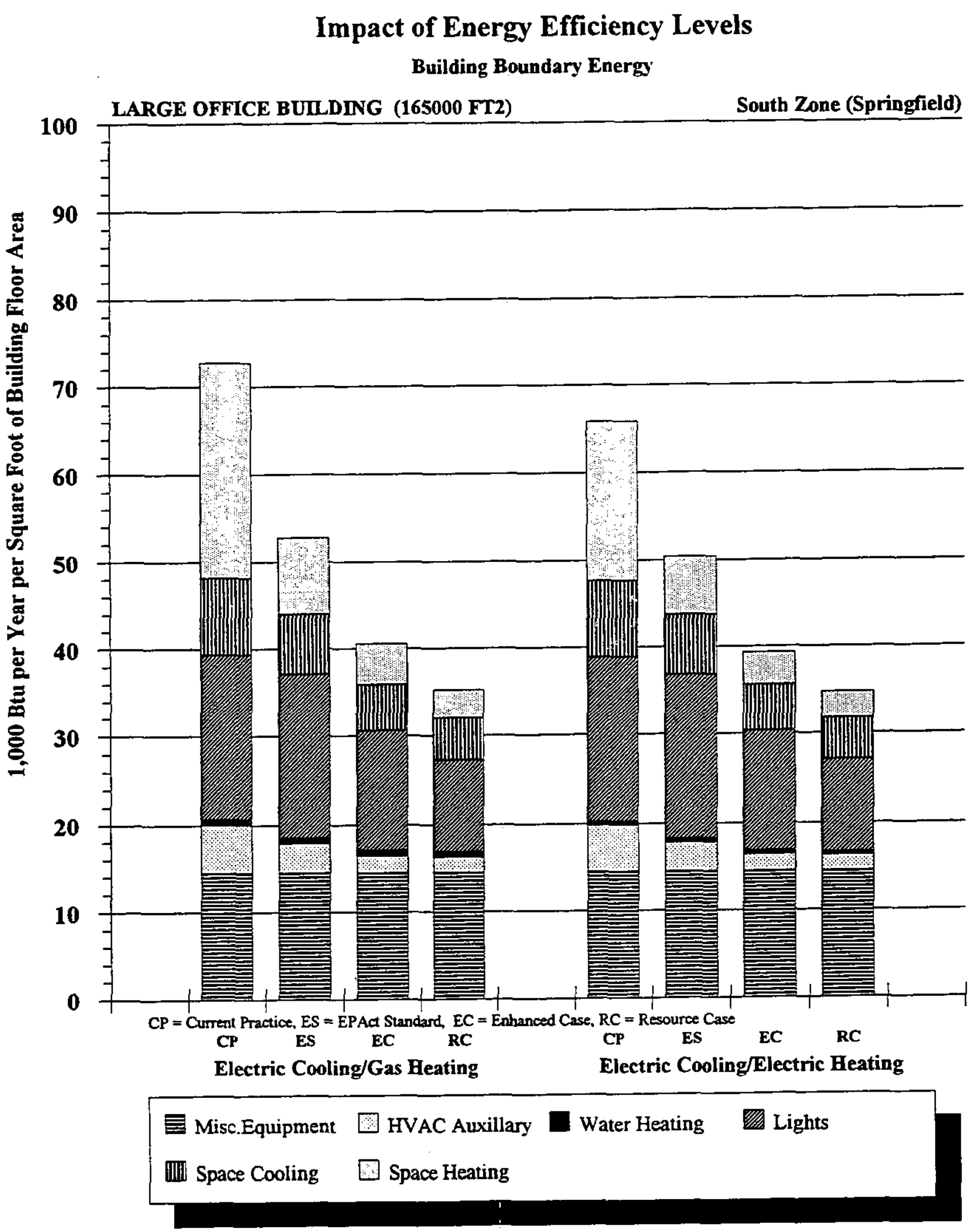
Large Office Building

Impact of Energy Efficiency Levels

Building Boundary Energy



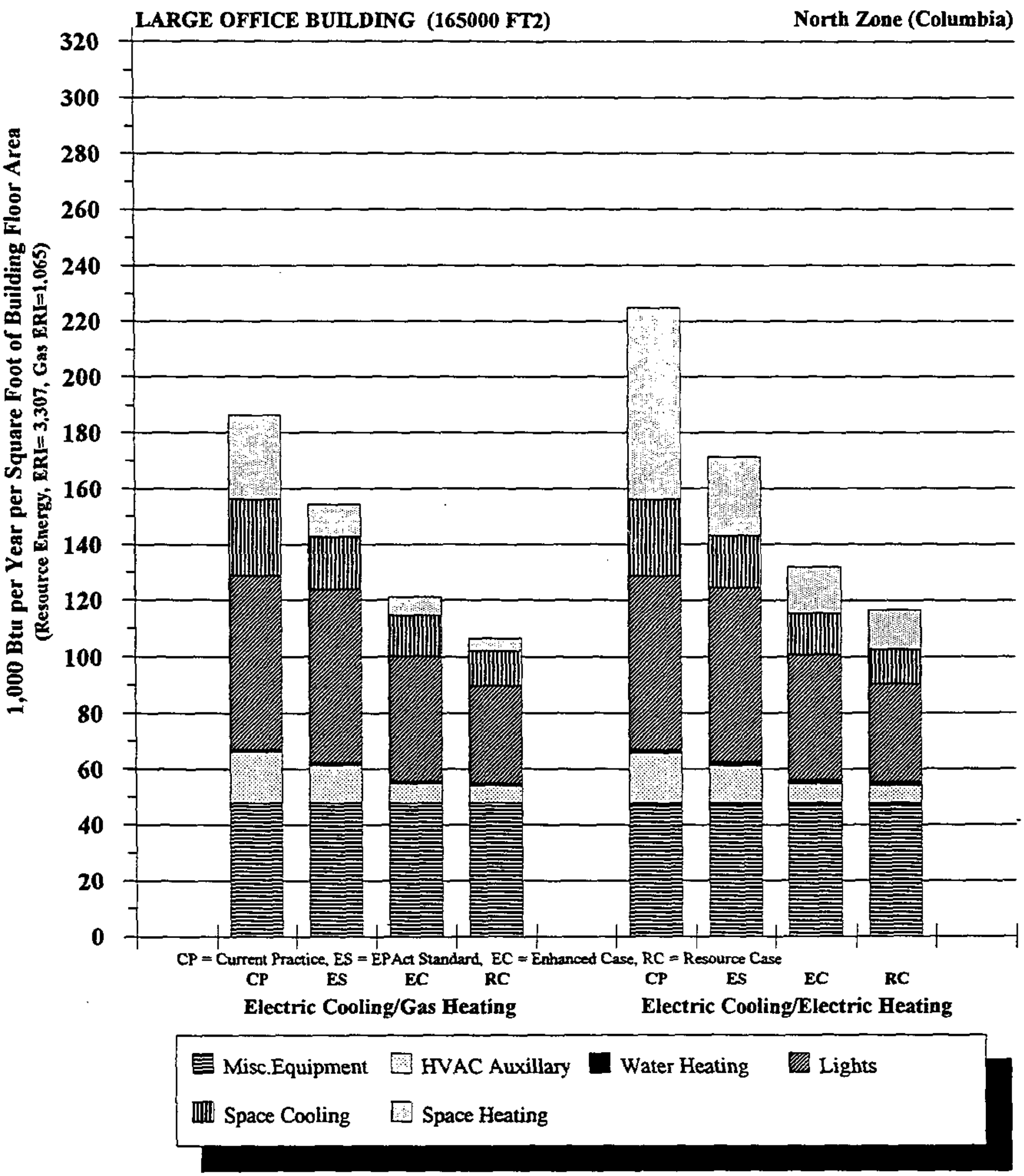
Large Office Building



Large Office Building

Impact of Energy Effiency Levels

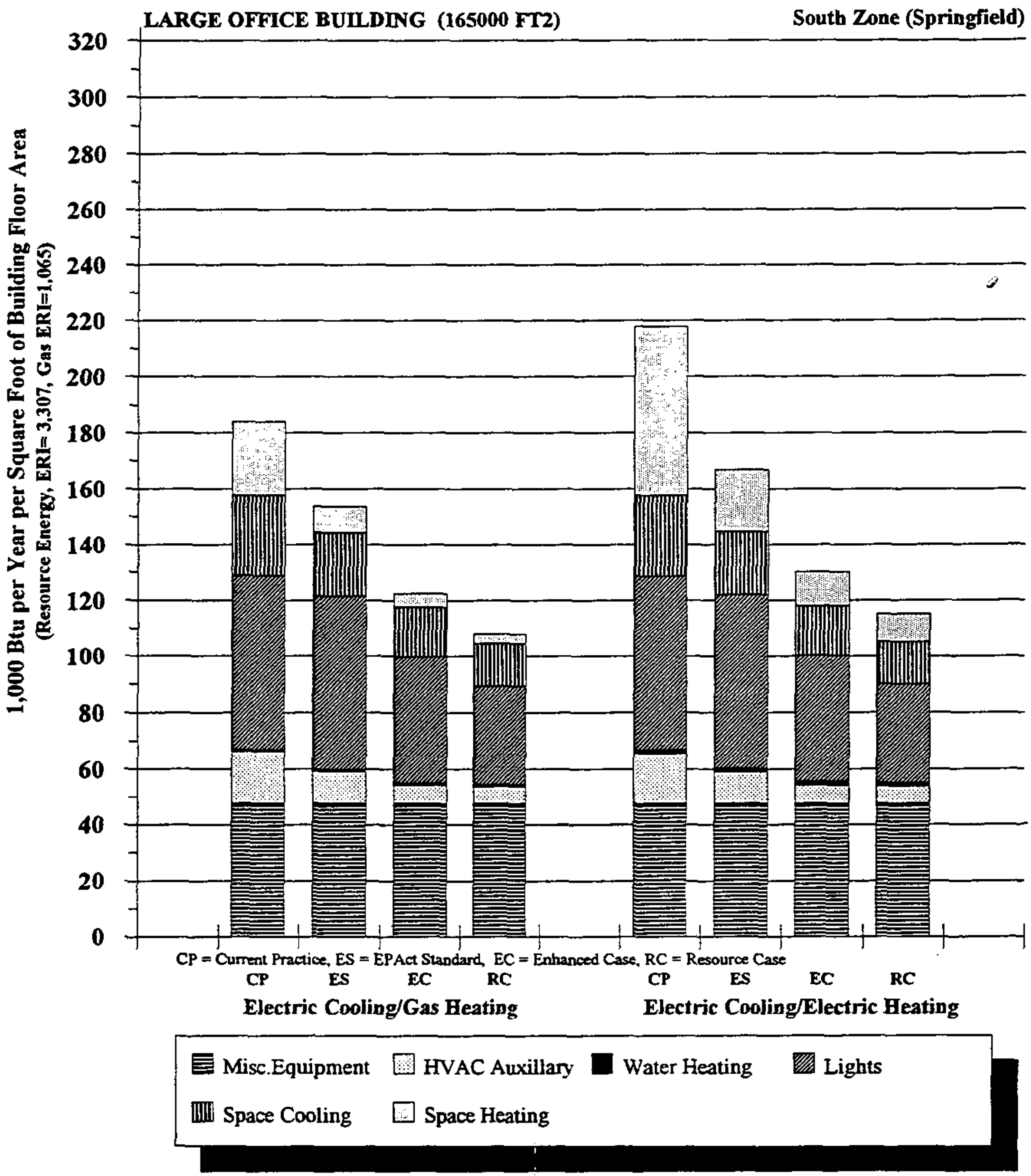
Resource Energy



Large Office Building

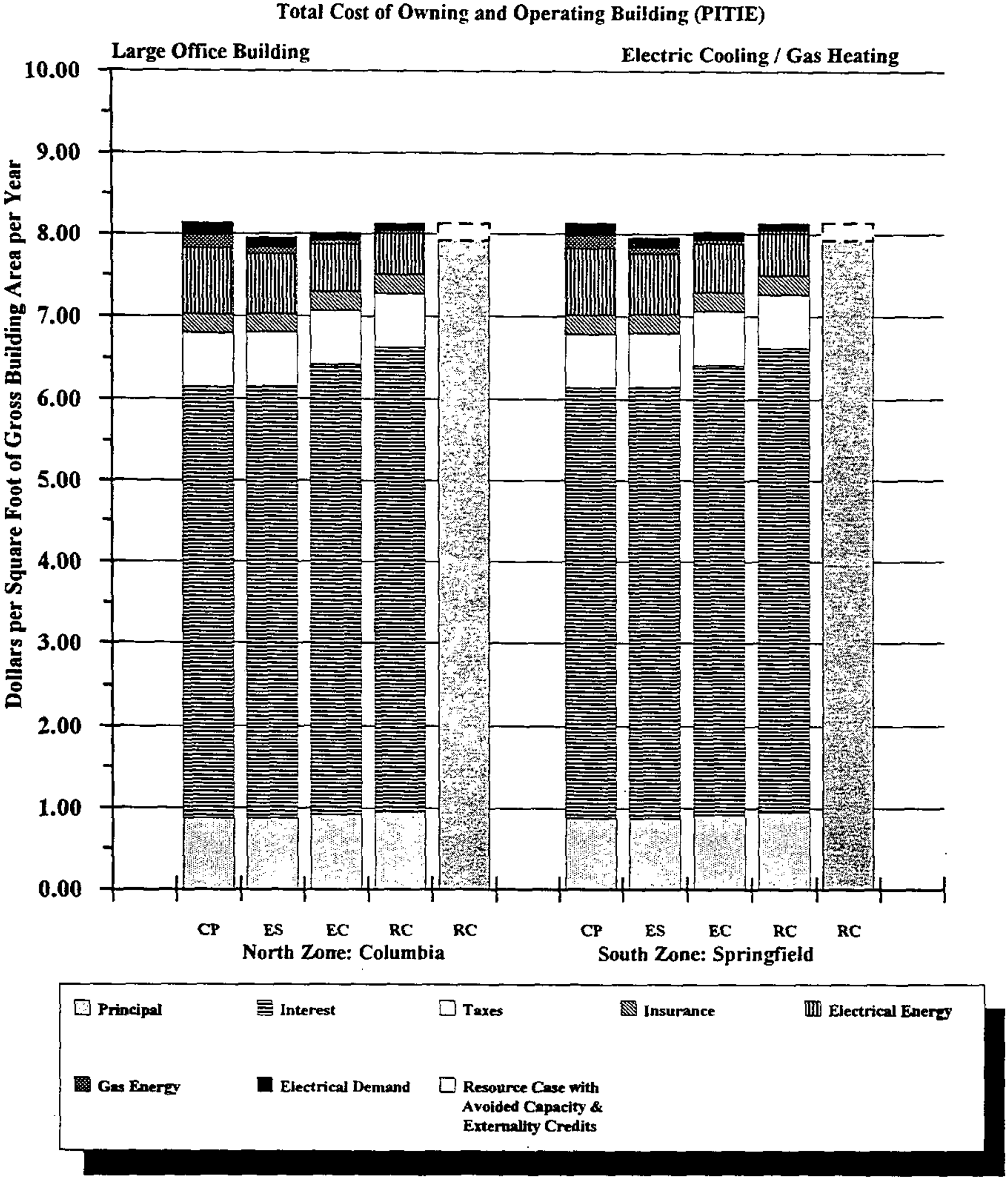
Impact of Energy Effiency Levels

Resource Energy



Large Office Building

Impact of Energy Efficiency Levels



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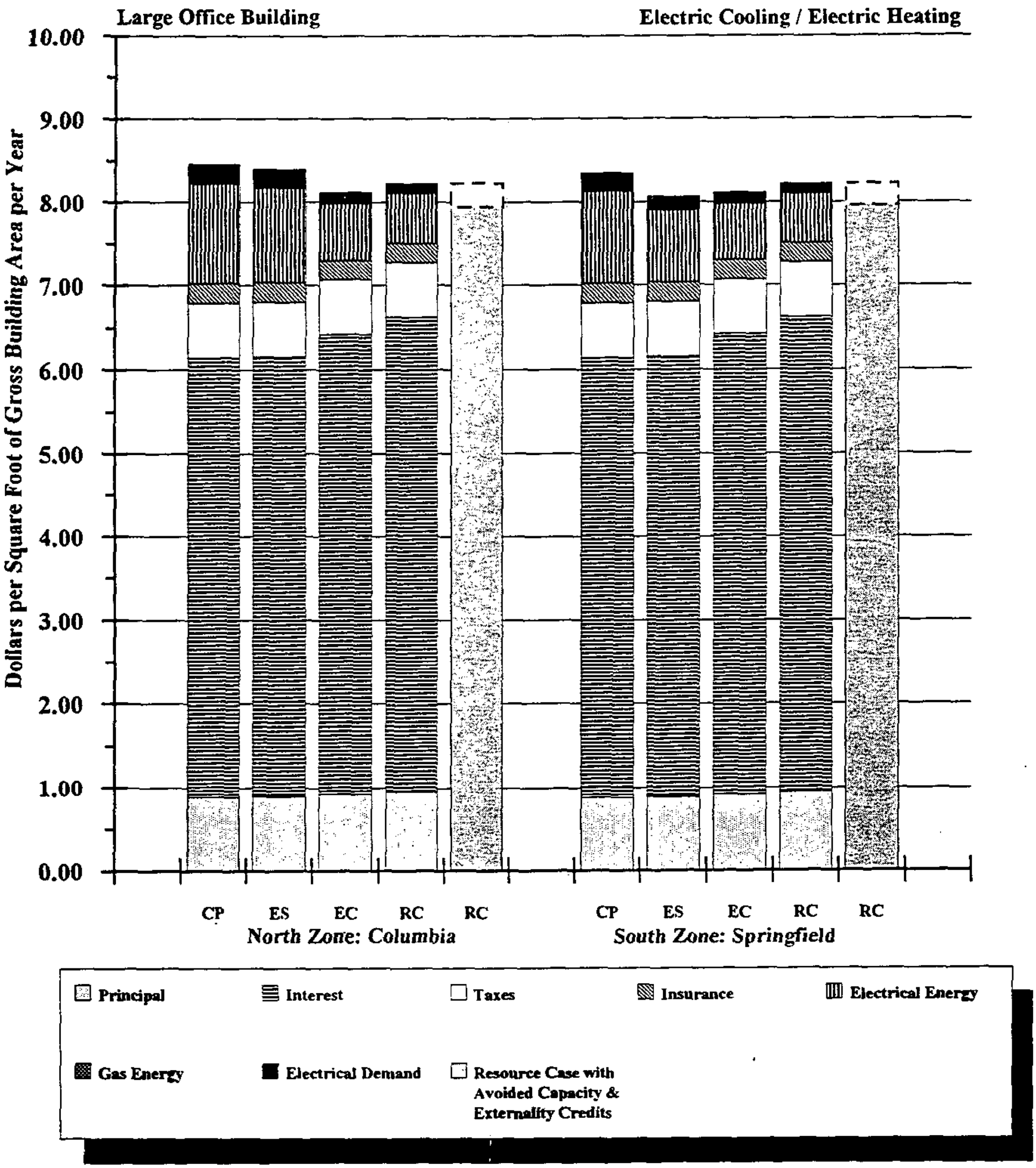
Large Office Building

Impact of Energy Efficiency Levels

Total Cost of Owning and Operating Building (PITIE)



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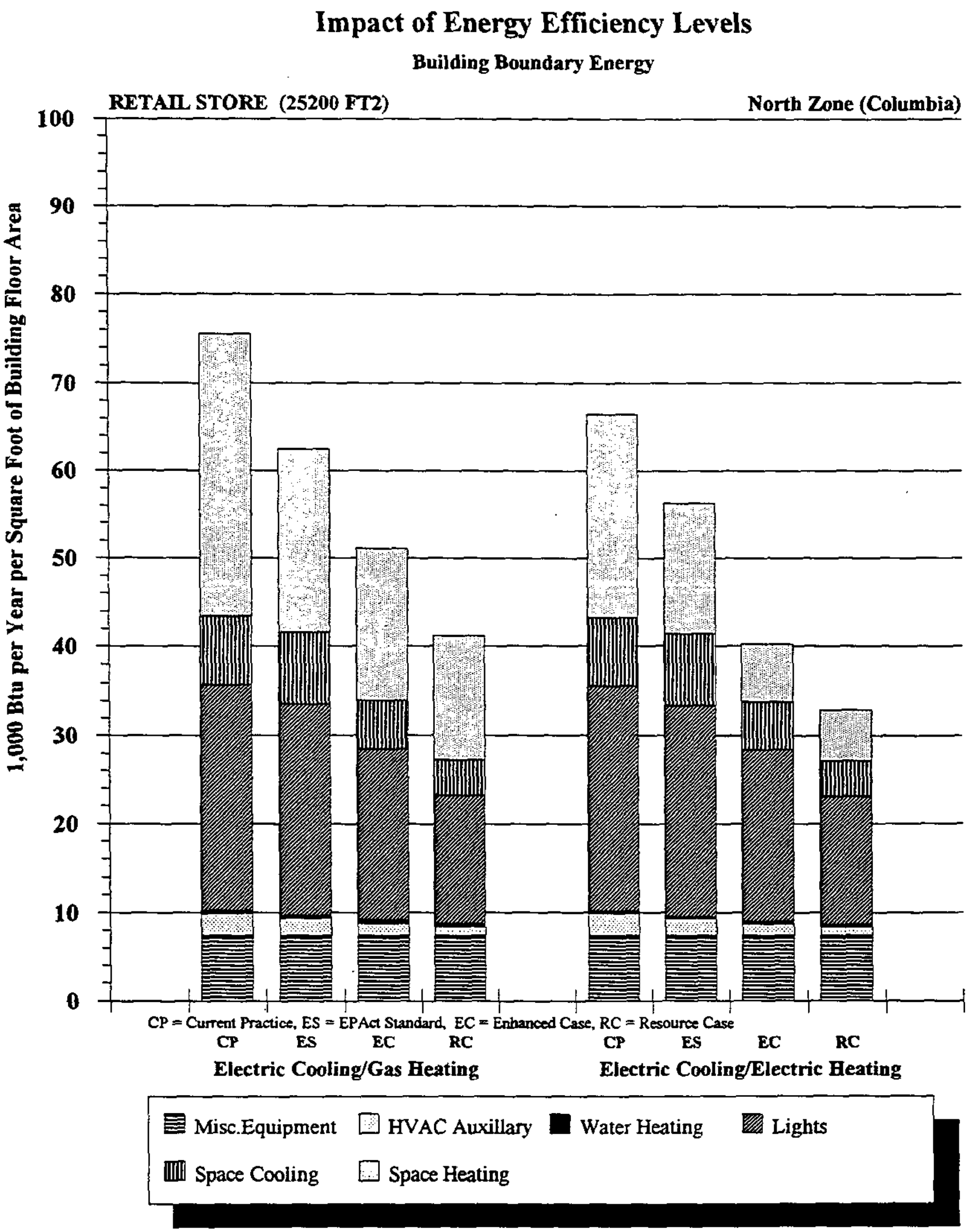
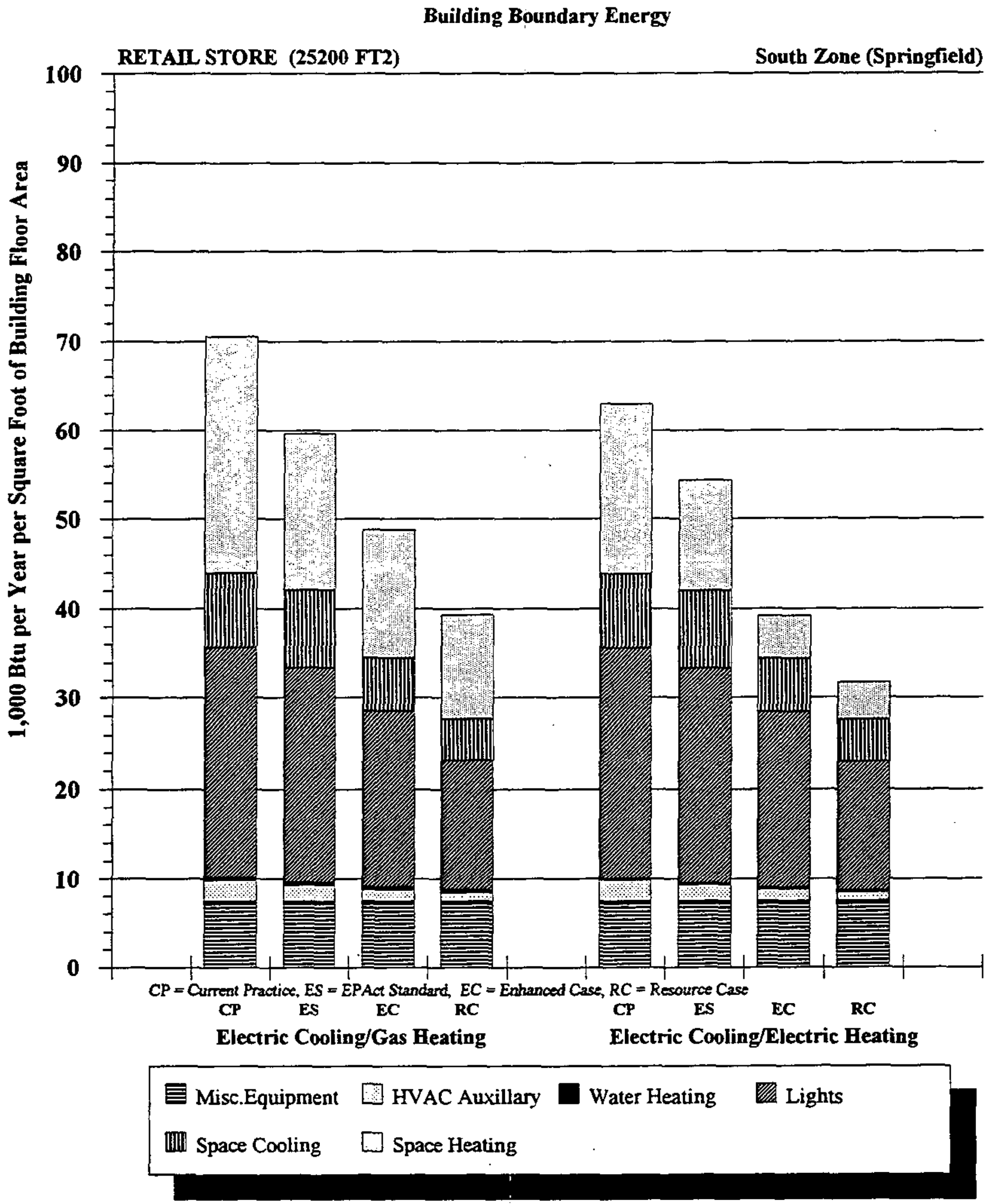
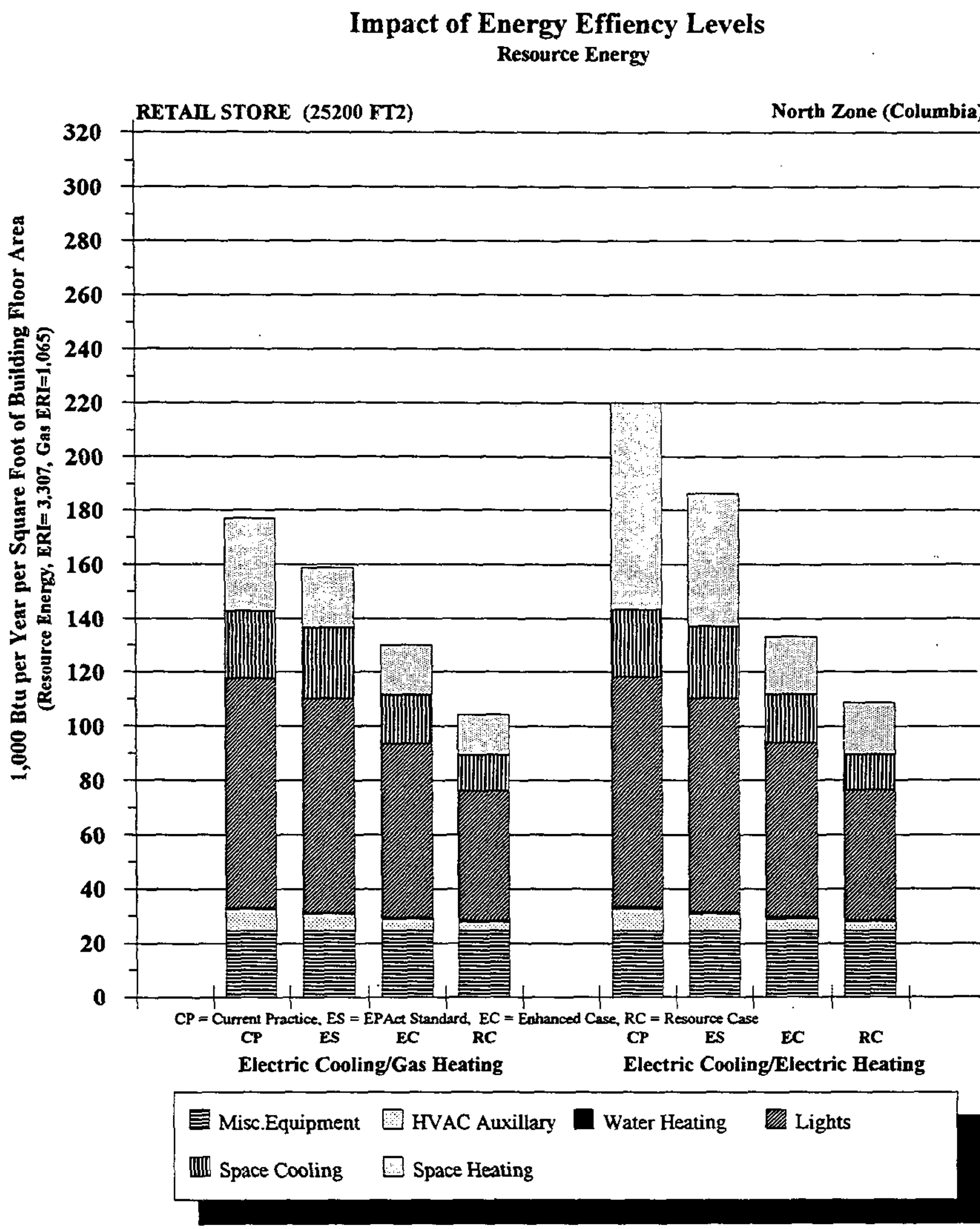

Impact of Energy Efficiency Levels
Building Boundary Energy
RETAIL STORE (25200 FT2)
North Zone (Columbia)
1,000 Btu per Year per Square Foot of Building Floor Area
100
90
80
70
60
50
40
30
20
10
0
CP = Current Practice, ES = EPAct Standard, EC = Enhanced Case, RC = Resource Case
CP
ES
EC
RC
Electric Cooling/Gas Heating
CP
ES
EC
RC
Electric Cooling/Electric Heating
Misc.Equipment
HVAC Auxillary
Water Heating
Lights
Space Cooling
Space Heating

Retail Store

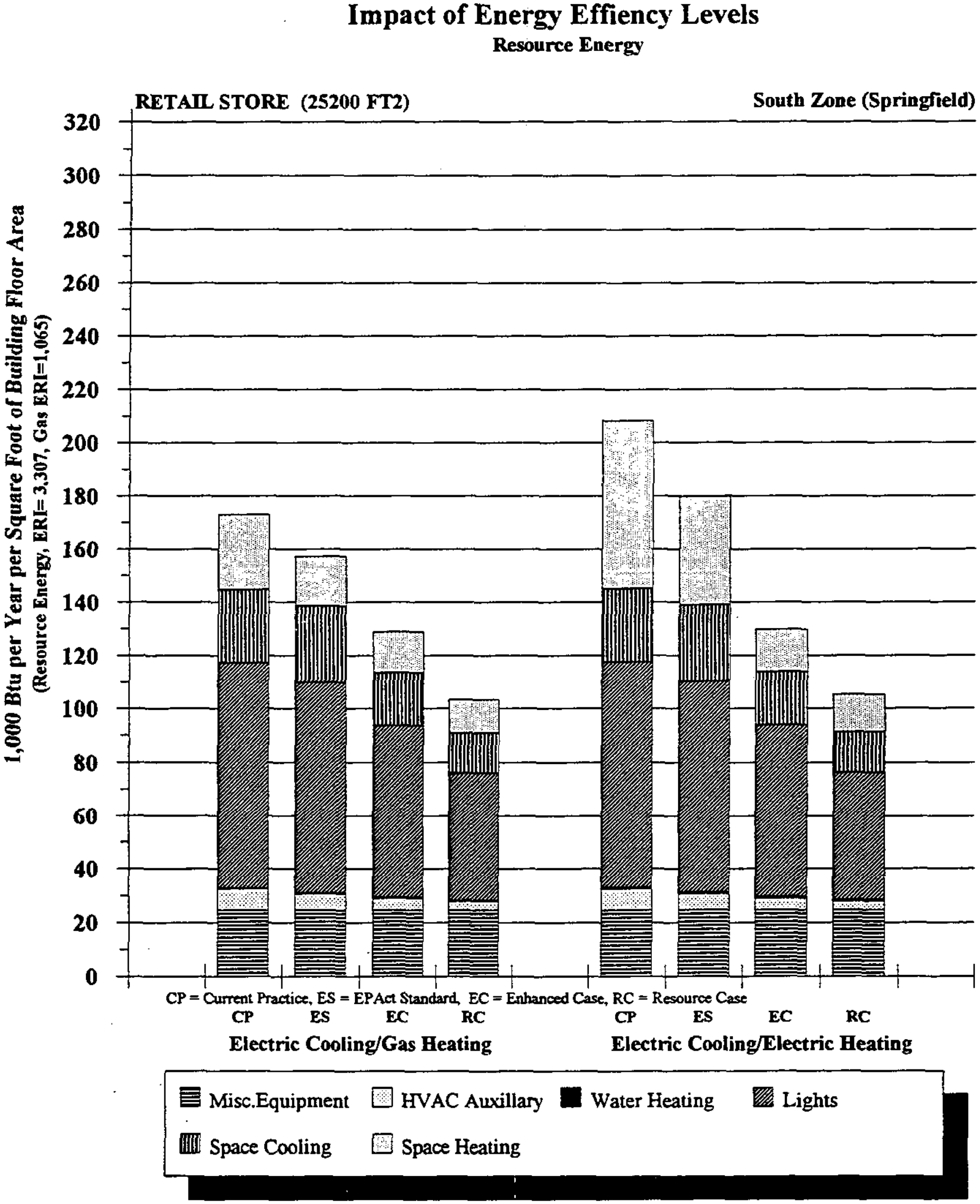
Impact of Energy Efficiency Levels



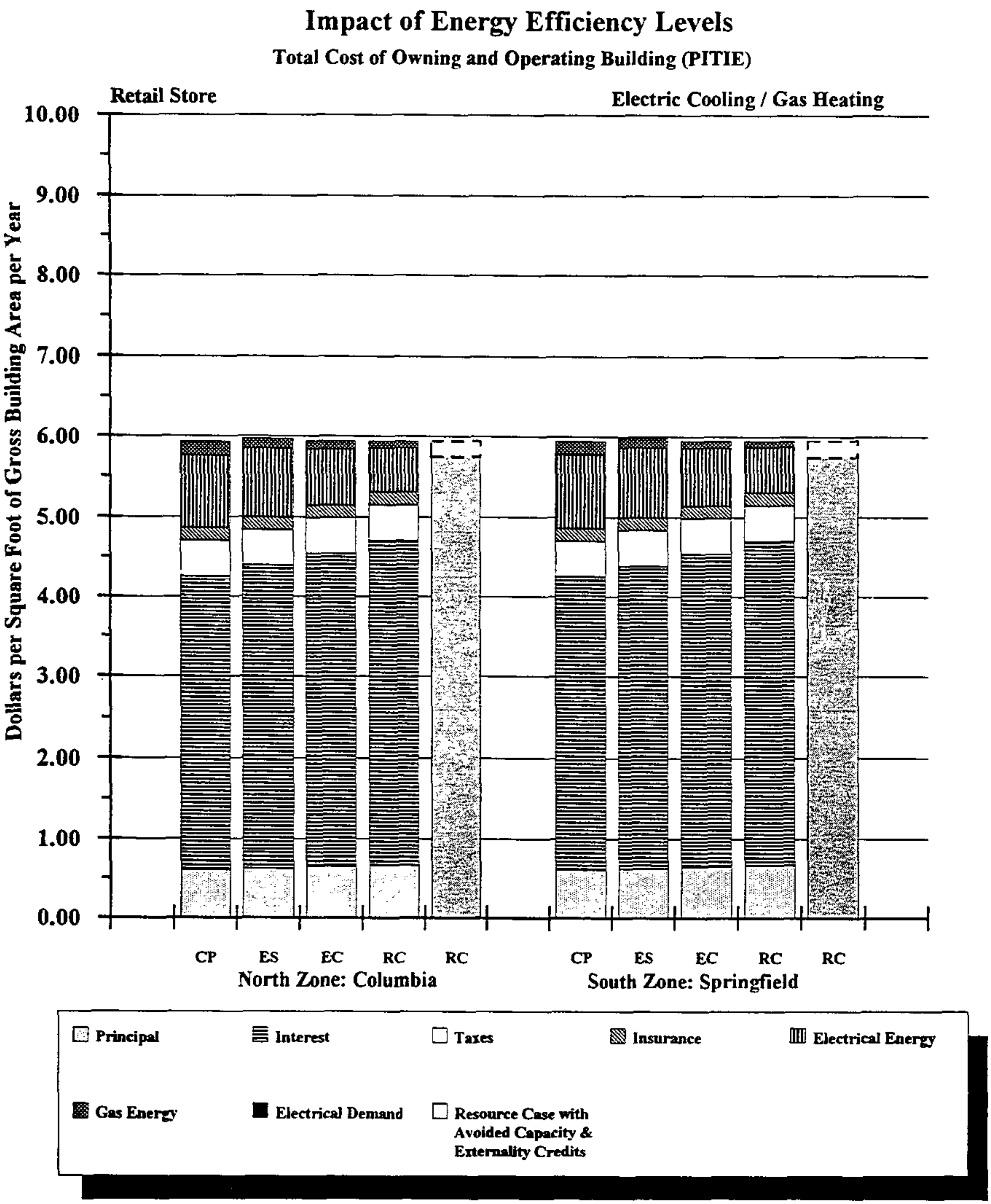
Retail Store



Retail Store



Retail Store



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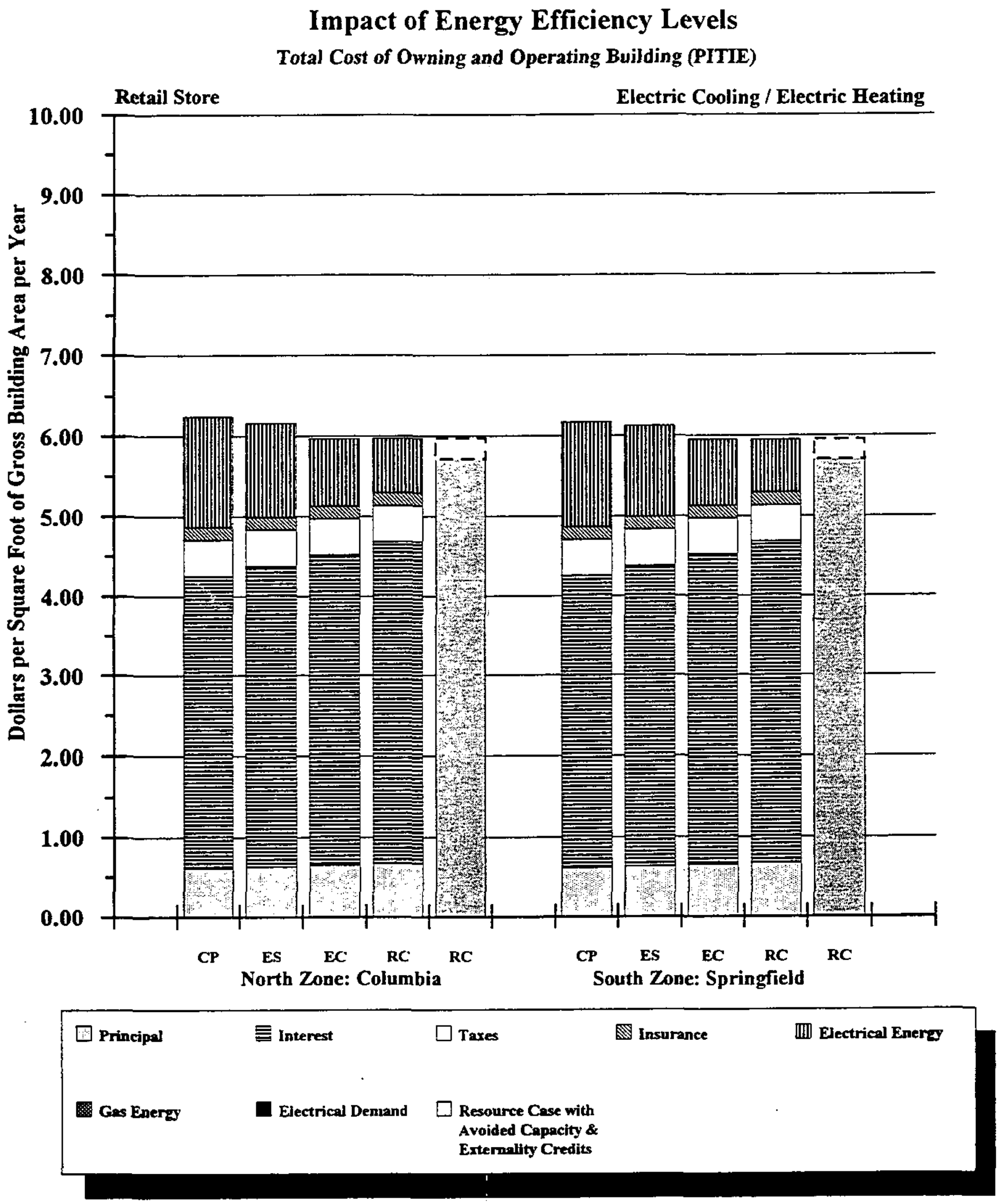
Retail Store



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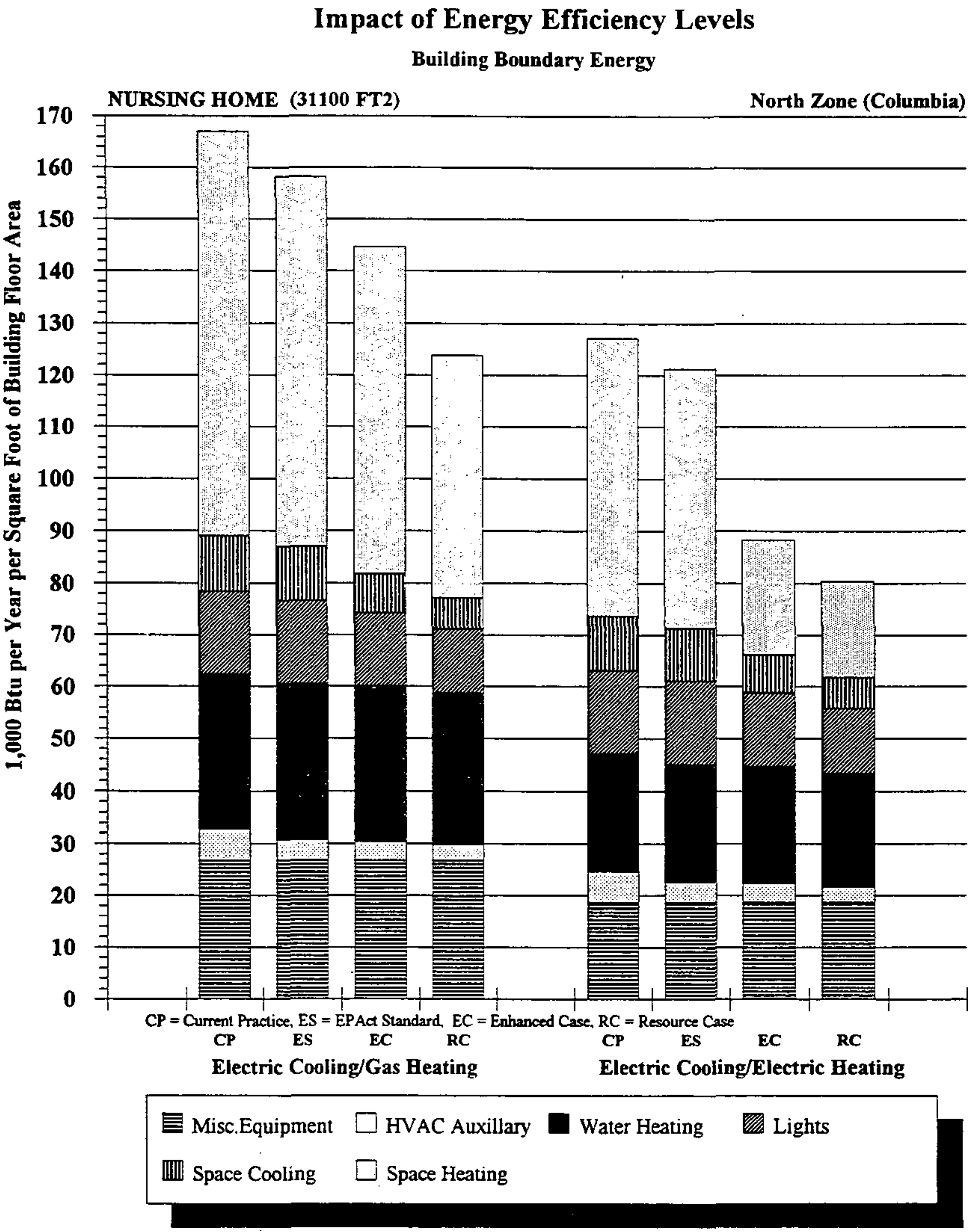
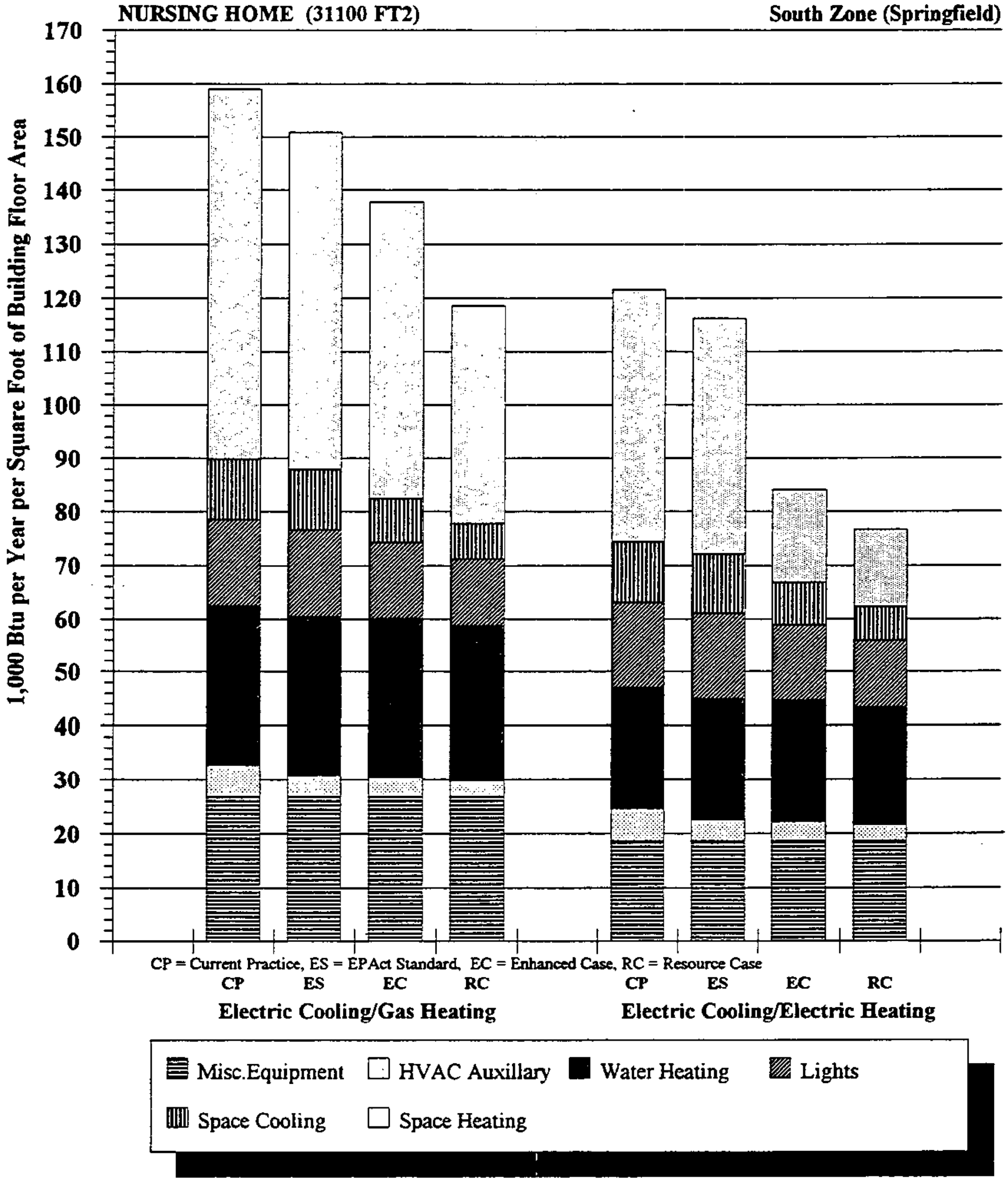
Nursing Home



Nursing Home

Impact of Energy Efficiency Levels

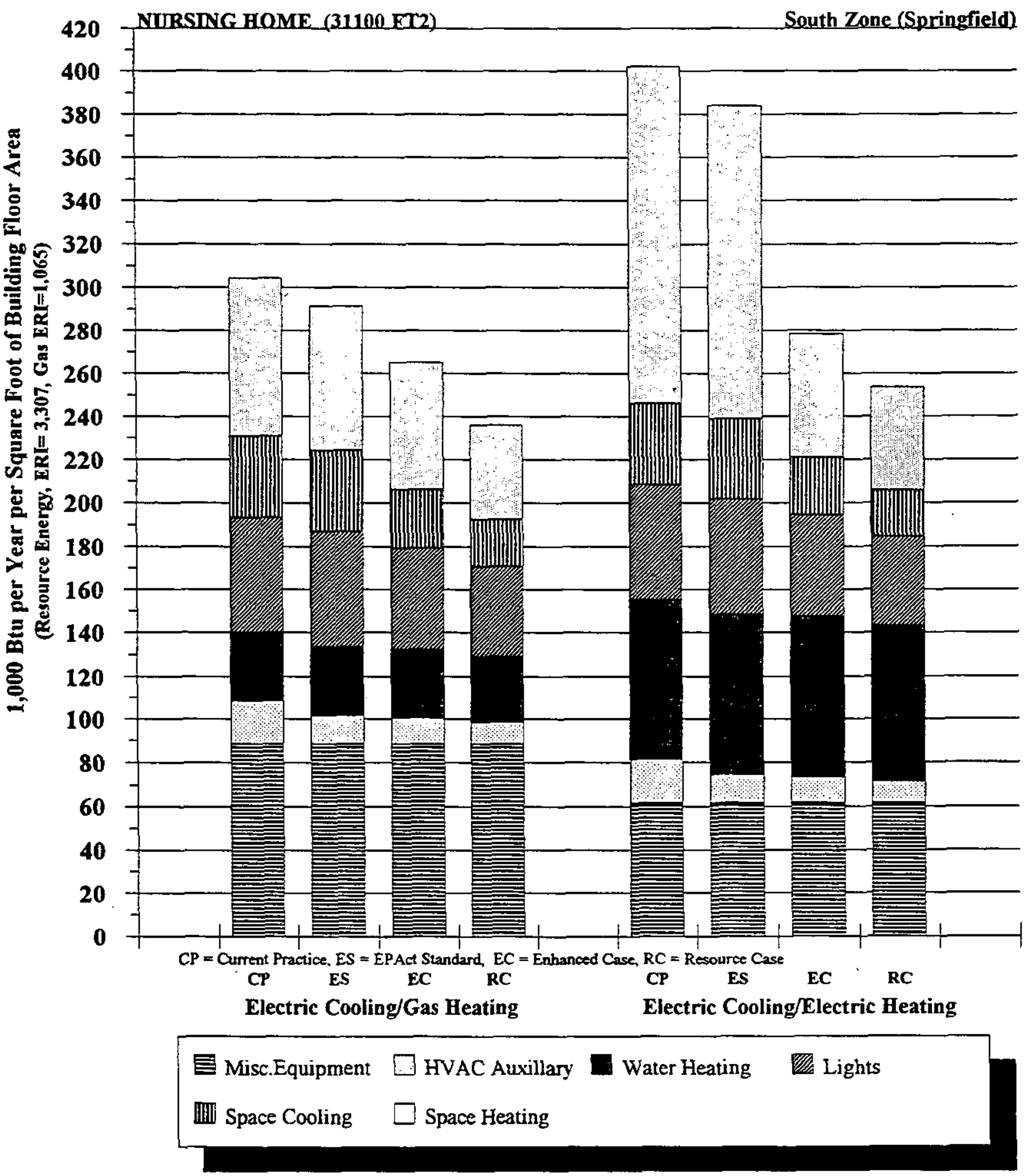
Building Boundary Energy



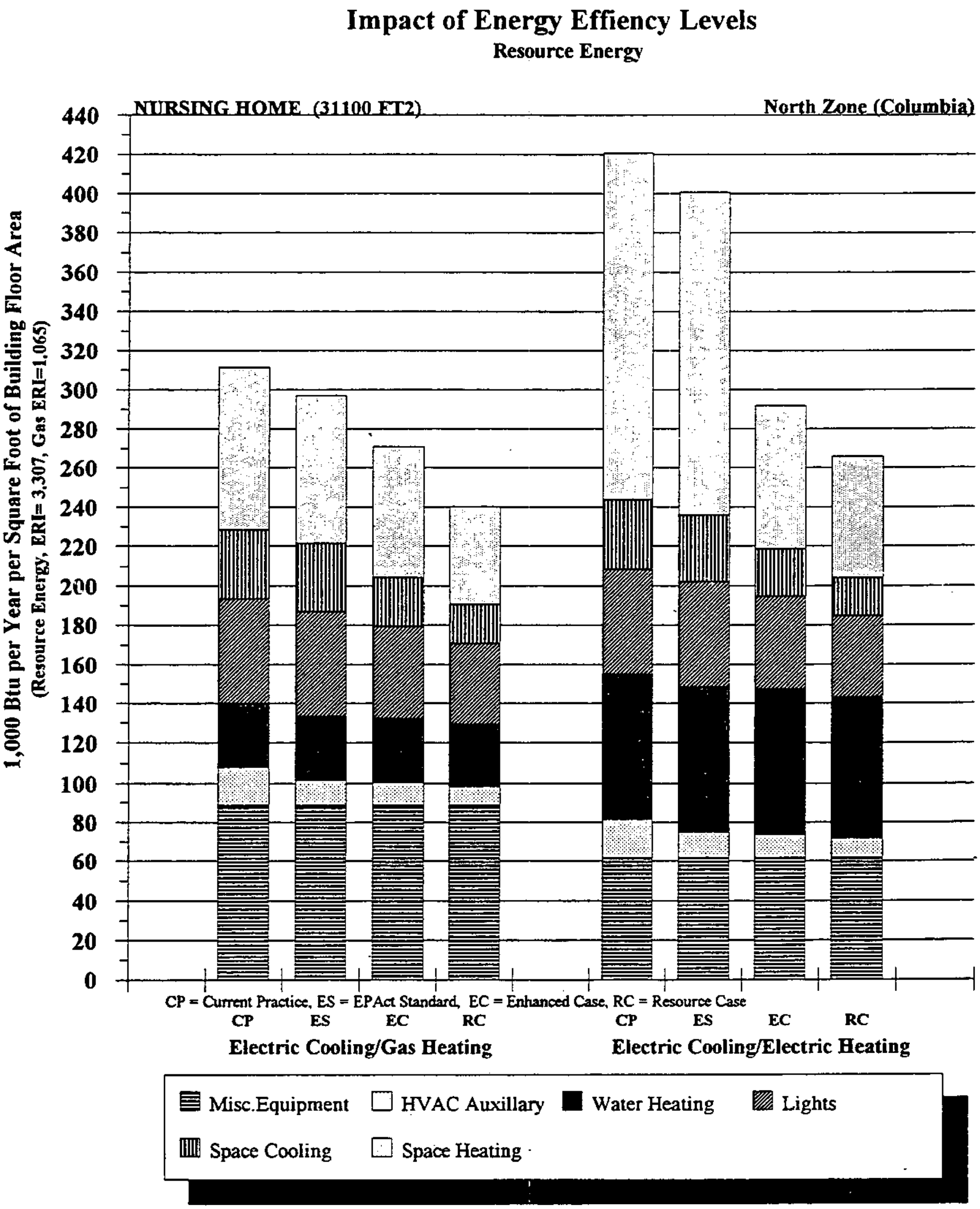
Nursing Home

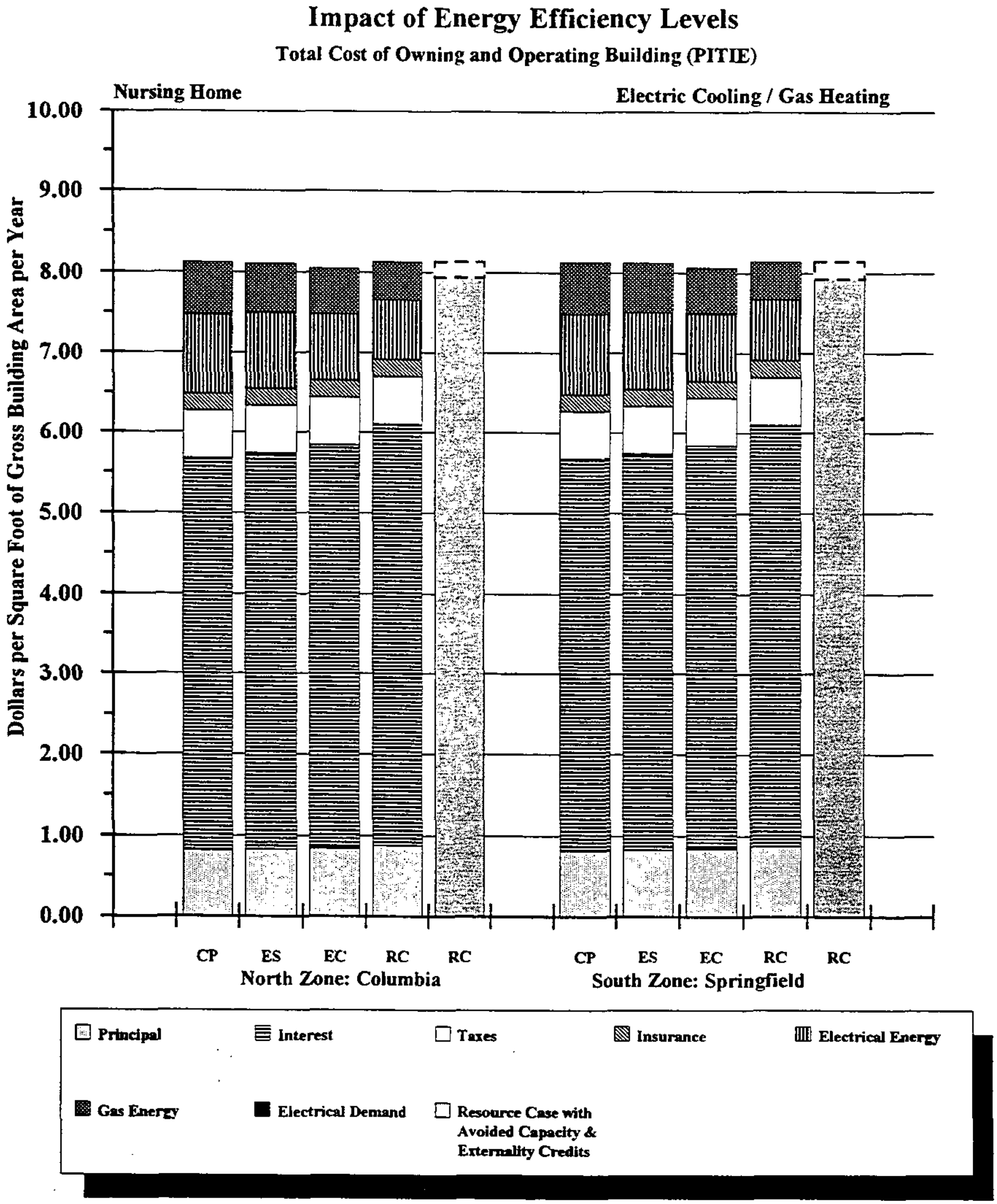
Impact of Energy Effiency Levels

Resource Energy



Nursing Home





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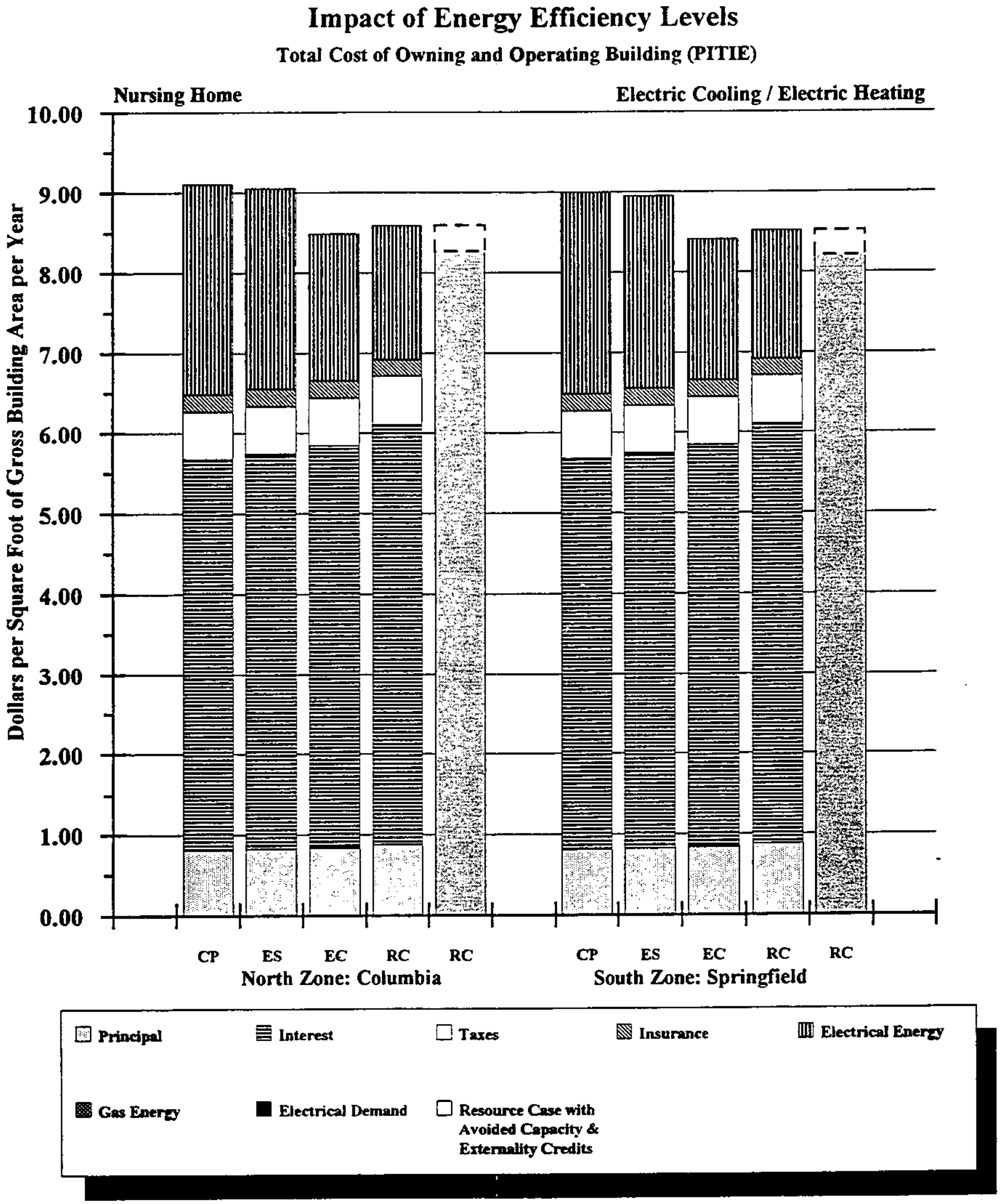
Nursing Home



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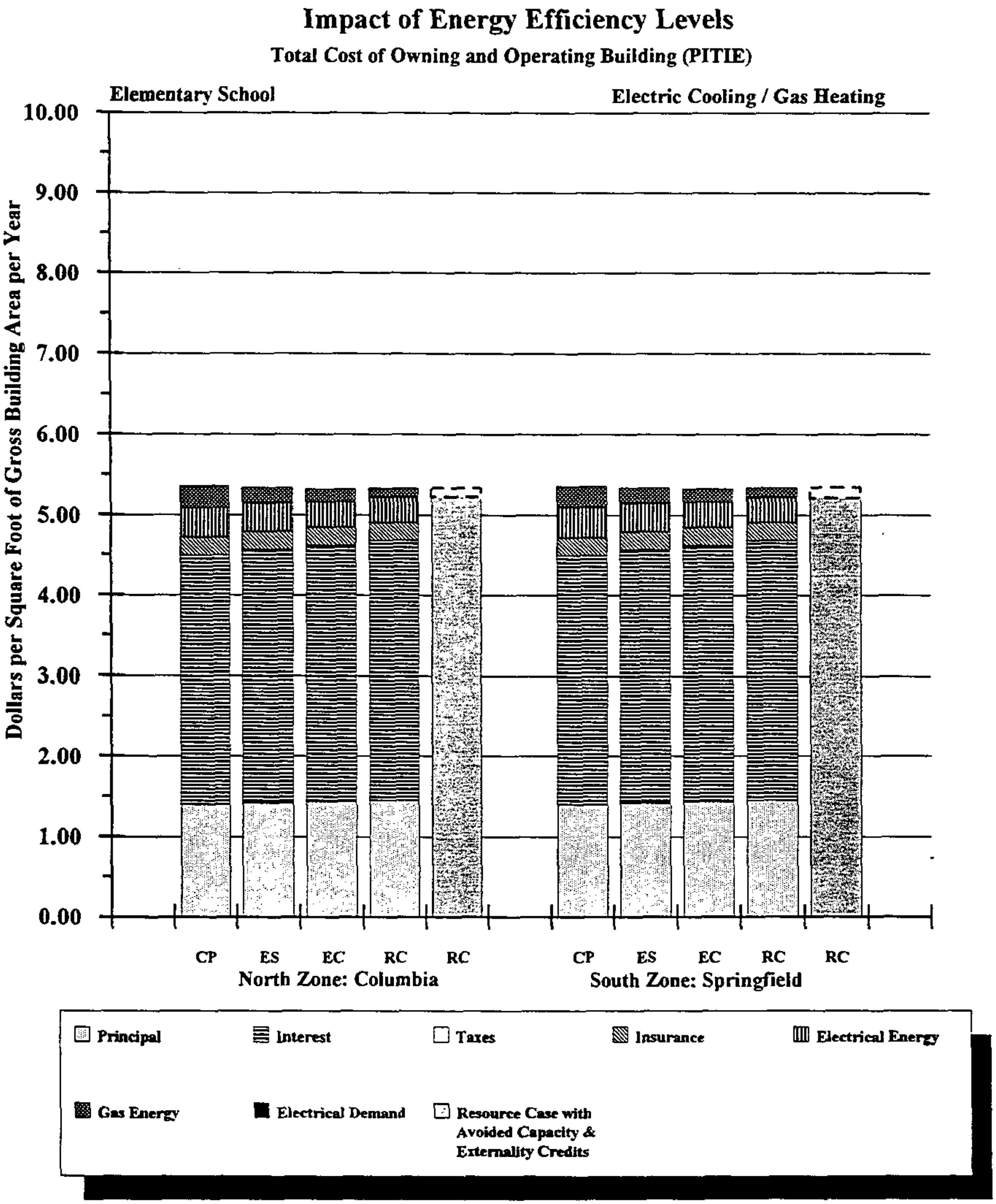
Elementary School



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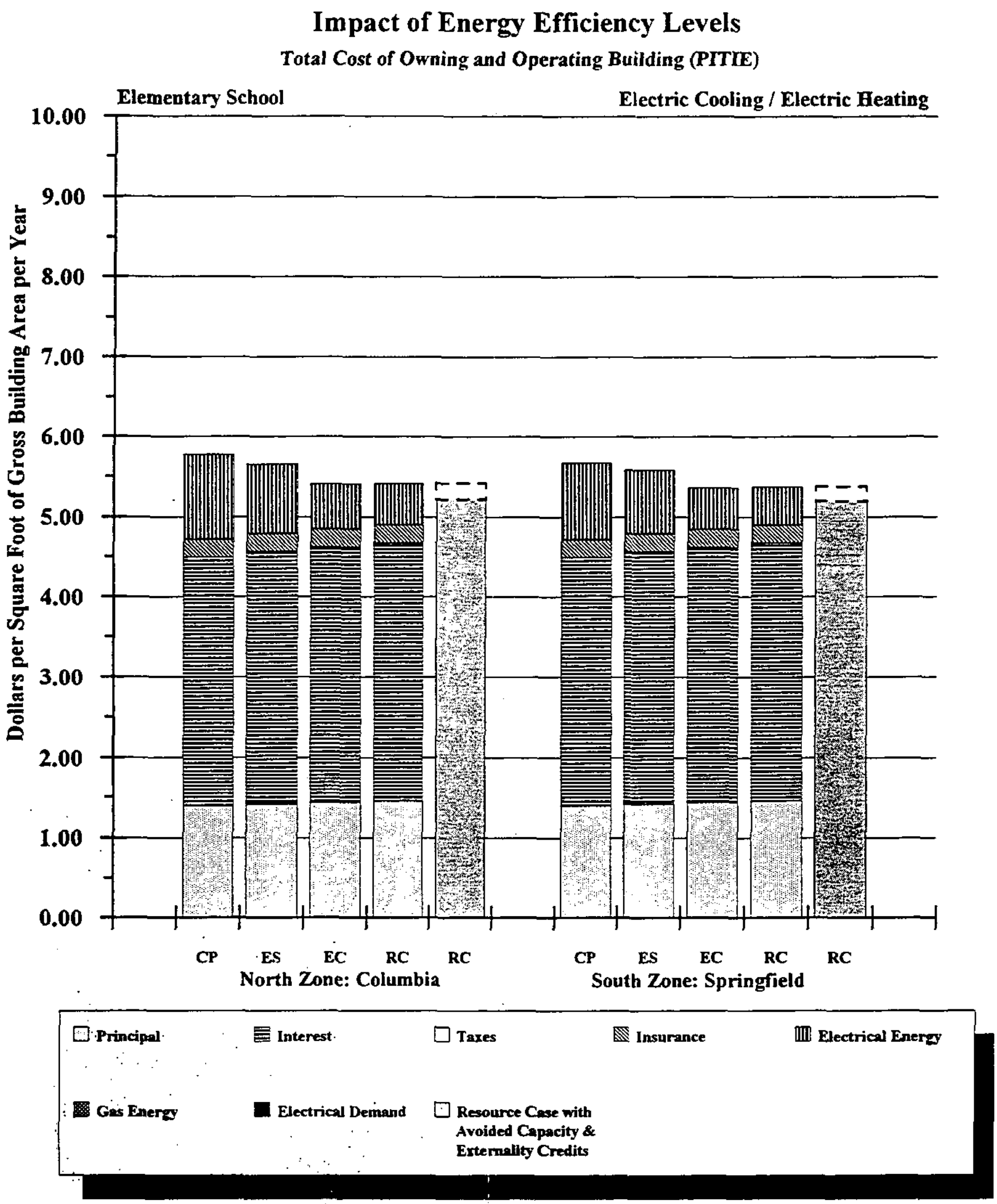
Elementary School



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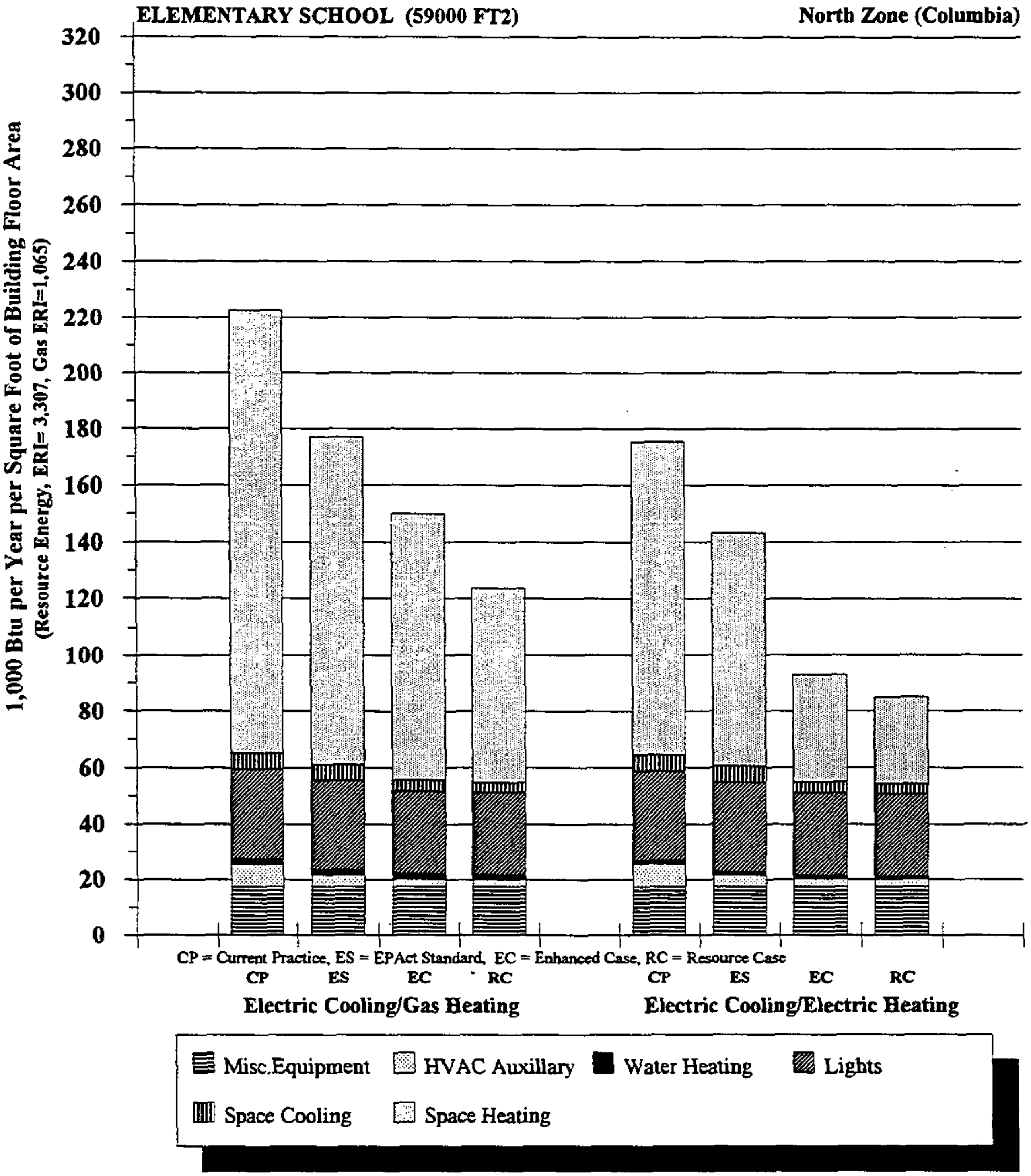
Elementary School

Impact of Energy Effiency Levels

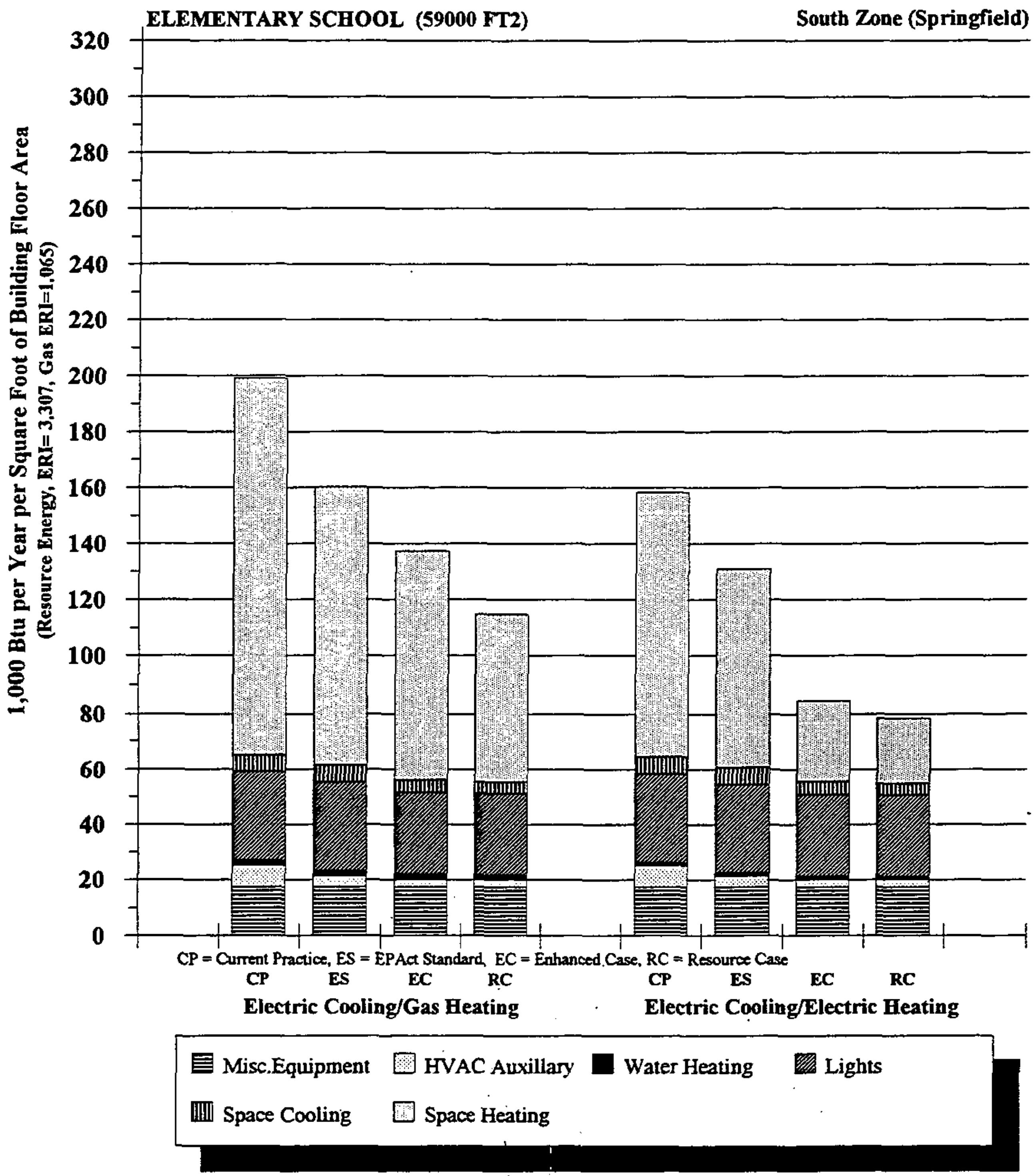
Resource Energy



Elementary School

Impact of Energy Effiency Levels

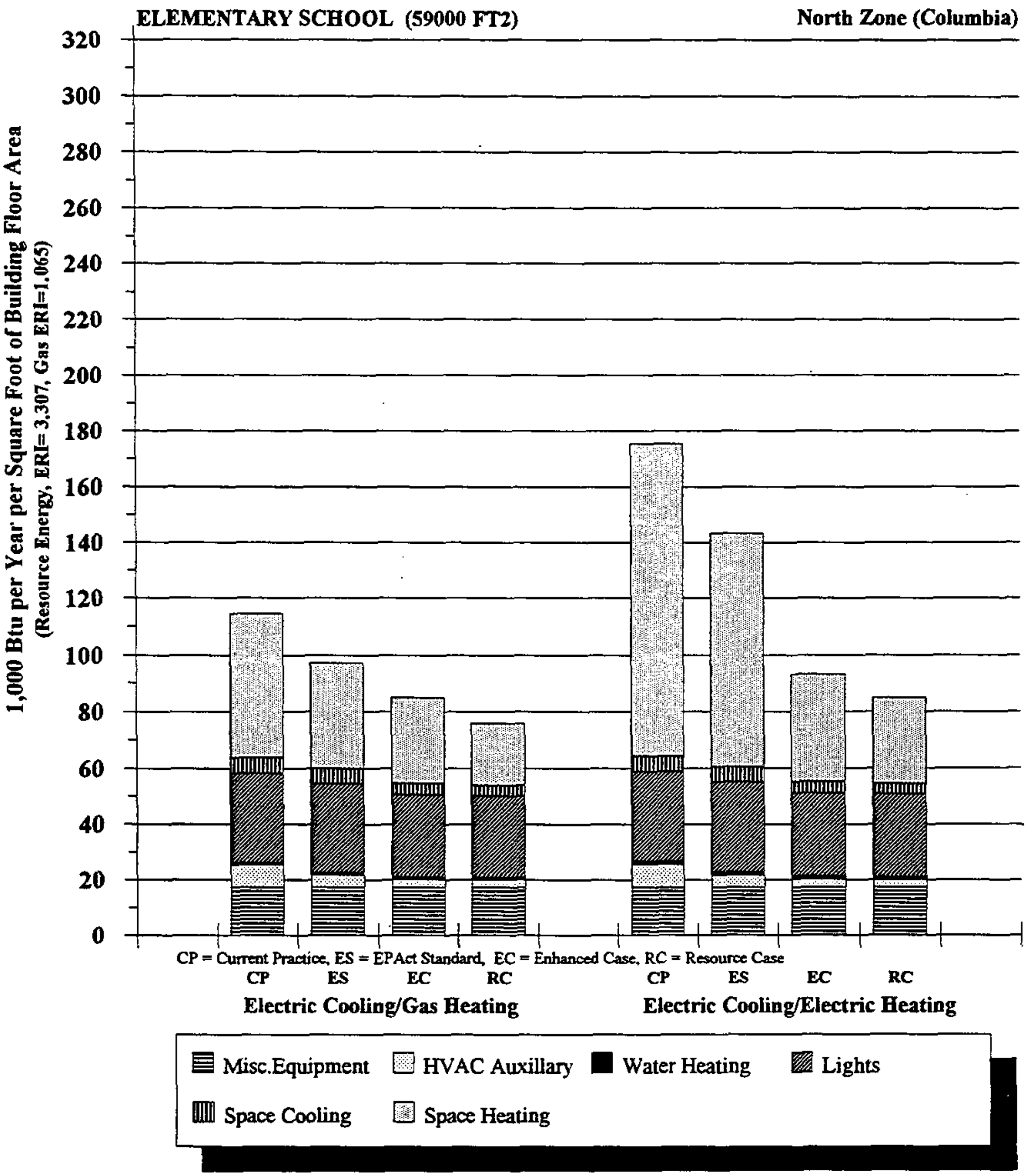
Resource Energy



Elementary School

Impact of Energy Effiency Levels

Resource Energy



Elementary School

Impact of Energy Effiency Levels

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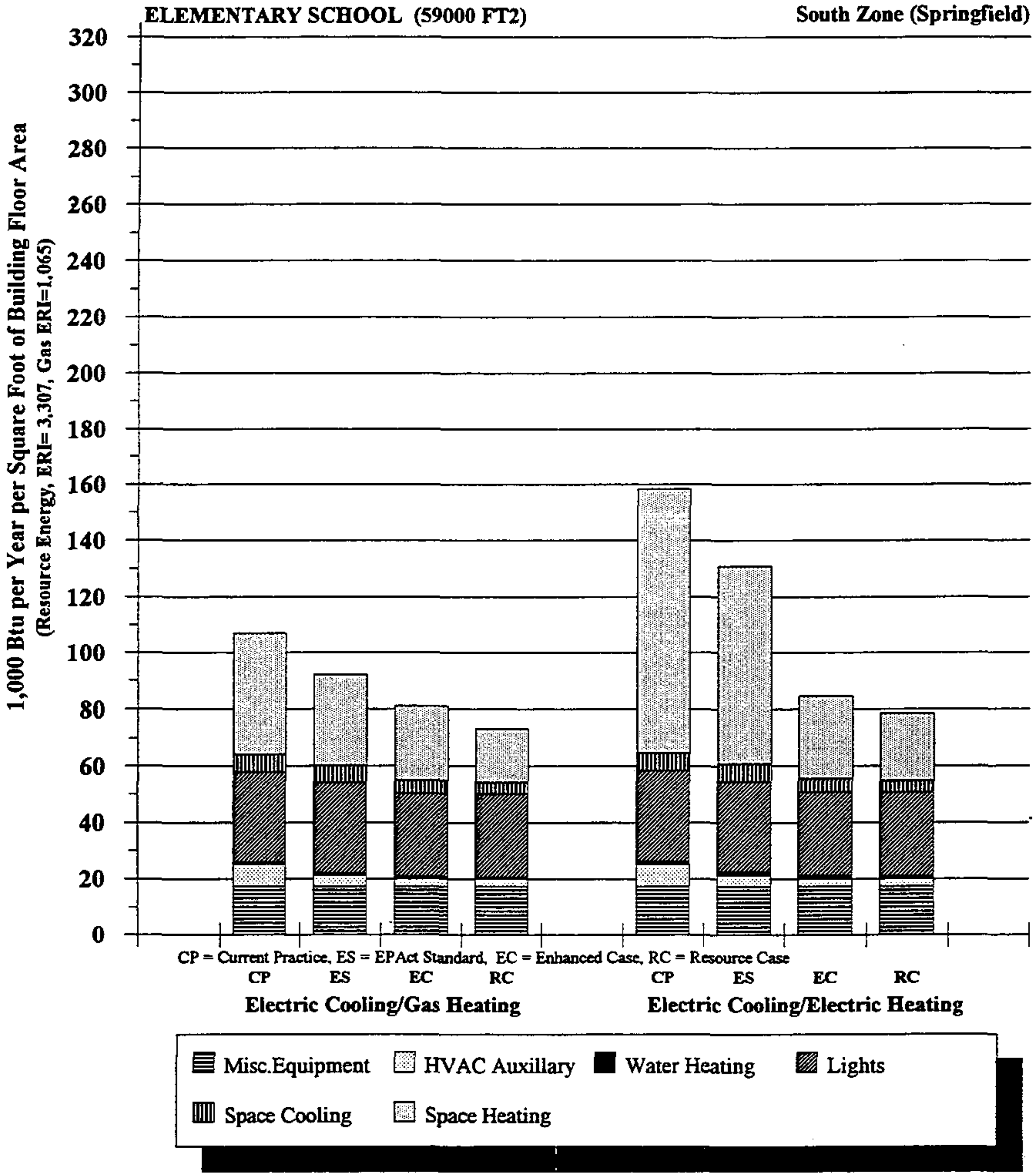
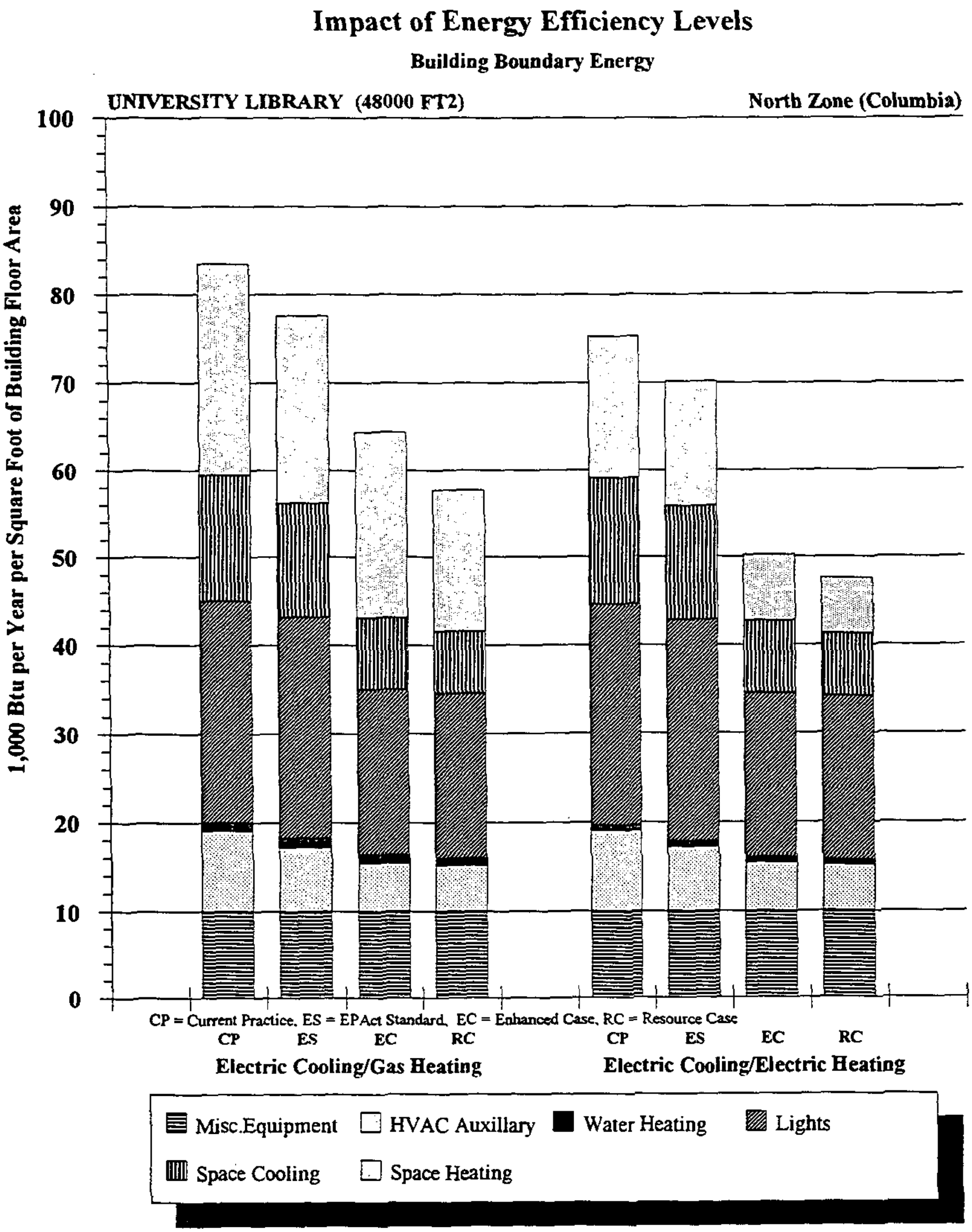


University Library



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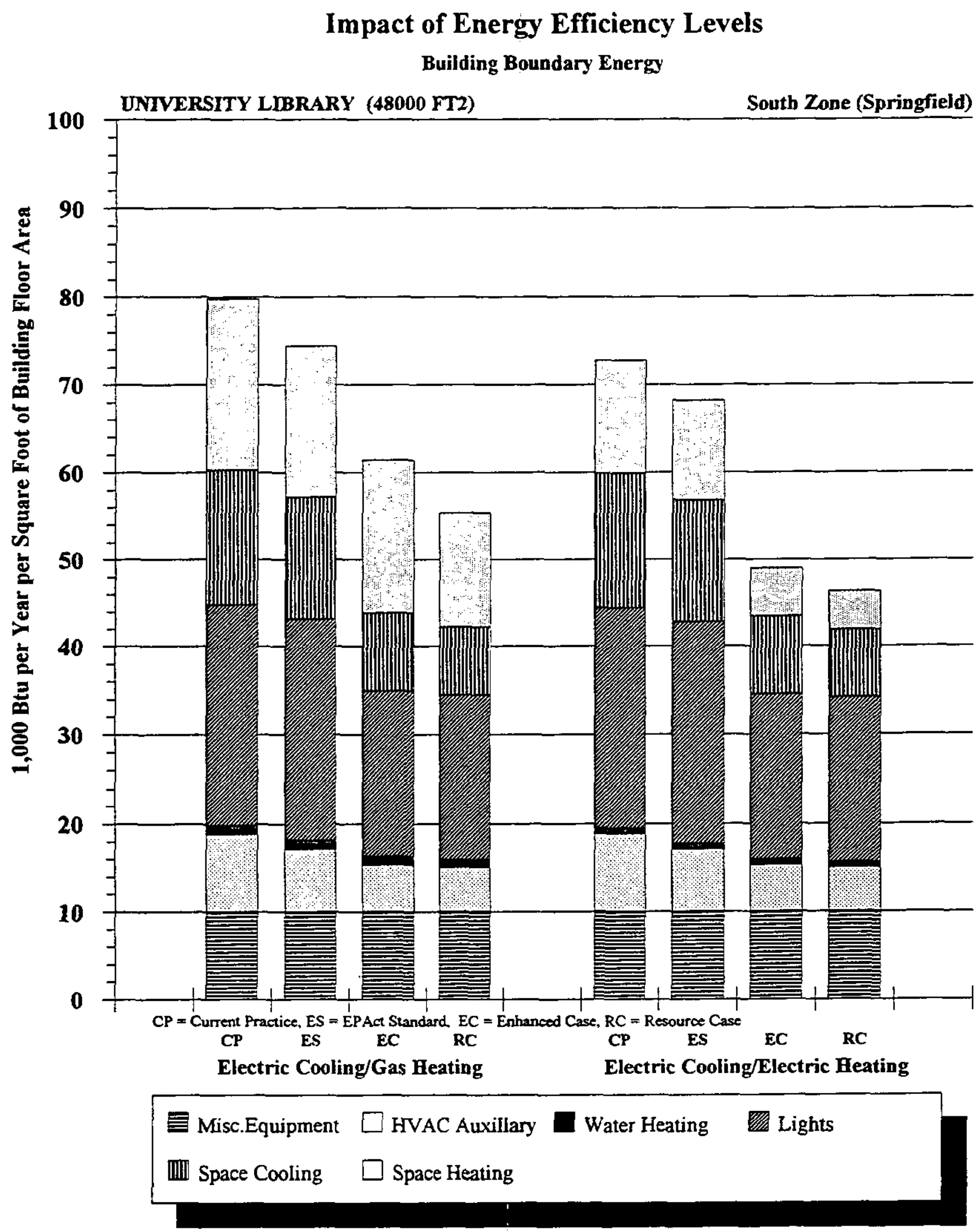

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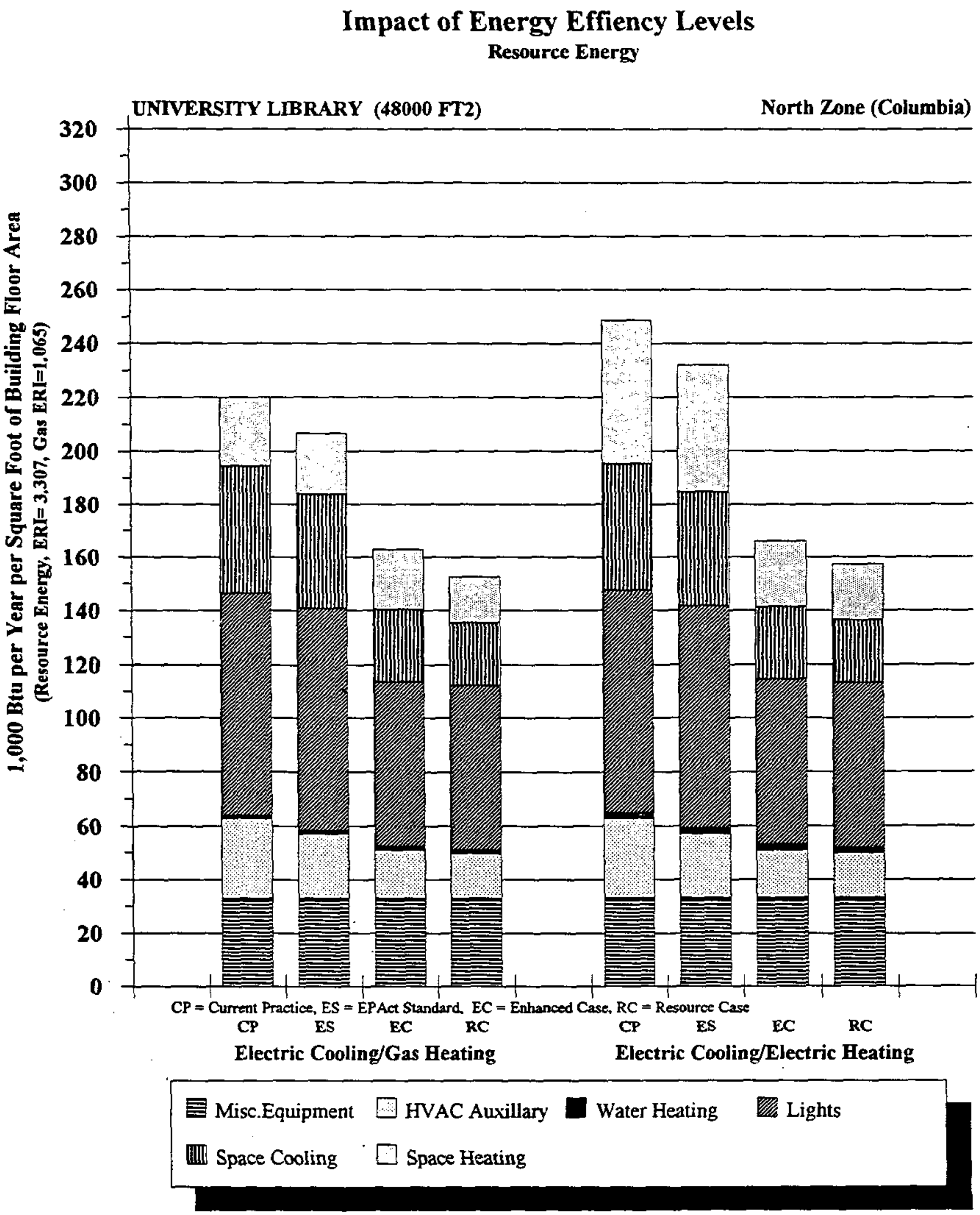

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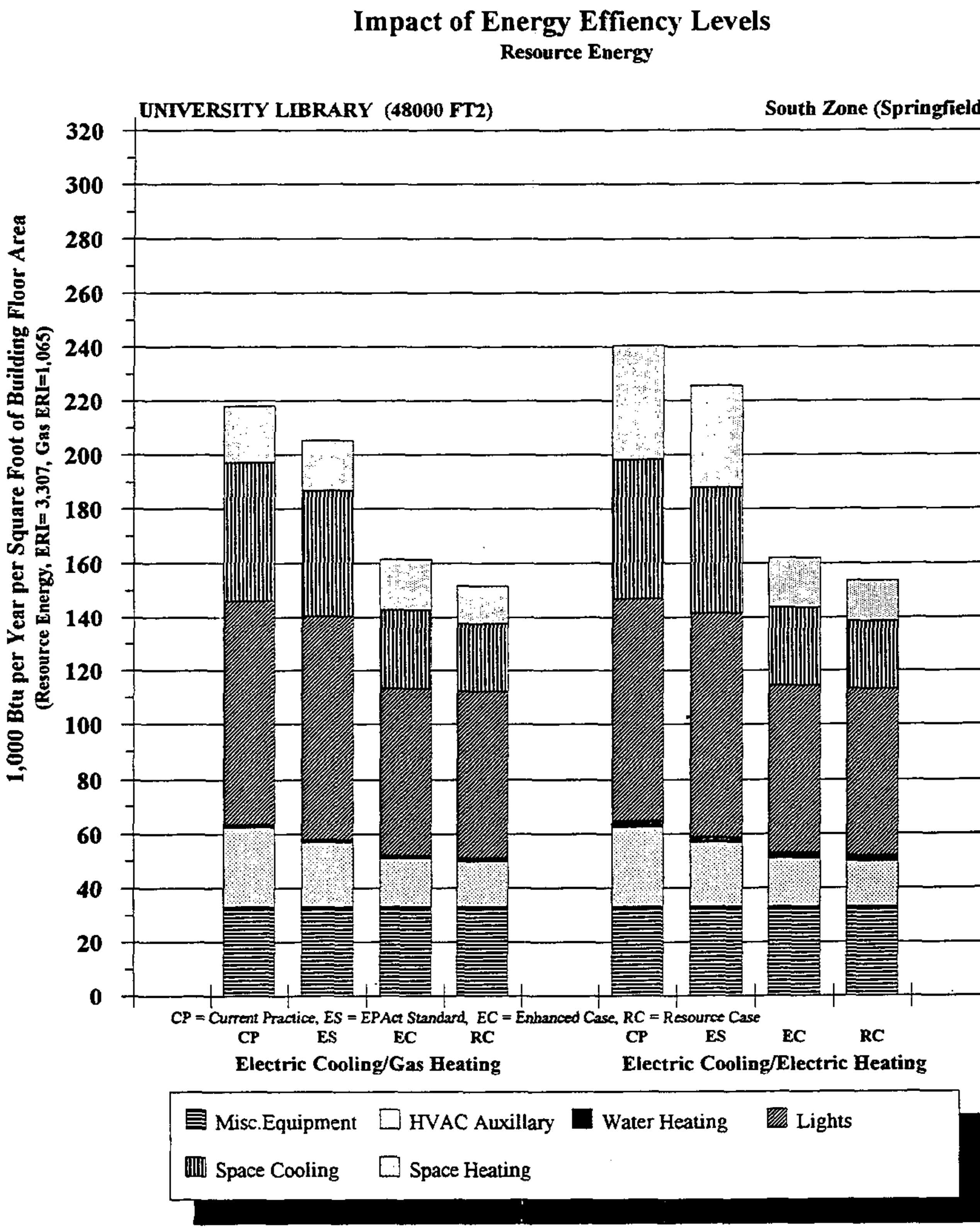

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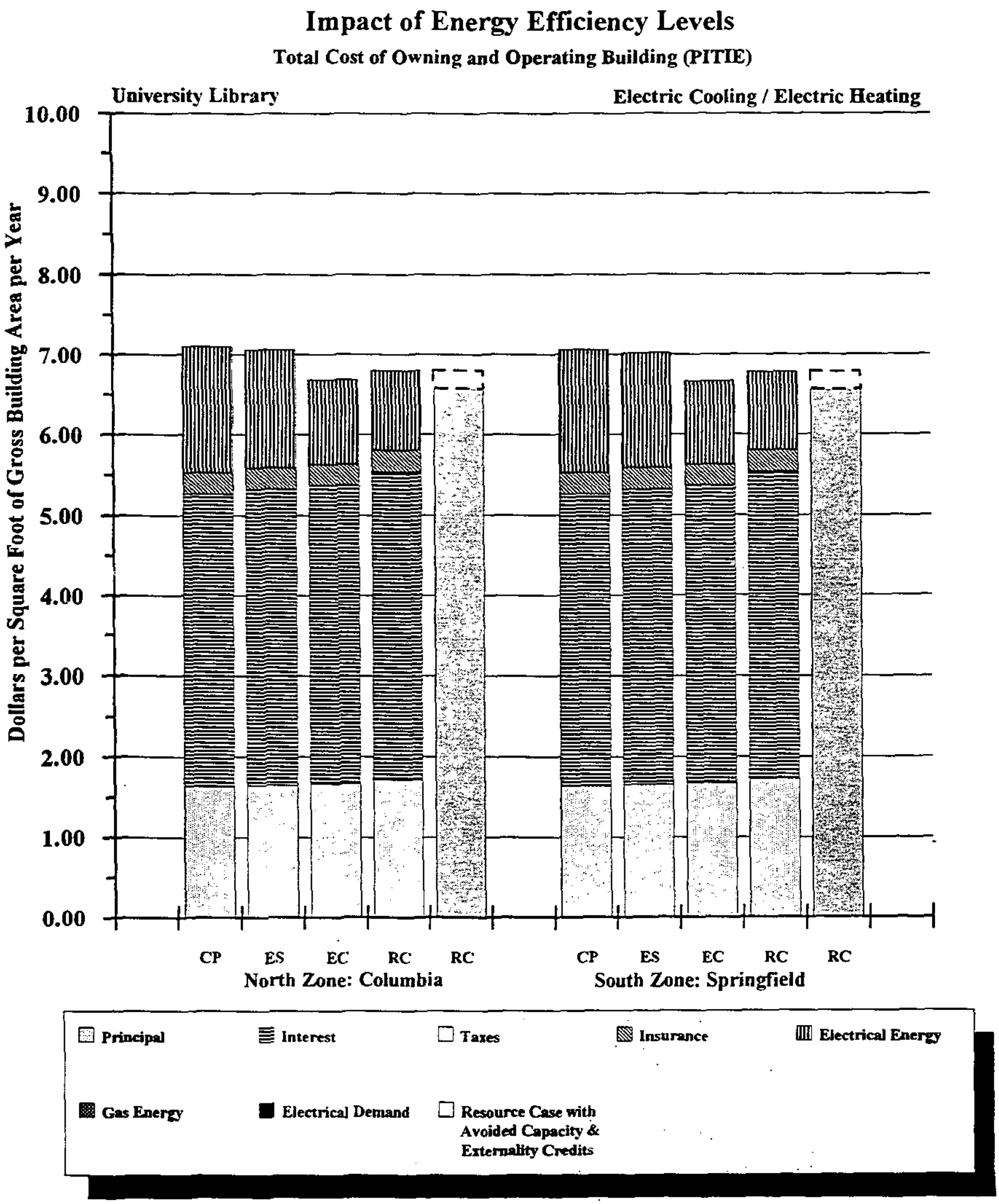

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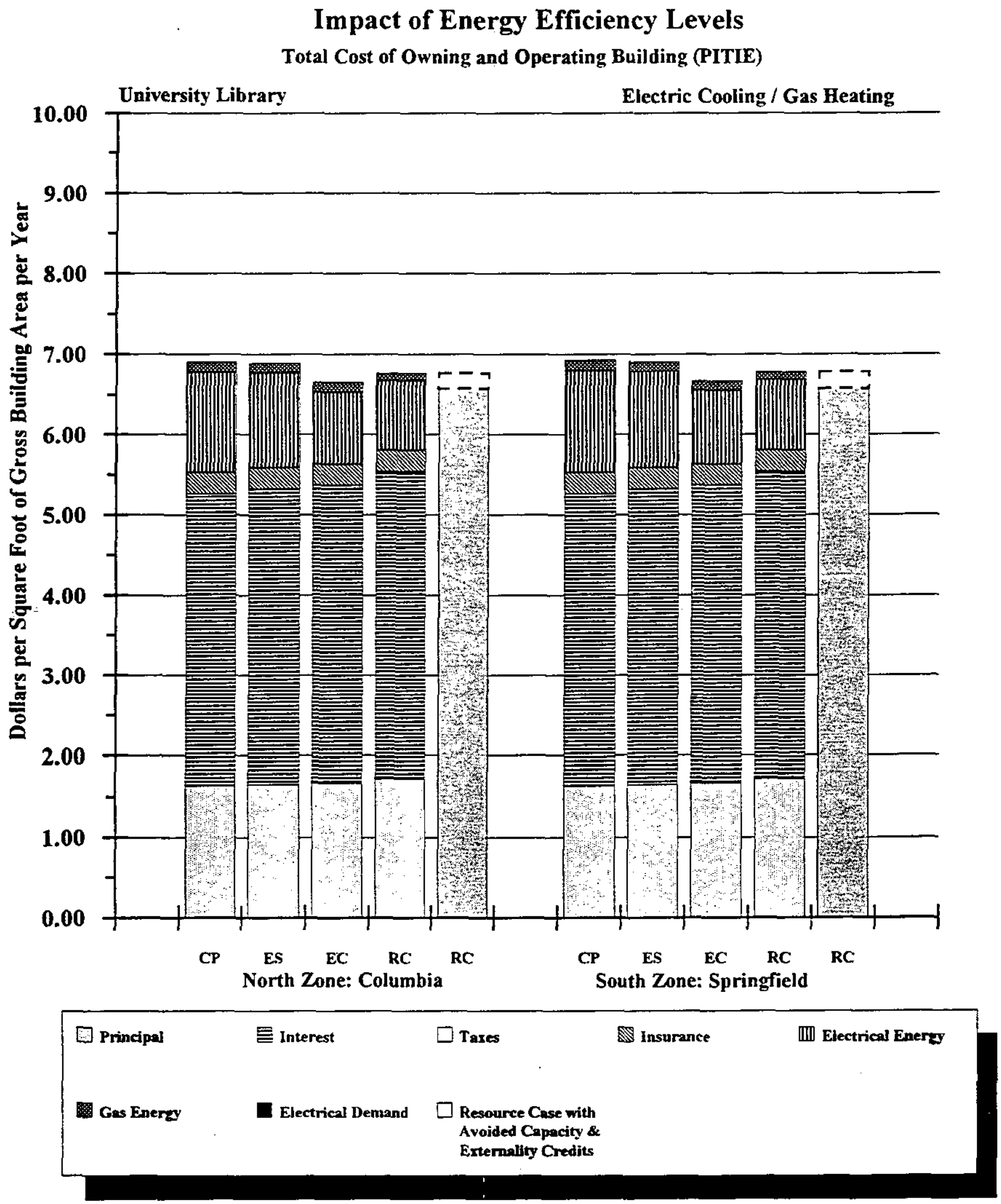

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