L. 92–463, 86 Stat. 770) requires that agencies publish these notices in the **Federal Register** to allow for public participation. This notice announces the meeting of the Biomass Research and Development Technical Advisory Committee

DATES: August 1, 2002.

TIME: 8:30 a.m.

ADDRESSES: Hilton Crystal City Hotel at National Airport, Crystal Room, 2399 Jefferson Davis Highway, Arlington, VA 22202.

FOR FURTHER INFORMATION CONTACT: Douglas E. Kaempf, Designated Federal Officer for the Committee, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585; (202) 586–7766.

SUPPLEMENTARY INFORMATION: *Purpose of Meeting:* To provide advice and guidance that promotes research and development leading to the production of biobased industrial products.

Tentative Agenda: Agenda will include discussions on the following:

- Full committee discussion on the development of a Vision document for federal biomass research and development programs.

Public Participation: In keeping with procedures, members of the public are welcome to observe the business of the Biomass Research and Development Technical Advisory Committee. To attend the meeting and/or to make oral statements regarding any of the items on the agenda, you should contact Douglas E. Kaempf at 202–586–7766 or *Bioenergy @ee.doe.gov* (email). You must make your request for an oral statement at least 5 business days before the meeting. Members of the public will be heard in the order in which they sign up at the beginning of the meeting. Reasonable provision will be made to include the scheduled oral statements on the agenda. The Chair of the Committee will make every effort to hear the views of all interested parties. If you would like to file a written statement with the Committee, you may do so either before or after the meeting. The Chair will conduct the meeting to facilitate the orderly conduct of business.

Minutes: The minutes of the meeting will be available for public review and copying within 60 days at the Freedom of Information Public Reading Room; Room 1E–190; Forrestal Building; 1000 Independence Avenue, SW, Washington, DC, between 9 a.m. and 4 p.m., Monday through Friday, except Federal holidays.

Issued at Washington, DC on July 9, 2002.

Rachel M. Samuel,

Deputy Advisory Committee Management Officer.

[FR Doc. 02–17636 Filed 7–12–02; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Office of Energy Efficiency and Renewable Energy

[Docket No. EE–DET–02–001]

Building Energy Standards Program: Determination Regarding Energy Efficiency Improvements in the Energy Standard for Buildings, Except Low-Rise Residential Buildings, ASHRAE/IESNA Standard 90.1–1999.

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy (DOE).

ACTION: Notice.

SUMMARY: The Department of Energy (DOE or Department) today determines that the 1999 edition of the *Energy Standard for Buildings, Except Low-Rise Residential Buildings,* American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Illuminating Engineering Society of North America (IESNA) Standard 90.1–1999, (Standard 90.1–1999 or the 1999 edition) would achieve greater energy efficiency in buildings, except low-rise residential buildings, than the 1989 edition (Standard 90.1–1989 or the 1989 edition). As a result of this positive determination regarding Standard 90.1–1999, each State is required to certify that it has reviewed and updated the provisions of its commercial building code regarding energy efficiency to meet or exceed Standard 90.1–1999 for any ''building'' within the meaning of Section 303(2) of the Energy Conservation and Production Act, as amended. This Notice provides guidance to States on Certifications, and Requests for Extensions of Deadlines for Certification Statements.

DATES: Certifications and Requests for Extensions of Deadlines, with regard to Standard 90.1–1999, are due at DOE on or before July 15, 2004.

ADDRESSES: Certifications, or Requests for Extensions of Deadlines should be directed to the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technology Assistance, EE–42, 1000 Independence Avenue, SW., Washington, DC. 20585–0121. Envelopes or packages should be labeled, ''State Certification of Commercial Building Codes Regarding Energy Efficiency.''

FOR FURTHER INFORMATION CONTACT: Jean J. Boulin, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Forrestal Building, Mail Station EE–2K, 1000 Independence Avenue, SW., Washington, DC 20585–0121, Phone: 202–586–9870, FAX: 202–586–1233.

SUPPLEMENTARY INFORMATION:

I. Introduction

A. Statutory Requirements

Title III of the Energy Conservation and Production Act (ECPA), establishes requirements for the Building Energy Efficiency Standards Program (42 U.S.C. 6831–6837).

ECPA provides that whenever the Standard 90.1–1989, or any successor to that code, is revised, the Secretary must make a determination, not later than 12 months after such revision, whether the revised code would improve energy efficiency in commercial buildings and must publish notice of such determination in the **Federal Register** (42 U.S.C. 6833 (b)(2)(A)). The Secretary may determine that the revision of Standard 90.1–1989, or any successor thereof, improves the level of energy efficiency in commercial buildings. If the Secretary makes a determination that the revised standard will improve energy efficiency in commercial buildings, then not later than two years after the date of the publication of such affirmative determination, each State is required to certify that it has reviewed and updated the provisions of its commercial building code regarding energy efficiency with respect to the revised or successor code for any ''building'' within the meaning of Section 303(2) of ECPA. The State must include in its certification a demonstration that the provisions of its commercial building code, regarding energy efficiency, meet or exceed the revised standard (in this case, Standard 90.1–1999) (42 U.S.C. 6833(b)(2)(B)(i)). If the Secretary makes a determination that the revised standard will not improve energy efficiency in commercial buildings, State commercial codes shall meet or exceed Standard 90.1–1989 or the last revised standard for which the Secretary has made a positive determination (42 U.S.C. 6833(b)(2)(B)(ii)).

ECPA also requires the Secretary to permit extensions of the deadlines for the State certification if a state can demonstrate that it has made a good faith effort to comply with the requirements of Section 304(b) and that it has made significant progress in doing so (42 U.S.C. 6833(c)).

B. Background

1. Publication of Standard 90.1–1999

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) and the Illuminating Engineering Society of North America (IESNA) approved the publication of the 1999 edition of *Energy Standard for Buildings Except Low-rise Residential Buildings*, in June 1999. Several appeals to this decision were heard and subsequently rejected and the 1999 edition was published in February 2000.

The Standard was developed under American National Standards Institute approved consensus standard procedures. The American Society of Heating Refrigerating and Air-Conditioning Engineers submitted the standard to the American National Standards Institute (ANSI) for designation as an approved ANSI standard. In December 2000, after several appeals by the American Gas Association, the 1999 edition of Standard 90.1 was approved as an American National Standard.

2. Workshop and Comments on Analysis Methodology

In arriving at a determination, the Department first reviewed all significant changes between the 1989 edition and the 1999 edition of Standard 90.1. Standard 90.1 is complex and covers a broad spectrum of the energy related components and systems in buildings ranging from simple storage buildings to complex hospitals and laboratories. The size of buildings addressed range from those smaller than single family homes to the largest buildings in the world. The approach to development of the standard changed from that used for the 1989 edition, as did the scope and the way components were defined. We concluded that a simple comparison of the two editions would not be possible. Therefore, we decided to hold a public workshop and seek public comment on our proposed analysis methodology. On February 8, 2000, we proposed a methodology, announced a public workshop, and sought public comment. 65 FR 6195. On February 17, 2000, we held a workshop to obtain comment on the approach we proposed to use. See the summary of the proposed approach in Appendix A.

We requested comments and/or data concerning issues relating to the comparative analysis of Standard 90.1–1989 and Standard 90.1–1999. We especially expressed interest in any comments or data regarding: (1) The seven building types selected for analysis; (2) the 11 representative climate locations proposed for the analysis; (3) the frequency of use of alternative paths to compliance in building standards (e.g., space-by-space versus whole building lighting power allowances); (4) new non-residential building construction data by state or census division and building type; (5) data to quantify the impact of Standard 90.1–1999 on additions and renovations to existing buildings; (6) the prevalence of the semi-heated building envelope subcategory in the building types proposed for analysis; and (7) specific comments on the preliminary energy savings analysis distributed in June 1999.

We received comments from American Electric Power, the American Gas Association, the Edison Electric Institute, GARD Analytics, Inc., the New Buildings Institute, and Virginia Power.

American Electric Power, the Edison Electric Institute, and Virginia Power recognized that, given the numerous assumptions required to simulate the potential impact of the new standard, reasonable minds could differ over both the specific model employed and over the assumptions used in those models. For that reason, they cautioned the Department against becoming involved in a lengthy process aimed at reconciling all approaches. They expressed belief in the results of the initial analysis that the 1999 edition would save energy across a broad section of commercial buildings. We recognized their cautions about the complexity of the problem and magnitude of alternative compliance approaches in the standard. However, we felt obligated to extend the analysis as far as feasible.

The New Buildings Institute supported the proposed methodology for the purpose of a simple yes/no determination but felt that the proposed methodology was inadequate for determining energy savings estimates associated with using Standard 90.1–1999. Here too, we recognized the difficulty of absolute quantification of savings, and make no such claim for the analysis on which this determination relies.

The American Gas Association argued that the Department should rely solely on quantitative estimates of energy savings as a means of comparing the two editions of Standard 90.1 and minimize the use of qualitative comparisons. We tend to agree with the previous comments from American Electric Power, the Edison Electric Institute, and Virginia Power, and the New Buildings Institute regarding the details of the analysis, and concluded that it was necessary to note changes that individually, or in net, result in increased energy efficiency, even where they could not be accurately quantified. We believe that States can use this information when upgrading their energy codes.

The American Gas Association also expressed a strong belief that the analysis should be based on the minimum requirements of each edition and not on typical design and construction practice. In the area of heating, ventilating and air-conditioning and water heating equipment, the American Gas Association expressed the opinion that the Department should include analysis of equipment market share impacts in its analysis. It also expressed the opinion that the analysis be based on consensus forecasts of commercial construction activity, rather than on existing building stock, and use these forecasts as the basis for energy consumption calculations. It was concerned that the Department select the correct version of the 1989 edition for the baseline and recommended that the baseline be the 1989 edition plus all addenda to that edition, up to the publication of the 1999 edition. Finally, the American Gas Association expressed the belief that the analysis must include a cost-effectiveness and economic justification review.

We agree that the analysis should be based on the minimum requirements of each standard but in assessing the impact of those requirements, we believe that assessment should be based on a realistic estimate of what is being built. We believe that we have done this in our analysis.

We do not believe it is necessary for the Department to perform a quantitative analysis of the likely effects of Standard 90.1–1999 on fuel and equipment market shares in order to support a conclusion regarding the likely net energy savings that would result. Without performing a quantitative analysis of the possible effects on fuel or equipment market shares, there are several reasons why the Department has concluded that these effects are likely to be insignificant. First, since Standard 90.1–1999 places the same requirements on buildings with different types of heating or cooling equipment (and this was also true of previous ASHRAE standards), the impacts of the standard on most building costs should be identical, regardless of the type of energy or equipment used. Second, if the comparative costs and market shares of equipment used in buildings covered by the ASHRAE standard are influenced by other administrative actions taken by the Department of Energy or other government agencies, any effects on fuel market shares that result from such other actions cannot properly be attributed to the ASHRAE standard that is the subject of today's determination. Finally the choice of fuels and equipment by new building designers, builders, and owners is affected by many factors, only a few of which are related to the comparative first costs of the equipment and building systems involved. In cases where comparative equipment and system costs are a significant factor in fuel choice, the small changes in these costs that might be attributable to the ASHRAE 90.1–1999 building standard are very unlikely to significantly affect market shares or the resulting energy savings.

We considered using what the American Gas Association referred to as consensus forecasts of commercial construction activity, rather than data on the existing building stock in our analyses. We concluded, however, that available forecasts are not really consensus forecasts. These latter forecasts are extremely short term in perspective, and reflect that the construction market is likely to remain volatile over the intermediate term. We have therefore used the new construction square footage data from 2001–2010, extracted from the Energy Information Administration's National Energy Modeling System, as the basis for our analysis.

Furthermore, AGA believes that each addendum should be treated as a revision to the standard, thus requiring DOE to issue a determination for each addendum pursuant to Section 304(b)(2) of ECPA, as amended, 42 U.S.C. 6834 (b)(2). AGA has also questioned the appropriateness of the baseline DOE used when comparing the revised ASHRAE Standard 90.1–1999 with its predecessor, ASHRAE Standard 90.1–1989, in order to determine whether the new ASHRAE Standard improves energy efficiency. AGA would have DOE use ASHRAE Standard 90.1–1989 with all of the addenda up until the publication of ASHRAE 90.1–1999 for the comparison.

Section 304(b)(2) of ECPA, as amended, which applies to commercial building code updates, requires that when the provisions of ASHRAE Standard 90.1–1989, or any successor standard, are revised, the Secretary shall, not later than 12 months after the date of such revision, publish a notice in the **Federal Register**, with its determination as to whether the revised standard will improve energy efficiency in commercial buildings. Once the Secretary issues a determination, States have two years, with possible extensions for good faith efforts, to comply with the certification requirements in Section 304(b)(2).

DOE interprets the language in Section 304(b)(2) to mean that when a comprehensive revision of the ASHRAE Standard is published, which in this case is ASHRAE Standard 90.1–1999, then that revised or successor standard triggers the Secretary's obligation to issue a determination as to whether the revised standard improves energy efficiency. This determination is made by comparing the revised or successor standard to the last predecessor standard.

While it is true that the addenda process is part of the ongoing maintenance of the standard and thus continually modifies the existing standard over time, it would be an unreasonable reading of the statute to categorize each addendum in this maintenance process as a ''revised or successor standard'' within the meaning of Section 304(b)(2), so as to require a determination by the Secretary. Such an interpretation of the statute would put an unreasonable burden both on the States and DOE. For the States, a determination by the Secretary requires some State action, and what is required depends upon whether the Secretary issues an affirmative or a negative determination. If the Secretary were required to issue a determination after each addendum was published, the States would be constantly required to change their codes. This would affect the stability and certainty of State commercial building codes. DOE believes that Congress could not have intended this result. Therefore, DOE concludes that the statute only requires a determination by the Secretary when there is a comprehensive revision to the standard.

With respect to the baseline for comparing the energy efficiency of revised ASHRAE Standard 90.1–1999 with its predecessor, ASHRAE Standard 90.1–1989, DOE's position is that the appropriate baseline is ASHRAE

Standard 90.1–1989 with addenda in effect at the time EPACT was enacted. Since this is the first determination for commercial building codes since ECPA was amended by EPACT on October 24, 1992, it is reasonable to interpret section 304(b)'s reference to ASHRAE Standard 90.1–1989 to include the addenda in effect on the date of enactment. DOE interprets the statute to require a comparison of that version of ASHRAE 90.1–1989 (and not any subsequent addenda) with ASHRAE Standard 90.1–1999. If DOE were to adopt the AGA position and include all of the intervening addenda to ASHRAE Standard 90.1–1989 up to the adoption of ASHRAE 90.1–1999 in the baseline, it would render DOE's determination almost meaningless. That is, if all of the post-enactment addenda to ASHRAE Standard 90.1–1989 were included in the baseline, the real energy efficiency improvements (assuming there are any) of the revised standard would be reflected in the baseline. A comparison of a revised standard and the previous standard (under such an interpretation) would always show little, if any, energy efficiency gains. That would defeat the statute's purpose of requiring DOE to compare the energy efficiency of revised standards (*i.e.,* comprehensive revisions of ASHRAE Standard 90.1–1989 or successor standards) with the prior or last standard.

AGA and the Natural Resources Defense Council argue that DOE has a statutory responsibility to determine whether the revised standard would improve energy efficiency in commercial buildings and also whether all new energy efficiency measures are technologically feasible and economically justified. (Letter dated April 12, 2000, from the American Gas Association and the Natural Resources Defense Council, signed by Charles H. Fritts and Katherine Kennedy, to Dan W. Reicher, Assistant Secretary Energy Efficiency and Renewable Energy) They contend that DOE is required to conduct cost-effectiveness and economic justification analyses as part of the process in making its determination concerning ASHRAE Standard 90.1–1999 pursuant to Section 304 of ECPA, as amended. These who commented believe that the statutory scheme, including Section 307, entitled ''Support for Voluntary Building Energy Codes,'' supports its argument.

The statutory language in Section 304(b) states that the Secretary is required to make a determination as to whether any successor standard to ASHRAE Standard 90.1–1989 will improve energy efficiency. The Secretary must publish a notice of this determination in the **Federal Register**. The language does not require that DOE perform an independent economic analysis as part of the determination process. As a matter of fact, Section 304(b) omits any reference to language concerning economic justification.

However, Congress was concerned that the technological feasibility and cost effectiveness of the Voluntary Building Energy Codes be considered. Section 307 clearly requires DOE to participate in the ASHRAE process and to assist in determining the cost effectiveness and technical feasibility of the ASHRAE standard. It also requires DOE to periodically review the economic basis of the voluntary building energy codes and participate in the industry process for review and modification, including seeking adoption of all technologically feasible and economically justified energy efficiency measures.

Unlike Section 307 which specifically includes language concerning economic justification, Section 304 omits any reference to economic justification. It is generally presumed that Congress acts intentionally and purposefully where it includes particular language in one section of a statute but omits it in another section. *See Bates* v. *United States,* 522 U.S. 23, 29–30 (1997). Accordingly, the statutory scheme cannot be read to require an economic analysis as part of the determination process in Section 304(b).

The fact that the Section 304 determination process does not require the Secretary to perform an economic analysis does not diminish the importance that the ASHRAE standards be technologically feasible and economically justified. However, it appears that Congress assumed that these concerns would be worked out by stakeholders, with DOE participating in the ASHRAE process itself. The language of Section 307 clearly delineates DOE as one participant in the process, not the ultimate decision maker of the ASHRAE standard or successor revisions.

Accordingly, for all of these reasons, DOE has determined that it is not required to perform an economic analysis as part of its determination process in Section 304 of ECPA, as amended.

A number of the GARD Analytics comments were incorporated into our analysis. They include: (1) Extending the aggregation to cover buildings with different window area fractions instead of doing a sensitivity analysis; (2) use of the Alternate Component Packages tables in the 1989 edition's envelope section, to make it easier to identify the criteria which should be used in modeling the 1989 edition's envelope criteria; and (3) eliminating estimates of equipment operating hours in weighting equipment efficiency. In addition, we estimated efficiency improvement for cooling equipment and incorporated estimates of both single and three phase unitary cooling equipment less than 65,000 Btu per hour, shipped to commercial buildings.

GARD Analytics suggested we use specific prototype buildings as it did in its analysis, instead of our scaling approach. It also urged us to select specific building sizes for analysis. We believe that by using a scaling approach, we can better assess the impact of building envelope changes. Scaling permits us to better account for the actual ratio of building wall area to floor area in a population of buildings, rather than assume some fraction of the building population has a single size and geometry and that those characteristics hold for all buildings in that fraction of the building population. The size selection of the prototype used for scaling is near the median square footage for most building categories. Using a building size that is close to the median helps ensure that the characterization of secondary effects, such as the transitional performance of the building under thermostat setback conditions, is captured in a manner that is reasonable for the majority of the building population.

GARD Analytics also commented on our use of a one-to-one aspect ratio (the ratio of length to width of a building) in the prototype. While we use an aspect ratio of one-to-one in the prototype simulation, to make the simulation orientation neutral, our scaling process does include typical aspect ratios for all building types to correctly determine the ratio of perimeter and core areas in the building population. GARD Analytics commented that the use of scaling does not allow the use of different lighting power densities for different building sizes, as are shown in the 1989 edition. In our approach the weighted average lighting power density over all Commercial Building Energy Consumption Survey building sizes was used as the basis of our simulation of the 1989 edition's requirements. This correctly characterizes the average lighting improvement over all building sizes.

GARD Analytics also had a number of comments on our proposed methodology. It suggested that selection of building types by baseline energy use was less correct than if it was done by square footage. We disagree. The purpose of selection by energy use, as opposed to square footage, is to select the building types that will be most significant in terms of national energy use. We believe that as the number of building types used is increased, the set of buildings types selected by either method will converge to the same set.

GARD Analytics also questioned elimination of the in-patient health care facilities category from our analysis and stated that available hospital models could be used. In-patient health care facilities are perceived to have high thermal loads and equipment loads within the health care category. Given the requirements of the 1999 edition, inclusion of this category would increase estimates of energy savings. However, we considered the relatively low ranking of in-patient health care buildings in terms of net energy use and the modest level of future in-patient health care new building growth. This reduced the importance of modeling this category. Finally, we did not have confidence in the representative nature of available in-patient healthcare models. We therefore chose not to simulate this building type separately in our analysis. We believe that not doing so resulted in a conservative estimate of the energy savings attributable to the 1999 edition.

GARD Analytics also commented that we should use the operating schedules and loads from the 1999 edition for the analysis. Our selected schedules are based on accurate measured data and we believe that they are at least as representative of typical buildings as those in the 1999 edition.

GARD Analytics commented on the use of supplemental lighting power allowances. We concluded that the most appropriate lighting power allowances for our quantitative comparison were the whole-building lighting requirements. We commented on the space-by-space requirements and the impact of the supplemental lighting power allowances in our detailed textual analysis.

GARD Analytics commented that we should use the maximum fan power allowances under both standards in our comparison. However, since the maximum fan power allowances are effectively the same in both standards, and are not believed representative of typical building design, we chose to use a more typical fan power usage and thus show a more realistic level of energy usage for buildings under both standards. Utilizing the maximum fan power would increase internal building loads, decrease heating loads and lower building balance temperature. The impact would be to increase absolute energy savings over the 1989 edition.

DOE2.1 and BLAST (Building Loads and System Thermodynamics) are both building energy analysis computer programs. GARD Analytics commented that DOE should use DOE2.1, instead of BLAST, as the basis of the energy simulations. They state that DOE2.1 is more commonly used by building designers and that further development of BLAST is being phased out. DOE disagrees with the comment since BLAST forms the basis of the Department's new, improved simulation tool, Energy Plus, and since DOE is actually phasing out support for DOE2.1.

GARD Analytics commented that we should use the most stringent compliance path on which to do our quantitative analysis. The Department considered this but selected the prescriptive compliance paths on which to base its quantitative analysis, since it is those paths for which specific requirements can be accurately identified for ''prototype'' buildings. Selecting representative requirements from the variable requirements in the other paths becomes highly speculative. We have addressed requirements from these other compliance paths in the detailed textual analysis.

GARD Analytics commented on the selection of climates and regional weighting for our analysis. It felt that DOE's strategy to select the cities (which represent sets of climate data) is suboptimal and ignores the real effect of the standard having different criteria in different climates. We have reviewed our selection of climates and methodology and believe it to be entirely representative and appropriate for this analysis. GARD Analytics also commented that it was unnecessary to use sub-census regions in our aggregation approach. However, we feel that the use of sub-census regions is necessary to correctly represent the variation in energy costs in the western U.S. We believe that it introduces no additional error in the remainder of the analysis.

GARD Analytics made a number of comments that we should do more detailed analyses. Examples of further analysis suggested by GARD Analytics included: state by state comparisons of the standards, the development of lighting power usage using the space-by-space method, inclusion of room air conditioners in the development of the cooling equipment efficiencies, the use of below ground building spaces in the comparison, and the use of marginal energy costs. We reviewed these comments, but concluded that the limited data available for describing building populations and weighting the results of more simulations would not result in a more accurate conclusion to our analysis. A number of these comments are addressed in our detailed textual analysis.

3. Comments on Preliminary Quantitative and Textual Analyses

As a matter of policy to further the determination process, we sought further comments on the application of the methodology and the validity of preliminary conclusions posted on our web site. A summary of comments and responses on common topical issues, regarding the application of the methodology and the preliminary conclusions, follows below. For detailed responses to the comments received, see *Response to Comments on Preliminary Analyses Supporting DOE's Determination Regarding Standard 90.1–1999,* which is part of the administrative record for this Determination Notice. This document may be viewed at the DOE Freedom of Information Reading Room, U.S. Department of Energy, Forrestal Building, Room 1E–190, 1000 Independence Avenue S.W., Washington, D.C. 20585, (202) 586–3142, between the hours of 9:00 a.m. and 4:00 p.m., except Federal holidays, or a copy may be obtained from the Department from the contact person identified above.

We received 12 comments, two from design practitioners (G. Johnson and Kay), four from States or code officials (Lloyd, Weitz, Cowen, Hogan), one representing States in a region (Coakley), one jointly from the two professional societies sponsoring the consensus process that developed the Standard (Wolf and Timmings), one from a public interest group (Goldstein), one from an energy code consultant (J. Johnson), and two representing the gas industry (Ranfone and Hemphill). Two who commented (Johnson and Kay) did not comment on the analysis. One of those who did not comment on the analysis joined four others who commented that the Department was late in making its determination and that the delay was hampering the Region's or State's updating of its energy codes (G. Johnson, Lloyd, Coakley, and Weitz). Of the nine commenting on the analysis, seven felt the analysis was well done or reasonable and agreed with the results. (Lloyd, Cowen, Coakley, Weitz, Wolf and Timmings, Goldstein and J. Johnson). One who commented suggested a change and wanted some further analysis done (Hogan), and another who commented had 35 detailed comments (Hemphill).

Five complained about the amount of time it is taking the Department to make a determination (Johnson, Cowen, Coakley, Weitz, and Goldstein). They stated that the delay was adversely impacting States ability to update their energy codes and gain energy and greenhouse gas benefits.

Five commented that they interpreted the analyses to conclude that there would be a net positive increase in commercial building energy efficiency and agreed with the conclusion for a positive determination. (Coakley, Lloyd, Weitz, Wolf and Timmings, Goldstein, and J. Johnson). Three of these further commented that the analyses were reasonable. One (Weitz) expressed the opinion that this is an achievable standard and indicated that Massachusetts has already adopted a new construction energy code based on the 1999 edition. However, one (Ranfone) commented that DOE should not complete its determination, until such time as an analysis is done to determine whether all new energy efficiency measures are technologically feasible and economically justified, a comment DOE previously addressed above.

One (Hogan) commented, and we agree, that the building envelope criteria for the ''lodging'' category in our quantitative analysis should be taken from the ''residential'' column in the tables in Appendix B of the 1999 edition, rather than from the ''nonresidential'' category, since the only change was in the opaque envelope. We have revised the analysis accordingly.

Hogan also commented that the quantitative analysis should be expanded to include all energy used in buildings, including elevators, exterior lighting for entrances and facades, parking lighting, and parking ventilation, and be expanded to differentiate part-load operation between fan systems with and without variable frequency fans. Data on buildings and building component characteristics are insufficient to accurately include these in our analysis. However, each is addressed in the detailed textual analysis, except for elevators which are not addressed in either the 1989 or 1999 editions of Standard 90.1.

One who commented (Hemphill) submitted 35 detailed comments on our analyses. We agreed in whole or in some part with eleven of these comments and have accordingly made changes or clarifications to our textual analysis. These eleven include comments on: exterior lighting power, interior lighting power—space-by-space, envelope air leakage, floors over unconditioned spaces, opaque wall thermal transmittance, opaque doors, load calculations and sizing, off-hour controls and setbacks, simultaneous heating and cooling controls, air-conditioning equipment, and non-code language. In several cases, while we disagreed with comments, we further clarified our rationale, as noted below.

Six comments received had to do with differing interpretations of the standard. These included comments having to do with lighting power exemptions, lighting integral to equipment, transformers, transportation systems, energy management systems, and the energy cost budget compliance path. On review, we disagreed with the interpretations presented in the comment and made no change. For example, in the case of energy management systems, they are recommended not required, as implied in the comment, in buildings over 40,000 square feet in the 1989 edition. In the 1999 edition, energy management systems are not omitted but are addressed differently, under controls. In the case of the comment on the energy cost budget compliance path, we believe that both editions establish a baseline of requirements from the prescriptive compliance approach and require the energy cost of the design to be equivalent or less than the baseline. We therefore believe that in each edition the energy cost budget compliance path criteria are roughly equivalent to the prescriptive compliance path.

The comments of Hemphill, which related to transformers, transportation systems, and energy management systems, suggested that we might have missed some differences between the two editions of the standard. On inspection we found that we had missed some differences. Therefore we have added analysis that addresses the subdivision of electric power feeders and provisions for check metering of loads.

Eight comments received had to do with differing opinions on appropriate approaches to the textual analysis. These included comments on the subjective nature of the analysis of the envelope section, exit signs, the use of the prescriptive compliance path and not the performance paths in the analysis, our conclusions on the lighting power exemptions, window thermal transmittance and solar heat gain, temperature reset controls, and heating equipment. Four of these comments provide no suggestion of an alternative approach. We believe that our approach in the textual analysis provides useful information to states which will adopt the standard, even if the changes cannot be fully quantified. In the case of exit signs, and heating equipment, we did not agree that, where there were no criteria in the 1989 edition and there were criteria in the 1999 edition, we could not or should not project savings. No changes were made in response to these comments except for the comment on window thermal transmittance, where explanatory text was added to the textual analysis.

Six other comments were received with which we disagreed but which led us to adding explanatory text to the textual analysis. This was done in the analysis relative to speculative building envelopes, envelope thermal transmittance in cold climates, slab on grade and below grade wall insulation, roof thermal transmittance, temperature controls, and pipe and duct insulation. One of these, the comment on pipe and duct insulation appeared to be a misinterpretation of what we wrote. In addition, more analysis was done on the subject of roof thermal transmittance.

Five comments appear to have been a misinterpretation of our written analysis. These comments concerned parts of our whole building interior lighting power criteria, interior lighting controls and separate air distribution systems, radiant heating, and service water heating equipment. In the case of the comment on interior lighting controls, there are also opinions stated without support. Review of our explanations did not suggest any change.

One (Hemphill) argued that there was no difference in scope between the two editions. However, four others (Coakley, Weitz, Wolf and Timmings, and Goldstein) all recognized the expansion of the scope of the 1999 edition to renovations of existing buildings. We agree with the latter majority opinion including those representing the organizations sponsoring the two editions. We note that through the mid 1990s the American National Standards Institute recognized the ASHRAE Standard 100 series, that explicitly addressed existing buildings. Under American National Standards Institute policy, two standards (Standard 90.1–1989 and ASHRAE Standard 100) could not address existing buildings.

One (Hemphill) interpreted our analysis regarding increasing the scope of the 1999 edition to existing buildings to imply that the increased energy efficiency could approach 50 percent of the energy use reduction from new construction and expressed the opinion that there was absolutely no basis for this assertion, and that the implication was wholly inappropriate. Another

(Wolf and Timmings) commented on the subject that industry estimates indicate that at least 60 percent of heating and cooling equipment sales are for replacement markets, and only 40 percent for new buildings, but did not provide a source for this estimate. We continue to believe that it is difficult to quantify the energy efficiency impact of the change in scope to include existing buildings. We will not attempt to estimate the impact of this change. Today's determination does not address or rely on this difference.

C. Summary of the Comparative Analysis

We carried out both a broad quantitative analysis and a detailed textual analysis of the differences between the requirements and the stringencies in the 1989 and the 1999 editions.

1. Quantitative Analysis

The quantitative comparison of energy codes was done using whole-building energy simulations of buildings built to each standard. We simulated seven representative building types in 11 representative U.S. climates. Only differences between new building requirements were considered in this quantitative analysis. The simulations were based on a 15 zone building prototype used in previous DOE building research. The simulated Energy Use Intensities (EUI) for each zone were scaled to correctly reflect variations in building size and shapes for each representative building type. Energy use intensities developed for each representative building type were weighted by total national square footage of each representative building type to provide an estimate of the difference between the national energy use in buildings constructed to both editions. A more detailed explanation is located in Appendix B to this notice.

The quantitative analysis of the energy consumption of buildings built to the 1999 edition, compared with buildings built to the 1989 edition for new buildings, indicates national source energy savings of approximately 6.4 percent of commercial building energy consumption. Site energy savings are estimated to be approximately 4.5 percent. These figures represent a conservative estimate of energy savings for new buildings.

2. Detailed Textual Analysis

We also performed a detailed analysis of the differences between the textual requirements and stringencies of the two editions of Standard 90.1 concerning the scope of the standard, the building envelope requirements, the building lighting and power requirements, and the building mechanical equipment requirements. The detailed textual analysis addresses a number of differences that, while very real, we could not accurately or reliably quantify because of lack of reliable information about the building stock and the incorporation of various components and equipment in various parts of the country. Therefore, the detailed textual analysis makes no attempt to quantify the differences between the 1989 and 1999 editions.

The emphasis of our detailed requirement and stringency analysis was on differences between the envelope, lighting, and mechanical sections of both editions of Standard 90.1.

The lighting requirements comparison focused on the impact the different lighting requirements have on lighting energy use, as well as on building loads. The comparison looked separately at the whole building and space-by-space lighting requirements in both standards in a variety of commercial building types, as well as examined the effect of any ''additional lighting power allowances.'' It also looked at controls.

The mechanical requirements comparison looked at equipment efficiency requirements and system design requirements. The system design requirements affect the system efficiency, system thermal load, and also had some direct energy impacts.

In comparing the envelope requirements, we made judgements of relative stringency and frequency of occurrence of components.

Each standard has multiple ways to demonstrate compliance. We did not perform a detailed comparison of the relative stringency of the alternate paths internal to a single standard or between standards. The large number of variables among the alternative compliance paths made such a comparison prohibitive to undertake. Further, we knew of no data on which to base the selection of representative requirements for such an analysis. Assignment of requirements would have been arbitrary. Rather we focused on the prescriptive compliance paths in each section, which we believe represent the most common approach to using the standard in question for most buildings.

D. Determination Statement

The Department's review and evaluation found that there are significant differences between the 1989 edition and the 1999 edition. Our overall conclusion is that the 1999 edition will improve the energy efficiency of commercial buildings, even though in certain limited instances stringencies for some requirements are reduced. However, we found a number of changes in textual requirements and stringencies that will decrease energy efficiency. Overall, we concluded the changes in textual requirements and stringencies are ''positive,'' in the sense that they will improve energy efficiency in commercial construction. Our quantitative analysis shows, nationally, new building efficiency should improve by about six percent, looking at source energy, and by about four percent, when considering site energy. DOE has therefore concluded that the 1999 edition should receive an affirmative determination under Section 304(b) of the Energy Conservation and Production Act for ''buildings'' within the meaning of Section 303(2).

II. Results of Quantitative Analysis

Tables 1 and 2 show the aggregated energy use and associated energy savings by building type for the seven categories analyzed and on an aggregated national basis for the 1989 and 1999 editions, respectively. See Appendix B for an explanation of the methodology we used. For each edition the building floor area weight is used to calculate the building energy or cost use intensity. The electric and gas building energy use intensity is presented for each type analyzed with electric predominating in all types. Site energy use intensities ranges from more than 137 thousand Btu per square foot annually for the Food building type to more than 18 thousand Btu per square foot annually for the Warehouse building type. Source energy use intensities have similar ranges as site energy ranges but vary in quantitative order from site energy intensities. (Lodging and Office rank 4th and 5th respectively for site energy, while for source energy their ranking is reversed, 5th and 4th respectively.). Building energy cost intensities are also presented.

TABLE 1.—ESTIMATED ENERGY USE INTENSITY BY BUILDING TYPE—1989 EDITION

Building type	Building type floor area weight	Whole building energy use intensity (kBtu/sf-yr or $/sf-yr)				
		Electric	Gas	Site EUI	Source EUI	$UI
Assembly	0.068	61.55	32.18	93.73	231.78	1.48
Education	0.218	35.65	18.86	54.50	134.47	0.87
Food	0.027	101.60	35.52	137.12	363.04	2.32
Lodging	0.079	42.80	17.61	60.41	155.88	1.00
Office	0.190	49.85	5.61	55.45	165.00	1.09
Retail	0.246	57.14	3.95	61.09	186.39	1.23
Warehouse	0.173	10.43	8.19	18.62	42.32	0.27
National	....	43.36	12.09	55.44	151.52	0.99

TABLE 2.—ESTIMATED ENERGY USE INTENSITY BY BUILDING TYPE—1999 EDITION

Building type	Building type floor area weight	Whole building energy use intensity (kBtu/sf-yr or $/sf-yr)				
		Electric	Gas	Site EUI	Source EUI	$UI
Assembly	0.068	55.71	33.88	89.59	215.04	1.37
Education	0.218	31.59	20.05	51.64	122.88	0.79
Food	0.027	102.78	34.91	137.69	366.12	2.35
Lodging	0.079	41.04	15.94	56.98	148.41	0.95
Office	0.190	44.56	6.32	50.88	148.95	0.98
Retail	0.246	48.14	5.17	53.31	159.08	1.05
Warehouse	0.173	17.91	9.11	27.02	67.15	0.43
National	....	40.04	12.91	52.95	141.88	0.92

Table 3 presents the estimated percent energy savings between the 1989 and 1999 editions. Overall, considering those differences that can be reasonably quantified, the 1999 edition will increase the energy efficiency of commercial buildings. However, this is not true for new buildings of all building types. In the case of the Food Service and the Warehouse building categories, the 1999 edition will allow increased energy usage. This is primarily due to an increased lighting power allowance for these building categories under the 1999 edition. Numbers in Table 3 represent percent energy savings. Thus, negative numbers represent increased energy use.

TABLE 3.—ESTIMATED PERCENT ENERGY SAVINGS WITH 1999 EDITION—BY BUILDING TYPE

Building type	Building type floor area weight	Percent reduction in whole building energy use intensity				
		Electric	Gas	Site EUI	Source EUI	$UI
Assembly	0.068	9.5	−5.3	4.4	7.2	7.5
Education	0.218	11.4	−6.3	5.2	8.6	9.0
Food	0.027	−1.2	1.7	−0.4	−0.8	−0.9
Lodging	0.079	4.1	9.5	5.7	4.8	4.7
Office	0.190	10.6	−12.7	8.2	9.7	9.8
Retail	0.246	15.7	−30.7	12.7	14.7	14.9
Warehouse	0.173	−71.6	−11.3	−45.1	−58.7	−59.7
National	1.000	7.6	−6.8	4.5	6.4	6.6

A comparison of energy savings by building type for each of the different standard scenarios modeled is shown in Table 4, to give an idea of where most of the savings or increases derive. For example, we estimate a slight percentage increase in energy use intensity indicated in the ‘‘1989 edition with 1999 edition envelope requirements’’ row, indicated by the negative savings. Similarly there is an estimated percentage increase in gas energy use intensity indicated in the ‘‘Gas EUI’’ column, also indicated by negative savings. Conversely, other rows indicate estimated percentage reduction in energy use intensity for lighting and mechanical requirements.

TABLE 4.—PERCENT ENERGY SAVINGS FROM 1989 EDITION

[National figures, all building types]

Standard scenario	Electric EUI	Gas EUI	Site EUI	Source EUI	$UI
1989 edition	0	0	0	0	0
1989 edition with 1999 edition envelope requirements	−0.1	−4.3	−0.9	−0.3	−0.3
1989 edition with 1999 edition lighting requirements	5.9	−8.3	2.8	4.6	4.9
1989 edition with 1999 edition lighting and envelope requirements	6.0	−10.1	2.5	4.6	4.8

TABLE 4.—PERCENT ENERGY SAVINGS FROM 1989 EDITION—Continued

[National figures, all building types]

Standard scenario	Electric EUI	Gas EUI	Site EUI	Source EUI	$UI
1989 edition with 1999 edition mechanical requirements	2.2	3.0	2.4	2.3	2.2
1999 edition compliant buildings	7.6	−6.8	4.5	6.4	6.6

III. Discussion of Detailed Textual Analysis

The 1999 edition is written in code language and as a result excludes some of the guidance provided in the 1989 edition. Although the guidance in the 1989 edition is not enforceable, it provided designers with suggestions for implementing energy efficient solutions. However, the guidance in the 1989 edition made it difficult for designers and code officials to quickly identify the relevant criteria.

A. Lighting and Power

1. Interior Lighting Power Exemptions

The 1989 edition entirely exempts a number of lighting categories such as display or accent lighting for galleries, and lighting in spaces designed for the visually impaired. In doing so, it also exempts controls for those lights. While the 1999 edition exempts the lighting power requirements, it retains requirements for controls in the exempted areas. Lighting for outdoor manufacturing, commercial greenhouses, and process facilities; and special lighting for research are exempt in the 1989 edition but not in the 1999 edition. These differences can be expected to result in some reduction in lighting power use as a result of the additional coverage in the 1999 edition. Conversely, there are a number of narrowly targeted exemptions in the 1999 edition that are not in the 1989 edition. These include: lighting integral to equipment installed by its manufacturer; lighting integral to open and glass enclosed refrigerator and freezer cases; lighting integral to food warming and preparation equipment; lighting in interior spaces that have been designated as a registered interior historic landmark; exit signs; lighting that is for sale or lighting educational demonstration systems; and casino gaming areas. The first three of these are not generally controlled by the 1989 edition because they are rarely known at the time the lighting plans are approved. While portions of gaming areas are often considered entertainment areas and exempt, the broader 1999 edition exemption can be expected to increase energy use in casinos. Lighting for landmark interiors might also increase in some cases. The net effect of these differences in exempted spaces is expected to be a small increase in efficiency in the 1999 edition.

2. Exterior Lighting Power

The 1989 edition prescribes maximum installed lighting power (Watts/square foot or Watts/ linear foot) for exterior building and grounds areas that, when added together, become the allowed exterior wattage. The 1999 edition sets similar criteria for exits, entrances and surface areas or facades, but also adds an efficacy requirement of 60 lumens per Watt in luminaries of more than 100 Watts. There is a three Watts per lineal foot increase in allowable wattage for entrances without canopies in the 1999 edition. However, there is a decrease in allowable wattage for all exits (five Watts per lineal foot), and for high traffic canopied entrances (seven Watts per square foot), and for light traffic canopied entrances (one Watt per square foot). The net impact is unknown as data on the number of building entrances and exits and their characteristics are not known.

For loading areas, loading doors, storage and non-manufacturing work areas, and driveways, walkways, and parking lots, the 1999 edition deviates from the 1989 edition by eliminating any Watts/square foot or Watts/linear foot maximums and instead sets an efficacy requirement of 60 lumens per Watt (more than 100 Watts per luminaire). This requirement in the 1999 edition eliminates the use of low efficiency technologies, such as incandescent lamps, and allows the economics of fixture and energy cost to restrict the exterior lighting use to the minimum needed. We are aware of no data on which to make a judgement as to net decrease or increase in energy use from this change.

3. Lighting Controls—Interior

The 1989 edition requires control points for each task or group of tasks within a 450 square foot area. It ''counts'' control ''points'' (one for manual, two for occupancy sensors, etc.) to show compliance with this requirement, giving credit to automatic controls versus manual ones. It further sets a minimum of one control for each 1,500 Watts of lighting. In place of this task control requirement, the 1999 edition requires all buildings more than 5,000 square feet in size to have automatic lighting shutoff in all spaces using time of day, occupancy sensor or similar methods. Buildings more than 5,000 square feet make up approximately half the number of commercial buildings built and more than 89 percent of the floor area constructed. This should save energy in these buildings during unoccupied hours. Where occupant sensors are used to comply with the requirement, the savings should be greatest, since this will shut off lights in unoccupied individual spaces, even during regular business hours.

The 1999 edition adds control requirements for six specific lighting functions: all task lighting, hotel/motel guest rooms, display/accent lighting, case lighting, nonvisual (plant growth, food warming), and demonstration (for sale or for lighting demonstration). Furthermore, the 1999 edition requires that spaces up to 10,000 square feet in size have at least one control per 2,500 square feet and that larger spaces have one control per 10,000 square feet. In buildings with large open areas with multiple task areas lit by general lighting, the 1989 edition would require more (total manual or automatic) switching than the 1999 edition. The 1999 edition instead reduces lighting use in unoccupied spaces with automatic controls that do not require human intervention. The 1999 automatic control requirements are more likely to reduce lighting energy use in these spaces, than the manual controls permitted in the 1989 edition.

The 1989 edition provides lighting control credits for use in calculating interior lighting power densities to encourage the use of automatic controls. For each area or group of lights that are controlled by an occupancy sensor, lumen maintenance sensor, daylight sensor, or combination of sensors, the design connected lighting power value, used in showing compliance, can be reduced from 10 percent to 40 percent, depending on the controls used. This allows more lighting power to be used in the space in exchange for the use of an automatic lighting control. The 1999 edition requires the use of automatic controls without allowing an increase in connected power.

The 1989 edition requires permanently wired lighting fixtures and switched receptacles in hotel suites of rooms to be controlled at the entrance to each room. The 1999 edition further requires this control to be at the entrance of the entire suite area. The 1999 edition should save energy by making it easier to turn off all the lights on the way out.

4. Ballast Efficacy Factor

The 1989 edition includes a minimum ballast efficacy factor. The 1999 edition does not. However, new ballast manufacturing standards, required under the Energy Policy and Conservation Act, serve the same purpose and no longer make it necessary to include such criteria in the 1999 edition. There will be no change in energy use as a result of this difference.

5. Exit Signs

The 1999 edition includes an additional section specifying a minimum efficiency (35 lumens per Watt) for all exit signs operating at greater than 20 Watts that is intended to eliminate the use of standard incandescent lamps in exit signs. This will essentially eliminate the use of incandescent exit signs thereby reducing energy consumption.

6. Interior Lighting Power—Whole Building

The 1999 edition provides greater clarity in specifying the calculation of luminaire or lighting system wattage that covers self ballasted, remote ballasted, track lighting systems and other miscellaneous lighting. This could eliminate some underestimation of installed lighting power. For example, it is common for a fluorescent lighting fixture to be described by builders (with respect to power consumption) as the simple sum of the lamp wattages while ignoring ballast energy use.

The 1989 edition presents a set of whole building lighting power density requirements for 11 building types in six different building size ranges (0–2,000; 2,001–10,000; 10,001–25,000; 25,001–50,000; 50,001–250,000; and greater than 250,001 square feet). The 1999 edition presents a single set of whole building lighting power density requirements for 31 building types without building size variation. For four of the building types, where there is a reasonable match between 1989 and 1999 editions, the 1999 allowance is higher by 0.06 to 0.64 Watts per square foot. Seven other matched building types show the 1989 edition having lighting power allowances 0.20 to 0.80 Watts per square foot higher than in the 1999 edition. Considering all eleven matched building types, there is an average reduction of 0.11 Watts per square foot with the 1999 edition. Within the two building types representing the largest percentage of building floor area in the commercial sector (office and retail) the reductions with the 1999 edition are 0.40 Watts per square foot for office and 0.60 Watts per square foot for retail buildings. Because there is an average reduction of lighting power densities from the 1989 edition to the 1999 edition in all matching building types, and also a reduction in the lighting power densities allowed in the two largest building types (office and retail), the overall effect of the whole building lighting power density requirements in the 1999 edition will be to provide increased energy efficiency in most building types. However, it should be noted that there is an increase in the lighting power allowance for warehouse and storage type buildings which are significant in terms of total commercial building area. We expect a net reduction in energy use, with the whole building requirements. (See also the quantitative analysis of lighting requirements, Table 4.)

7. Interior Lighting Power—Space-By-Space

Both the 1989 and 1999 editions present individual building space lighting power allowance values for use in applying a space-by-space compliance method where individual space lighting power is aggregated to arrive at a building total power allowance. The 1989 edition's tabulated space-by-space allowances are used in the compliance process only after they have been adjusted by an Area Factor (AF) ranging from 1.0 to 1.8. This factor is used to increase the allowed lighting power when the shape of the room (the size and height) necessitates the use of additional lighting power to achieve certain levels of illuminance. The area factor that can be used to calculate some space type allowances is limited. For example, the allowance for sports playing areas, corridors, open offices, and mechanical rooms cannot be modified by an area factor, while the allowance for enclosed offices can be modified by an area factor of up to 1.55. Spaces that are used for multiple functions, such as auditoriums, conference, banquet, and meeting rooms, are allowed an additional lighting power adjustment factor of 1.5. By contrast, this adjustment for room dimensions is already built into the 1999 edition's space lighting power values, so adjustments for space dimensions are not permitted. The 1999 edition does allow some additional lighting power allowances to accommodate specific lighting needs. These include additional power for decorative lighting (1.0 Watt per square foot), additional power for VDT terminal lighting (0.35 Watts per square foot), and additional power for retail display lighting. In the latter case, either 1.6 Watts per square foot of specific display area is allowed for general merchandise highlighting, or 3.9 Watts per square foot of specific display area is allowed for valuable merchandise highlighting. This additional power is only allowed if the specified luminaries are installed and can only be used for the specific purpose noted.

It is difficult to assess the actual impact from the use of the 1999 edition's space-by-space method versus the 1989 edition's. This is because the allowed power density for a building will depend greatly on the space makeup of the building, the individual room dimensions (affecting the area factor adjustment) and any additional allowances that may apply. However, the average of all matching 1989 and 1999 edition power density space values shows a 0.36 Watts per square foot decrease in the 1999 edition's values from those in the 1989 edition. Identical room geometry configurations (based on those used in the development of the 1999 edition's lighting power densities) were taken into account in reaching this conclusion. Furthermore, it is important to consider the items in both editions that can modify these lighting allowances. For example, the 1989 edition would allow the use of a 1.5 additional lighting power adjustment factor for multipurpose spaces, such as ''Auditorium,'' ''Conference/Meeting Room,'' and ''Banquet/Multi-Purpose Space.'' Whereas the 1999 edition would be even more energy efficient because there is no such area factor adjustment.

Determining the impact of the additional power allowances in the 1999 edition is difficult, since any comparison with values in the 1989 edition uses either example buildings or lighting models. Using either example buildings or lighting models requires many assumptions regarding what is ''typical '' in each type of space and how each space is used. For example, in the 1989 edition, the base lighting power density for a mass merchandise store in a warehouse type setting is 3.3 Watts per square foot. With the application of an appropriate area factor (1.05), the 1989 edition's adjusted power allowance is 3.46 Watts per square foot. The 1999 edition starts with a base lighting power density for all retail establishments of 2.1 Watts per square foot. The 1999 edition allows additional lighting power for certain lighting activities including retail sales lighting. These come in the form of an additional 1.6 Watts per square foot of lighted area for merchandise highlighting and 3.9 Watts per square foot of specific fine merchandise display. The application of these allowances will depend on the layout of the retail space and how and at what height lighting is employed. This is similar to how the area factor in the 1989 edition depends on the geometry of the individual space.

Office space lighting has a similar difference between the two editions. The 1999 edition offers an additional power allowance for visual display terminal lighting. Spaces with decorative lighting similarly are allowed extra power only for the decorative lighting used. No such allowances are included in the 1989 edition's values.

To make some assessment of the possible impact of these additional allowances, we developed characteristics of a space under the 1999 edition whose total space lighting power allowance would match that of the 1989 edition. For this comparison, we determined what additional lighting power allowances would need to be applied to the 1999 edition's base value to match the 1989 edition's value. This comparison allows for a determination of any stringency associated with the use of the low base numbers in the 1999 standard. In some of these cases a range of power values represents the possible variation in calculated values using the 1989 standard. The 1999 standard allows for only one base value. Table 5 presents comparisons for a variety of representative cases.

TABLE 5.—ADDITIONAL LIGHTING POWER ALLOWANCE IN THE 1999 EDITION NEEDED TO MATCH THE 1989 EDITION LIGHTING POWER ALLOWANCE

Space type [Additional lighting type]	1989 edition adjusted total power	1999 edition base power	Possible scenarios of use of additional power in 1999 to equal 1989 edition value
Hotel Lobby [Decorative]	2.51	1.7	Permits 20 percent of the entire space to have decorative lighting.
Office—enclosed [Visual Display Terminal].	2.38	1.5	Cannot reach the1989 edition's value (Max 1999 value = 1.85).
Office—open [Visual Display Terminal].	2.51	1.3	Cannot reach the 1989 edition's value (Max 1999 value = 1.65).
Jewelry Retail [Highlight Merchandise].	5.88 to 7.40	2.1	In most cases, one cannot reach the 1989 edition's value (Max 1999 value = 6.00). Need to have 97 percent of the entire space covered with spotlighted fine merchandise displays, to reach the 1989 edition's lower value.
Fine Merchandise Retail [Highlight Merchandise].	3.36 to 4.23	2.1	Need to have between 32 and 55 percent of space dedicated to spotlighted fine merchandise displays—or, more than 78 percent of the space dedicated to spotlighted general displays, to reach the 1989 edition's value.
Mass Merchandise (big box) Retail [Highlight Merchandise].	3.30	2.1	75 percent of space dedicated to spotlighted general displays—OR—30 percent of space dedicated to spotlighted fine merchandise displays, to reach the 1989 edition's values.
Department Store Retail [Highlight Merchandise].	3.10 to 4.10	2.1	Need to have between 26 and 51 percent of space dedicated to spotlighted fine merchandise displays, or over 62 percent of the space dedicated to spotlighted general displays, to reach the 1989 edition's values.
Food and Misc. Retail [Highlight Merchandise].	2.80	2.1	Need to have 43 percent of space dedicated to spotlighted general displays, to reach the 1989 edition's values.
Service Retail [Highlight Merchandise].	2.84 to 3.57	1.05 to 1.32	Need to have between 46 and 92 percent of the entire space dedicated to spotlighted general displays, to reach the 1989 edition's values.
Mall Concourse [Highlight Merchandise].	1.40 to 1.85	1.8	The 1999 value is within or close to possible 1989 values.

In the case of the hotel lobby it would be possible to use the decorative lighting power credit in 20 percent of the entire space without exceeding the requirements of the 1989 edition, which is quite reasonable. However, in the case of the mall concourse example, no additional lighting power allowance is required for the 1999 edition lighting power allowance to equal or exceed the 1989 edition value. By contrast, the enclosed and open office examples show that the 1989 edition lighting value cannot be achieved, even with the maximum allowance possible applied.

In the case of Jewelry stores, in most cases one cannot reach the 1989 value. Where one can reach the 1989 value, it would require an unreasonable 97 percent of the entire sales area to be covered with fine merchandise displays, in order to meet the 1989 value. In the Mass Merchandising, Food and Miscellaneous Retail and Service Retail categories, the additional areas of highlighted merchandise required to match the 1989 values are excessive and generally unrealistic. In the remaining two examples (fine Merchandise and Department Store) the 1989 edition lighting values can be achieved with additional lighting power scenarios that are generally reasonable for some of the spaces, but only where low room cavity ratio values occur. Overall, these results indicate that the 1999 edition lighting values are more stringent, with the additional lighting power allowances more than compensated for by the reduction in base lighting power in the 1999 edition.

8. End Use Metering

The 1989 edition had requirements for the subdivision of electrical power feeders by use category, to facilitate end-use metering in buildings with more than 250 kVA connected load. In addition it had provisions to check meter loads of individual tenants with more than 100 kVA of connected load. The removal of requirements for subdividing metering loads, in the 1999 edition, will make check metering and commissioning of these systems more difficult. In doing so, it will likely result in some increase in energy consumption.

9. Transformers

The 1989 edition suggested that building transformers be selected to optimize the combination of no-load, part-load, and full-load losses, and had a requirement that an annual operating cost calculation be done and added to the electrical design documentation for buildings with total building transformers more than 300 kVA. The requirement has been removed from the 1999 edition. However, the 1989 edition did not provide for a comparison over multiple possible system designs, that might have produced more efficient options. Thus, the removal of the requirement is unlikely to have a significant impact on building efficiency.

10. Motors

The 1989 edition had motor efficiency requirements for motors operating more than 500 hours per year. However, the efficiency levels included are less efficient than Federal manufacturing standards enacted in 1992 and thus have no impact on building efficiency.

B. Building Envelope

1. Air Leakage

The 1989 edition provides a series of air-leakage standards or requirements that individual components must meet. The 1999 edition replaces all these standards with a requirement to use the National Fenestration Rating Council's, *Procedure for Determining Fenestration Product Air Leakage,* NFRC 400, as the test procedure. Table 6 compares the air leakage requirements for envelope openings in the two editions. The number in the right-hand column indicates that the 1999 edition permits more air leakage and is therefore less stringent.

TABLE 6.— COMPARISON OF AIR LEAKAGE REQUIREMENTS IN THE 1989 AND 1999 EDITIONS.

Product	1989 edition	1999 edition	1989–1999 difference
Windows:	.		
Aluminum Framed, Operable	0.37 cfm/lon ft	0.4 cfm/ft^2	+0.03
Aluminum Framed, Jalousie	1.5 cfm/f2	0.4 cfm/ft^2	−1.10
Aluminum Framed, Fixed	0.15 cfm/ft^2	0.4 cfm/ft^2	+0.25
Vinyl Framed	0.06 cfm/ft^2	0.4 cfm/ft^2	+0.34
Wood Framed, Residential	0.37 cfm/ft^2	0.4 cfm/ft^2	+0.03
Wood Framed, Light Commercial	0.25 cfm/ft^2	0.4 cfm/ft^2	+0.15
Wood Framed, Heavy Commercial	0.15 cfm/ft^2	0.4 cfm/ft^2	+0.25
Skylights	0.05 cfm/ft^2	0.4 cfm/ft^2	+0.35
Doors:	.		
Aluminum Sliding	0.37 cfm/ft^2	0.4 cfm/ft^2	+0.03
Vinyl Sliding	0.37 cfm/ft^2	0.4 cfm/ft^2	+0.03
Wooden, Residential	0.34 cfm/ft^2	0.4 cfm/ft^2	+0.06
Wooden, Light Commercial	0.25 cfm/ft^2	0.4 cfm/ft^2	+0.15
Wooden, Heavy Commercial	0.10 cfm/ft^2	0.4 cfm/ft^2	+0.30
Commercial Entrance, glazed	1.25 cfm/ft^2	1.0 cfm/ft^2	−0.25
Commercial Entrance, opaque	1.25 cfm/f2	0.4 cfm/ft^2	−0.85
Residential Swinging	0.50 cfm/ft^2	0.4 cfm/ft^2	−0.10
Aluminum Wall Sections	0.06 cfm/ft^2	Not covered	+

The impact of these changes on energy efficiency is hard to evaluate. Air leakage requirements for windows are less stringent for six window types and more stringent in one window type in the 1999 edition. Skylight requirements are more stringent in the 1999 edition than in the 1989 edition. Doors are more stringent for three types and less stringent for five other types, in the 1999 edition. Jalousie windows are not a predominate window type in commercial construction, but there has been a significant increase in allowed leakage rate for other window types under the 1999 edition. Therefore, the overall impact in comparing the requirements for window air leakage is a reduction in stringency.

For doors, there are significant increased leakage rates for wooden doors and slight increased leakage for sliding doors. However for the categories of ''Commercial entrance doors'' and for ''All other commercial doors,'' there are expected to be significant reductions in allowed leakage. Because of the predominance of commercial steel doors in the latter category, we believe door air leakage requirements are more stringent in the 1999 edition.

The 1999 edition does include additional requirements for loading dock weather seals in colder climates (greater than 3,600 heating degree days, base 65 degrees Fahrenheit) and also a requirement for vestibules in commercial building entrance doors. Vestibules are not required in climates of less than 1,800 heating degree days, base 65 degrees Fahrenheit; in buildings of less than four stories; where doors open directly from a dwelling unit; where doors open directly from a space less than 3,000 square feet in area; in buildings entrances with revolving doors; and where doors are used primarily to facilitate vehicular movement or material handling and adjacent personnel doors. These requirements are not present in the1989 edition. The combination of the more stringent requirements for ''commercial'' doors and loading dock and vestibule requirements should improve energy efficiency in buildings where they are required.

We would expect there to be fewer doors than windows in most commercial buildings. We therefore expect an overall decrease in stringency due to air leakage under the 1999 edition.

2. Insulation Installation

The 1999 edition requires that insulation be installed in substantial contact with the inside surface of cavities. It also requires that lighting fixtures, heating, ventilating, and air-conditioning, and other equipment not be recessed in such a manner as to affect the insulation performance. Finally, the 1999 edition bans installation of insulation on suspended ceilings with removable ceiling panels. The 1989 edition does not address this subject at all. These 1999 edition insulation installation requirements are expected to save energy in commercial buildings.

3. Allowance for Speculative Buildings

Buildings constructed on speculation that they will be leased or occupied by as yet unknown occupants are referred to as ''speculative'' buildings in the 1999 edition. Speculative buildings are often designed and the envelope constructed prior to the final occupancy being known. Both the 1989 and 1999 editions cover this issue, albeit in somewhat different fashion. The 1989 edition sets the most stringent envelope requirements likely to be encountered to be installed in the building from the start, while the 1999 edition allows a less stringent envelope to be installed to accommodate a less demanding occupancy (such as a semi-heated warehouse), but then requires an upgrade to the envelope efficiency if the building use changes to a more demanding occupancy (such as office space). We believe that under the 1999 edition the transition from a semi-heated space (such as the conversion of a warehouse heated for freeze protection only to a conditioned space for other use such as office) would entail the addition of heating capacity, and likely cooling capacity in most climates. Similarly, changes in lighting would likely occur. Building inspections would normally be required which would trigger a review of energy code requirements. While these approaches differ, we do not believe the difference will impact the overall energy use of commercial buildings.

4. Envelope Thermal Transmittance in Cold Climates

The 1989 edition has an explicit set of requirements for the building envelope (wall, roof, and fenestration) for cold climates with more than 15,000 heating degree days, base 65 degrees Fahrenheit. The 1999 edition addresses these cold climates in three bins, or groupings of ranges of degree days, that are slightly different from the 1989 edition. These three bins include criteria for buildings in climates with heating degree day, base 65 degrees Fahrenheit between 12,601 and 16,200 (bin 24), between 16,201 and 19,800 (bin 25) and more than 19,801 (bin 26). The envelope criteria vary with differences in construction (see Table 7). The U-factor requirements in the 1999 edition are generally less stringent. However, the only U.S. climate in the 1989 or 1999 edition's weather data that would fall under the ''cold climate'' requirements would be Barrow Alaska. Thus we expect any impact to be negligible because of the small amount of construction in Barrow and similar smaller cold climate communities.

TABLE 7.—DIFFERENCES IN BUILDING ENVELOPE THERMAL REQUIREMENTS IN COLD CLIMATES BETWEEN THE 1989 AND 1999 EDITIONS

Envelope element	1989 edition cold climate (>15,000 HDD65) requirements	1999 Edition bin 25 (16,201–19,800 HDD65) requirements
Opaque Wall	U–0.053 for large buildings U–0.040 for small buildings	U–0.045 to 0.071, depending on type of wall.
Fenestration	U–0.52 (for window to wall ratios of less than 0.2 for large buildings and 0.15 for small buildings).	U–0.43, for the corresponding WWR values.
Roof	U–0.024	U–0.027 to 0.049, depending on type of roof.
Floor Over Unconditioned Space	U–0.023	U–0.033 to 0.064, depending on type of floor.
Slab on Grade Insulation	R–15 for 48 inches	R–15, for 24 inches.
Skylight	Not allowed	U–0.95.

5. Skylight Thermal Transmittance and Solar Heat Gain

For buildings whose overall roof U-factor, including skylights, is less than the 1989 edition's requirements, no separate skylight requirements must be met. For buildings that cannot meet this requirement, the 1989 edition contains skylight thermal transmittance requirements that are a function of heating degree days, base 65 degrees Fahrenheit, as well as provides credit toward the overall roof U-factor requirement, where lighting controls are used to reduce lighting consumption. The 1999 edition has separate requirements for glass skylights with curbs, plastic skylights with curbs, and skylights without curbs, which vary by climate bin. The least stringent of these are for glass skylights with curbs. The 1999 edition provides no envelope credits for using lighting controls in conjunction with skylights. A comparison of the 1989 and 1999 editions' U-factor requirements is shown in Table 8. The original 1989 edition had U-factors based on center of window measurements. The 1999 edition has U-factors based on whole window measurements. We used U-factors based on whole window measurements which are incorporated in Addenda F to the 1989 edition, for an accurate comparison.

TABLE 8.—COMPARISON OF SKYLIGHT U-FACTOR REQUIREMENTS IN THE 1989 AND 1999 EDITIONS

Climates with:	1989 edition	1999 edition
HDD65 <8000	U–0.7	U–1.17 to 1.98 (glass).
HDD65 ≥8000	U–0.52	U–0.88 to 1.17 (glass).
Skylight curbs all climates	U–0.21	Included in U-factor for skylights with curbs.

Furthermore, the 1989 edition limits the maximum allowable percent of skylight area, based on skylight visible light transmittance, number of heating degree days, base 65 degrees Fahrenheit, number of cooling degree hours, base 80 degrees Fahrenheit, foot candle level, and interior lighting power density. The allowable percent of roof area in skylight ranges from about 2 percent to 12 percent for specific combinations. The 1999 edition limits skylights to 5 percent of roof area.

The 1989 edition is more stringent than the 1999 edition in terms of required skylight U-factor. On the other hand, the total area of skylight that can be installed is less in the 1999 edition. In other words, the 1999 edition has greater restriction on the total roof area in skylights, but does allow skylights with a higher U-factor to be used. This essentially allows the user of the 1999 edition to put in a smaller amount of less efficient skylight than the 1989 edition.

The 1989 edition does not have any requirements for skylight solar heat gain. The 1999 edition does include specific solar heat gain coefficient requirements for skylights. Solar heat gain coefficient values for glass skylights range from 0.16 in very warm climates to ''No Requirement'' in very cold climates. Implicit in the1989 edition's thermal transmittance requirements, however, are SHGC values associated with the required glass. With required U-factors at 0.7 and 0.52 for skylights, skylights would have to be constructed with glazing similar to double pane and double low-emissivity glazing. Such construction would have solar heat gain coefficient values of 0.68 and 0.59. Using this logic, a comparison of skylight solar heat gain coefficient values is constructed in Table 9. Values are taken for five percent of the roof area in skylights, as this is the maximum prescriptive level in the 1999 edition. The upper range of solar heat gain coefficient values in the 1999 edition column is for cooler climates within each range.

TABLE 9.—COMPARISON OF SOLAR HEAT GAIN COEFFICIENTS IN THE 1989 AND 1999 EDITIONS

Climates with:	1989 edition SHGC	1999 edition SHGC
HDD65 ≤7,500	0.68	0.16 to 0.62.
HDD65 ≥7,500 <10,801	0.59	0.36 to 0.64.
HDD65 >10,801	0.59	No requirement.

The 1999 edition solar heat gain coefficient requirement is more stringent for virtually all locations in the US. The 1989 edition does have lower solar heat gain coefficient requirements in very cold climates, but since solar gain is a net benefit in these climates, restricting solar gain provides no benefit.

The lack of data on the amount of skylight in various parts of the country makes it inappropriate for us to reach a conclusion as to the net impacts of these changes.

6. Slab-On-Grade and Below Grade Wall Insulation

Slab-on-grade insulation requirements are nonexistent in both editions in warm climates. For cooler climates, the 1989 edition requires between R–7 and R–8 for vertical insulation, extended 24 inches deep, whereas there are effectively no requirements for slab insulation in the 1999 edition in the continental U.S. For heated slabs, the 1989 edition requires an additional insulation level of R–2, to that required for unheated slabs, in all cases. For below grade walls, the 1989 edition requires insulation levels from R–7 to R–16, for the first story below grade, depending on location. Whereas there are effectively no requirements for below grade wall insulation in the 1999 edition, until above 9,000 heating degree days, base 65 degrees Fahrenheit (much of Alaska and some northern Minnesota locations). The reduction of slab-on-grade and below grade wall insulation requirements in the 1999 edition will result in higher heating loads in cold climates, particularly for small buildings, resulting in more energy use. While a reduction in stringency, the impact of the removal of below grade or slab wall insulation is tempered by the insulating effect of the surrounding earth, relative to removing insulation from envelope components exposed to the air and sun (such as walls and roofs).

7. Roof Thermal Transmittance

We looked at roof thermal transmittance requirements first by estimating the building footprint area (assumed to approximate the roof area) by dividing the floor area by the number of floors for each building type. We then applied the Commercial Building Energy Consumption Survey statistical weights to each building type, to develop a table of the estimated roof area. This was done for each roof surface type classification for each of the 18 building use classifications in the 1992 Commercial Building Energy Consumption Survey. There are 17 Commercial Building Energy Consumption Survey roof surface classifications, which were aggregated into the three roof types in the 1999 standard as shown in Table 10, below. Where a significant fraction of a particular roof surface classification could be divided into one or more construction categories, estimates were made of the relative percentage in each category and are shown in parentheses in Table 10. Finally, the fraction of estimated roof area for each roof construction is shown for non-residential, semi-heated, and residential space types.

TABLE 10.—ESTIMATED ROOF AREA FRACTIONS BY 1999 EDITION ROOF CONSTRUCTION CATEGORY

1999 edition room construction	CBECS 1992 roof surface classifications	Estimated roof area fraction (in percent)		
		Non-residential	Semi-heated [a]	Residential [b]
Insulation Entirely Above Deck.	Built-up, Built-up & metal, Built-up & s/m ply, Composite, Foam/Styrofoam, Single/multiple ply (33%), Shingles & built-up (50%).	50.2	45.9	45.6
Metal Building	Metal/Rubber (80%), Metal Surfacing (80%), Single/multiple ply (33%).	16.5	32.9	4.9

TABLE 10.—ESTIMATED ROOF AREA FRACTIONS BY 1999 EDITION ROOF CONSTRUCTION CATEGORY—Continued

1999 edition room construction	CBECS 1992 roof surface classifications	Estimated roof area fraction (in percent)		
		Non-residential	Semi-heated [a]	Residential [b]
Attic and Other	Concrete Roof, Metal/Rubber (20&), Metal Surfacing (20%), Other (specify), Shingles & metal, Shingles & s/m ply, Shingles (not wood), Single/multiple ply (33%), Shingles & built-up (50%), Slate & shingles, Slate or tile, Wooden materials.	33.3	21.2	49.4

[a] Non-refrigerated warehouse assumed.
[b] Lodging buildings only.

Metal surfacing (about 13% of floor area) can be considered part of a metal building roof or a roof with metal joists (big box buildings such as Walmarts). The 80/20 split here allocates most of these surfaces to metal buildings which are the more prevalent class of new commercial construction. The shingles/slate, tile/wooden materials, are likely to be in place on roofs with attics or single rafter roofs, because they rely on roof pitch to shed water. The remaining categories cover a variety of combinations of materials, mainly synthetic/rubber surfaces. Some of these may be flat roofs, but they could be metal joists roofs or deck roofs. We allocated these evenly over the 1999 edition's roof construction categories.

The fractions of roof types estimated were used to weight the required U-factors from the 1999 edition for each climate and for each category of building, non-residential, semi-heated, and residential.

The results shown in Table 11 suggest that for most non-residential buildings, the 1999 edition has more stringent roof U-factor requirements in warm to mild climates (significantly so in Knoxville and Los Angeles, moderately so in Orlando, Seattle, and Shreveport, and slightly so in Fresno). It is slightly less stringent in the cooler climates of Denver, Detroit, and Providence, and is significantly less stringent in Minneapolis and Phoenix. Overall, we expect a slight increase in heating energy use and slight decrease in cooling energy use for most non-residential buildings from these requirements.

The semi-heated building category in the 1999 edition shows a substantial increase in average U-factor for all buildings, which is expected to result in increased energy use due to increased heating loads for these buildings.

A comparison of the requirements for the residential space category in the 1999 edition shows a reduction in U-factor (increase in stringency) for all climates except Los Angeles, which shows a substantial increase in U-factor (decrease in stringency).

Overall, it is expected that the changes in U-factor requirements in the 1999 edition will result in some increase in heating energy use, primarily as a result of the significant changes in requirements for semi-heated spaces. It is expected that it will also result in some decrease in cooling energy use in most (but not all climates).

TABLE 11.—AVERAGE ROOF U-FACTOR REQUIRED

City	1989 edition	1999 edition			Change 1989–1999 Non-res[1]
		Non-res	Semi-heated	Residential	
Denver	0.051	0.054	0.123	0.045	−0.003
Detroit	0.053	0.054	0.123	0.045	−0.001
Fresno	0.059	0.054	0.172	0.045	0.005
Knoxville	0.110	0.054	0.149	0.045	0.056
Los Angeles	0.100	0.070	0.202	0.200	0.030
Minneapolis	0.045	0.051	0.123	0.045	−0.006
Orlando	0.063	0.054	1.140	0.045	0.009
Phoenix	0.046	0.054	0.172	0.045	−0.008
Providence	0.053	0.054	0.123	0.045	−0.001
Seattle	0.064	0.054	0.149	0.049	0.010
Shreveport	0.066	0.054	0.172	0.045	0.012

[1] Negative U-factors indicate decreased stringency.

8. Floors Over Unconditioned Spaces

For each climate, the 1989 edition provides a single prescriptive U-factor for floors, while the 1999 edition provides nine possible U-factors (or R-values) depending on building type and floor type. The range of requirements for the 1999 edition addresses wood framed, steel framed, and mass (concrete) floor construction separately. Typically, wood framed floors have the lowest (most stringent) U-factor requirement, while mass floors have the highest (least stringent) U-factor. The 1999 edition is typically more stringent for wood framed and steel framed floors, and less stringent for mass floors in nonresidential (and residential) buildings. The 1999 edition is less stringent for semi-heated buildings. See Table 12.

TABLE 12.—COMPARISON OF FLOOR OVER UNCONDITIONED SPACE U-FACTOR CRITERIA IN THE 1989 AND 1999 EDITIONS

City	1989 edition all floors	1999 edition						1989–1999 difference		
		Non-residential			Semi-heated			Non-residential		
		Wood frame & other	Steel joists	Mass	Wood frame & other	Steel joists	Mass	Wood frame & other	Steel joists	Mass
Orlando	0.28	No requirement			No requirement				0.280	
Phoenix	0.19	0.051	0.052	0.137	No requirement			0.139	0.138	0.053
Los Angeles	0.17							0.119	0.118	0.033
Shreveport	0.11							0.059	0.058	−0.027
Fresno	0.10							0.049	0.048	0.037
Knoxville	0.074	0.051	0.052	0.107	0.660	0.069	0.322	0.023	0.022	−0.033
Seattle	0.056							0.050	0.004	−0.051
Denver	0.049	0.033	0.052	0.087	0.066	0.069	0.322	0.016	−0.003	−0.038
Detroit	0.048							0.015	−0.004	−0.039
Providence	0.048							0.015	−0.004	−0.039
Minneapolis	0.040							0.007	−0.012	−0.047

9. Opaque Wall Thermal Transmittance

The 1989 edition provides a single prescriptive U-factor for lightweight walls and a range of possible U-factors for mass walls (depending on thermal mass, percent fenestration, and internal load density), while the 1999 edition provides 12 possible U-factors (or R-values) depending on building type and wall construction. The maximum thermal transmittance requirements for mass walls in the 1999 edition generally fall within the range of allowable values in the 1989 edition, except for semi-heated buildings where in all cases the 1999 criteria are less stringent. However, since buildings in the semi-heated category are expected to have relatively low heating loads (due to the low internal temperature and limited heating capacity) and no cooling loads, the reduction in stringency is expected to have a minimal impact.

The difference in criteria for lightweight walls between the 1989 and 1999 editions varies, with some wall types being more stringent in some locations and other less stringent. In general, wood framed wall requirements in the 1999 edition are most likely to be more stringent than corresponding requirements in the 1989 edition.

To compare requirements for mass walls in the1989 edition, we used the Alternate Component Packages tables to determine U-factor requirements for 8 inch solid concrete and solid grouted concrete block mass walls (Heat Capacity > 15 Btu/ft\2\-F) as well as for 8 inch unfilled or insulated concrete block walls (10 Btu/ft\2\-F < Heat Capacity < 15 Btu/ft\2\-F). We did this for insulation on the inside of the wall; integral with the wall; and on the outside of the wall, under each of the three internal load density (ILD) ranges in the Alternate Component Packages tables. This was done for the 11 locations and for 18 percent and 38 percent window to wall area ratios. The requirements used were based on interpolation across the tabulated fenestration levels. For each internal load density range, we averaged together all calculated U-factor requirements. These results are shown in Table 13. In addition, we show the 1999 edition's U-factor requirements by that edition's three space-type categories (non-residential, residential, and semi-heated).

TABLE 13.—MASS WALL REQUIREMENTS COMPARISON

Location	1989 edition mass wall requirements			1999 edition mass wall requirements			U-Factor difference		
	Interior load density			Non-residential	Residential	Semi-heated	Non-residential	Non-residential [a]	Residential [b]
	Low	Medium	High						
ORL	0.624	0.649	0.636	0.58	0.151	0.58	−0.062	−0.473	−0.044
PHX	0.404	0.403	0.400	0.58	0.151	0.58	0.179	−0.253	0.176
LOS	0.737	0.791	0.793	0.58	0.151	0.58	−0.212	−0.586	−0.157
SHR	0.301	0.327	0.328	0.58	0.123	0.58	0.252	−0.178	0.279
FRS	0.293	0.307	0.311	0.58	0.151	0.58	0.271	−0.142	0.287
KNX	0.166	0.185	0.188	0.151	0.104	0.58	−0.036	−0.062	0.414
SEA	0.123	0.140	0.147	0.151	0.104	0.58	0.007	−0.019	0.458
DET	0.100	0.107	0.109	0.123	0.09	0.58	0.015	−0.010	0.480
DEN	0.131	0.144	0.144	0.123	0.09	0.58	−0.021	−0.041	0.449
PRV	0.100	0.107	0.109	0.123	0.09	0.58	0.015	−0.010	0.480
MNP	0.078	0.087	0.088	0.104	0.09	0.58	0.017	0.012	0.502

[a] Non-Residential versus average of Medium and High Interior Load Density cases.

[b] Residential versus Low Interior Load Density case.
[c] Semi-heated versus Low Interior Load Density case.

The difference in required U-factors for typical buildings is also shown in Table 13. For this comparison, we have assumed that most non-residential buildings in the 1999 edition would fall into either the medium or high interior load density ranges of the 1989 edition. The average U-factor for both of these interior load density ranges was used in the comparison. Most residential buildings would fall into the low interior load density range of the 1989 edition. Most semi-heated building spaces (assumed to be similar to warehouse buildings) would likely fall under the low interior load density range of the 1989 edition. As can be seen from the table, the requirements of the 1999 edition are more stringent for residential buildings, in almost all climates. This is particularly so in moderate to warm climates. The 1999 edition is considerably less stringent for semi-heated buildings in all but Orlando and Los Angeles, where heating losses are not expected to be significant. The 1999 edition is generally less stringent for non-residential construction in moderate to warm climates and slightly less stringent for cool or cold climates. Overall, it is expected that the reduced U-factor requirements for mass walls in the non-residential and semi-heated category will result in increased heating energy use over the 90.1–1989 mass wall requirements.

10. Window Thermal Transmittance and Solar Heat Gain

The 1989 edition does not specifically provide a prescriptive approach to window thermal transmittance or solar heat gain, but rather treats windows as a component of the building wall, where the wall must have certain overall heating and cooling performance to show compliance. However, the ACP (Alternate Component Packages) tables, which set out prescriptive requirements for the building envelope, provide tables of maximum percentage of wall glazing as a function of window U-factor, shading coefficient, projection factor, and building internal gains. The 1999 edition, by contrast, provides prescriptive U-factor requirements and Solar Heat Gain Coefficient requirements for particular combinations of percentage of glazing and building category (non-residential, residential, semi-heated), simplifying use and enforcement. Both editions require the use of an energy tradeoff methodology for buildings with very high percentages of window area (typically greater than 50 percent).

For our analysis, we assumed the mid-internal gain range of the ACP tables (1.51–3.00 W/ft^2) as being typical of the non-residential building loads, and the low-internal gain range of the ACP tables (0.0–1.5 W/ft^2) as being typical of semi-heated buildings such as warehouses. For residential space types such as hotels and hospitals, we assumed either low-or mid-internal gain ranges of the ACP tables could be appropriate in the 1989 edition. For multi-family high rise buildings we assumed low-internal gain ranges.

For these typical levels of internal gains, the requirements for window thermal transmittance in residential and non-residential buildings are very similar in both editions. The 1989 edition is somewhat more stringent in cold climates in buildings with a high percentage of glazing. The 1999 edition is marginally more stringent in the rest of the country. For semi-heated buildings, the requirements in the 1999 edition are less stringent, except for in warm climates where both editions require single pane glass.

Window solar heat gain requirements in the 1999 edition are typically more stringent in buildings with lower glazing areas (less than 30 percent), but often less stringent in buildings with higher glazing areas (38 percent or 45 percent). Maximum solar heat gain requirements do not exist for semi-heated buildings in the 1999 edition. However, limiting solar heat gain does not reduce energy use for a building that is only heated.

For windows with northern orientations, the 1999 edition generally allows greater solar heat gain per window area than the 1989 edition. A review of six of the seven building types (not including warehouse buildings which are commonly semiheated buildings) in the quantitative analysis suggested that approximately 73% of the floor area of these buildings would be in buildings with glazing fractions of less than 30%. This suggests that overall, the 1999 edition is more energy efficient in reducing solar heat gain in most buildings. It is somewhat less efficient with regard to window thermal transmittance, particularly in cold climates.

11. Opaque Doors

The 1999 edition contains explicit U-factor requirements for both swinging and non-swinging doors, with requirements ranging from a U-factor of 0.5 (for both door types in cold climates) to 1.45 for uninsulated doors of both types. An insulated metal door or a solid wood door requires a U-factor of 0.5. Glass doors that are more than one-half glass are considered to be equivalent to vertical fenestration and would need to meet vertical glazing requirements. The 1989 edition does not explicitly deal with either opaque or glazed doors, but instead treats them as part of the overall wall requirement. Opaque doors are part of the opaque wall, glass doors are part of the glazed area. Since the required thermal performance of opaque doors in the 1999 edition is generally worse than that of the surrounding opaque wall area, and the opaque door requirements are included in the overall wall requirements of the 1989 edition, the requirements of the 1999 edition are less stringent. Doors represent a small percentage of the wall area of multistory buildings. They also represent a fairly small percentage of the wall area of many large single story buildings. Most commercial entrance doors are glazed, reducing the impact of the difference in opaque door requirements. We therefore conclude that the energy impact of this change is likely to be small for most buildings. However, in individual buildings with a significant number of doors, such as some warehouses, the impact may be significant.

C. Mechanical Equipment and Systems

1. Load Calculations and Sizing

The 1999 edition has no explicit sizing requirements for heating ventilation and air-conditioning systems. The1989 edition requires the use of a computational procedure for load calculations, and it details selection of indoor and outdoor design temperature, the use of Standard 62–89 for minimum ventilation, and a selection of allowed sources for internal gain data. The 1989 edition also explicitly allows a ten percent safety factor for steady-state design loads and additional 30 percent and ten percent multipliers beyond that to account for heating and cooling pick-up loads. However, these additional parameters represent typical values or sources for sizing calculation data. The omission of explicit sizing requirements for heating ventilation and air-conditioning systems, while unlikely to have much impact on large commercial buildings, which are typically designed by engineering professionals, could have a significant impact on smaller commercial buildings, especially design-build facilities. The inclusion of explicit maximum safety factors in the 1989 standard recognizes the tendency for much larger values to be used by system designers. The exclusion of such factors in the 1999 standard has the potential for significantly oversizing equipment, resulting in operating inefficiency.

2. Separate Air Distribution Systems

The 1989 edition requires that zones with special process, temperature, and/or humidity requirements, either be served by air distribution systems separate from those used to satisfy zones conditioned for comfort only, or have provisions to allow control for comfort conditioning only. An exception to this allows up to 25 percent of the air flow serving primarily process systems to be directed for comfort cooling only needs with no system design modification. This exception might be used for office space in an industrial facility. This requirement provides the ability to operate the primary heating ventilation and air-conditioning systems for comfort conditioning only when processes are not operating. The 1999 edition has no requirements explicitly for systems and equipment used for process applications. However, where systems would also serve spaces conditioned for comfort only, the equipment and system requirements of the 1999 edition would apply. In particular, requirements referring to zone isolation, dehumidification, and simultaneous heating and cooling would address most of the issues addressed by the separate air distribution system requirement in the 1989 edition. This will result in a minor reduction in stringency in a limited number of buildings.

3. Temperature Controls

The 1999 edition has an additional requirement that all zone and loop controllers shall incorporate control error correction. In addition, it explicitly requires a set point overlap restriction when the heating and cooling to a zone are controlled by separate thermostats within that zone. In the 1989 edition, it is not clear whether individual thermostats are required that control both heating and cooling to a 5 degree Fahrenheit deadband, or whether it means that the space should be controlled to provide a 5 degree Fahrenheit deadband. The additional requirements make the 1999 edition clearer as to the requirements and better at controlling room temperature and will limit reheating and recooling done by separate systems, which will provide improved efficiency over the 1989 edition.

4. Off-Hour Controls and Setback

The 1999 edition requirements for off-hour controls are limited to systems with heating or cooling capacity greater than 65,000 Btu per hour and fan system power greater than ¾ horsepower. The requirement for off-hour controls in the 1989 edition are for systems greater than two kilowatts. Exceptions are also made for heating ventilation and air-conditioning systems serving hotel or motel guest rooms. In these cases the 1999 edition is less stringent. However, the optimum start controls required in the 1999 edition for large systems, should reduce the number of hours needed to bring the building to operating temperature.

The 1989 edition allows either independent shut-off controls or setback controls to reduce heating and cooling to the zone. The 1999 edition requires automatic shutoff controls for the supply of conditioned air, outside air, and exhaust air to each independent isolation area, as well as automatic shutdown controls. However, it specifically allows substitution of a system air flow reduction in the non-occupied zones, but limits the total volume of air to those zones to 14 percent of the system airflow. The 1999 edition, by requiring maximum setback air volumes, has explicit, and therefore more stringent, off-hour requirements. These would be achieved by simple thermostat setback. Both editions incorporate different exceptions to these off-hour requirements for multi-zone systems. Our limited data on commercial building multi-zone systems and operating schedules is insufficient to evaluate these exceptions.

5. Dampers

The 1999 edition requires motorized dampers in stair and elevator shafts and in all outdoor air supply exhaust hoods, vents, and ventilators. Gravity dampers are acceptable on buildings less than three stories and of any height in buildings in climates with less than 2,700 heating degree days, base 65 degrees Fahrenheit. These damper performance requirements are more stringent than similar requirements in the 1989 edition. However, the requirements in the 1999 edition pertain to fewer systems (only to systems larger than 65,000 Btu per hour). The 1989 edition requires dampers (motorized or gravity) or other means of volume shut-off or reduction. It exempts supply and exhaust systems less than or equal to 3,000 cubic feet per minute, in warm climates (less than or equal to 3,000 heating degree days, base 65 degrees Fahrenheit). Overall, the 1999 edition is considerably more stringent for large systems, but is less stringent for small systems in climates above 3,000 heating degree days, base 65 degrees Fahrenheit.

6. Humidity Control

The 1989 edition had a requirement that any humidity control device (humidistat) be capable of limiting the use of fossil fuel or electric energy to provide relative humidities of greater than 30 percent or less than 60 percent. This range limit setpoint requirement for zone humidification is not included in the 1999 edition. Instead a requirement for having the capability to prevent simultaneous humidification or dehumidification was added, with an exception for zones with tight humidity requirements, approved by local authorities, or for desiccant systems used in series with evaporative cooling. Minimum impact is expected from this change as both editions effectively require systems with both humidification and dehumidification to have the controls to limit possible waste of energy that would result from simultaneous humidification and dehumidification.

7. Radiant Heating

The title, purpose, and scope of the 1989 edition do not include unenclosed spaces, and has no requirements for heating such spaces. Hence, warm air heating systems may be used. By specifically including such spaces as loading docks without air curtains in the 1999 edition's title, purpose, and scope, and requiring radiant heating systems (excluding warm air systems), energy will be saved by requiring more efficient systems for that application.

8. Ventilation

The 1989 edition requires ventilation systems be designed capable of providing the ventilation levels prescribed in Standard 62–1989. The 1989 edition did not set the ventilation rate, but rather specified a minimum operational ventilation rate the system must be designed to provide. Operation of a system at higher or lower ventilation rates is allowed under the 1989 edition. The 1999 edition omits these requirements. No savings or loss in efficiency should occur from this specific change.

Further, the new requirements in the 1999 edition for automatic ventilation controls for high occupancy areas make the 1999 edition more stringent than the

1989 edition and should provide some energy savings.

9. Pipe and Duct Insulation

The 1999 edition has slightly less stringent pipe insulation requirements than the 1989 edition for most building applications. The 1999 edition does not require insulation of piping unions in heating systems or hot water piping between the shutoff valve and coil (up to 4 feet of pipe), in conditioned spaces. It requires more insulation on higher temperature (> 250 F) piping, and less insulation on lower temperature heating system and service hot water piping. In contrast, the 1989 edition requires more insulation on low temperature cooling system piping. Overall, there appears to be some small reduction in insulation requirements. However, since the piping is insulated under both standards, the incremental reduction in insulation is expected to have minimal impact.

The 1999 edition has significantly less stringent duct insulation requirements for some categories of ducts than the 1989 edition. For cooling only ducts, the 1999 edition requires generally lower insulation levels for ducts located outside the building, and insulation levels at or lower than required in the 1989 edition for most spaces inside the building. The 1999 edition, generally requires higher insulation levels for ventilated attics and for unvented attics with non-insulated attic decks, which can be high temperature areas of the building. It requires no insulation for indirectly conditioned spaces including return air plenums.

For heating only ducts, the 1999 edition requires somewhat less insulation on exterior heating ducts, except in the most extreme heating climates, where it requires more than the 1989 edition. It requires very little insulation on heating-only ductwork located inside the building envelope.

For return ducts located exterior to the building, the 1999 edition requires lower insulation levels than the 1989 edition. The lower duct insulation requirements are likely to be most significant for heating-only ducts in climates where insulation is not required for particular attics or unconditioned spaces. The reduction in the minimum insulation level for cooling only ductwork is significant for central systems that rely on year round cooling availability (such as variable air volume or dual duct systems). Both insulation reductions will decrease energy efficiency of the 1999 edition.

Finally, the 1999 edition does not restrict the use of pressure sensitive tape at seal level C for supply pressures up to 2 inches of pressure, whereas the 1989 edition restricts its use for seal class C above 1 inch. Research is ongoing regarding the impact of this, however, we believe that there is a potential reduction in energy efficiency with the 1999 edition.

10. Heat Recovery

New requirements in the 1999 edition for exhaust air heat recovery for systems of 5,000 cubic feet per minute or greater with 70 percent or greater outside air, will have significant positive impact on energy efficiency in heating ventilation and air-conditioning systems with high outside air requirements. However, the number of buildings that have these systems and that are exempted is significant.

Requirements have also been added that condenser heat recovery be used to provide heating of service hot water for buildings with a combination of continuous operation, high water heating loads (greater than 1,000,000 Btu per hour) and high cooling loads (approximately 400 tons). Primary examples are large hotel facilities. These requirements significantly increase efficiency, but in a relatively small percentage of buildings.

11. Completion Requirements

Both editions have requirements for testing and balancing of heating ventilation and air-conditioning equipment. The 1999 edition requires a written balancing report for zones more than 5,000 square feet in area, as well as requires the ability to measure differential pressure across pumps greater than 10 horsepower in size. For buildings larger than 50,000 square feet conditioned area, detailed commissioning instructions for heating ventilation and air-conditioning systems are required to be provided by the designer in plans and specifications. An exception to this requirement is made for warehouses and semi heated spaces. The more detailed and extensive documentation requirements have the potential to provide long-term energy efficiency beyond what would be expected under the minimum completion requirements of the 1989 edition.

12. Simultaneous Heating and Cooling Controls

The 1989 and 1999 editions have essentially identical text requiring that zone thermostatic and humidistatic controls shall be capable of operating the supply of heating and cooling energy in sequence to prevent reheating, recooling, or mixing of previously heated and cooled air, or other simultaneous operation of heating and cooling systems in the same zone. Similarly, exceptions are provided for both editions regarding: (1) Zones with special pressurization or cross-contamination requirements; (2) zones where at least 75 percent of the reheat energy is provided from a site-recovered or site-solar source; and (3) where the reheated volume of supply air to a zone is no greater than the maximum of several defined limits. However, the 1999 standard provides much more detail regarding the possible characterization of the circumstances under which these exceptions would apply. In the third category, the 1999 edition changes the stipulations to limit the use of most of these maximum-reheated-air exceptions. These changes should result in a reduction in building energy use for many common multi-zone heating ventilation and air-conditioning system designs.

13. Economizer Controls

The 1999 edition requires economizers in fewer locations than the 1989 edition, but requires them in the locations of the country where they are expected to be most beneficial. The 1989 edition requires economizers on 7.5 ton or larger equipment in climates where economizers are required. The 1999 edition uses a sliding scale of economizer requirements. These requirements depend on climate and system size. They range from 65,000 Btu per hour equipment in climates where economizers are most effective to 135,000 Btu per hour where economizers are least effective. In addition, the 1999 edition requires air economizers to be capable of providing 100 percent of the design supply air quantity, versus only 85 percent in the 1989 edition. In addition, the 1999 edition specifies: (1) Allowed economizer control types to maximize economizer savings in specific climates, (2) leakage rates for outside air dampers, and (3) that economizer dampers in multi-zone systems be capable of being sequenced with the mechanical cooling equipment and not be controlled by only mixed air temperature. In general, the 1999 edition attempts to provide more economizer savings where economizers are most beneficial.

14. Fan System Design Criteria

Both editions will result in similar fan power efficiencies. However, the 1999 edition requires the efficiencies be included on motor nameplates, in order to make them more easily inspected. In addition, the 1999 edition places these requirements on fan motors of five horsepower and above, whereas the 1989 edition places requirements on motors that are ten horsepower and above. The 1999 edition also has more stringent unloading requirements for variable air volume fans. The 1999 edition places those requirements on variable air volume systems of 30 horsepower and above, as compared to variable air volume systems of 75 horsepower and above, as specified in the 1989 edition. Both the constant volume and variable volume fan power requirements will be extended to far more system types in the 1999 edition. Overall, there is expected to be a reduction in allowed fan power use in the 1999 edition, particularly for multi-zone systems.

15. Pumping System Design

Both editions require that pumping systems designed for variable flow be designed to allow flow variation down to 50 percent of design flow rates. The 1999 edition also has a requirement that, for systems with more than 100 feet of pumping head and motors greater than 50 horsepower power, consumption at 50 percent flow, be no more than 30 percent of design flow. This will effectively require variable speed pump drives on these large pumping systems. Exceptions are made for pumps less than 75 horsepower where reduction of flow would be below the minimum flow requirements for heating ventilation and air-conditioning equipment and for systems that include no more than three control valves. Significant energy savings will result from application of the 1999 edition in larger pumping systems due to these part-load performance requirements.

16. Temperature Reset Controls

The 1989 edition requires system temperature reset controls on both multi-zone air systems and large, non-variable-flow hedonic systems. These controls shall be capable of providing a reset of at least 25 percent of the design supply to room air temperature difference, with some exceptions, most notably for low zone flow rates or for systems not capable of providing reheat. The primary purpose of this requirement is to reduce reheat in air systems. Supply water temperatures must also be capable of a reset equivalent to 25 percent of the design supply-to-return water temperature difference. This requirement does not apply to hydronic systems that can provide a 50 percent reduction in system flow, or are less than 600,000 Btu per hour in capacity. Nor does it apply to reset controls that would cause improper operation of heating, cooling, humidification, or dehumidification systems.

The 1999 edition requires reset on chilled and hot water temperature controls used for heating ventilation and air-conditioning systems more than 300,000 Btu per hour design capacity. Direct energy savings are expected from the reset of the supply water temperature from chiller and boiler, and the air supply temperatures in the system are assumed to follow the water temperature reset. An exception is made for hydronic systems that use variable flow to reduce pumping energy, or for systems where reset would cause improper operation of heating, cooling, humidification or dehumidification systems. Overall, there is little net change in the reset requirements for hydronic systems other than the 1999 edition applying them to more systems.

The 1999 edition removes the air supply reset requirements, while directly addressing simultaneous heating and cooling. This is addressed by better limiting the amount of air reheated or recooled and is set forth in a new section of the standard (see Simultaneous Heating and Cooling Controls above). Some minimal degradation in efficiency is expected from removal of the supply air reset requirements, but this is likely to be mitigated by the increase in efficiency from requiring reset on smaller hydronic systems.

17. Hot Gas Bypass Restriction

The 1999 edition introduces a new requirement that restricts the use of hot gas bypass in cooling equipment unless the equipment is designed with multiple steps of unloading. In the latter case, hot gas bypass is allowed, but maximum hot gas bypass levels are specified as a fraction of total capacity for different sizes of cooling equipment. This requirement will provide an improvement in part-load performance for cooling equipment, where manufacturers are not already incorporating multiple steps of unloading.

18. Heating Ventilation and Air-Conditioning Equipment

The 1999 edition provides updated equipment efficiency requirements with an effective date of October 29, 2001. Tables 6.2.1A–6.2.1G of the 1999 edition show the existing 1989 edition's heating ventilation and air-conditioning equipment efficiency requirements (shown in the ''minimum efficiency'' column) with the 1999 edition's update requirements shown in the ''Efficiency as of October 29, 2001'' column in each table across heating and cooling product categories. Where the 1999 edition has equipment efficiency requirements but the 1989 edition does not (as is the case with absorption and heat rejection equipment for example) increased energy efficiency occurs unless the requirements are set at or below common practice. In these cases, we used ASHRAE's assessment of the minimum performance of the equipment used in common practice as a baseline. A summary of the shipped capacity weighted efficiency improvements across generic product categories is shown in Table 14.

TABLE 14.—SHIPPED CAPACITY WEIGHTED EFFICIENCY IMPROVEMENT ACROSS GENERIC PRODUCT CATEGORIES, INCLUDING EQUIPMENT SHIPMENTS TO COMMERCIAL BUILDINGS COVERED BY FEDERAL MANUFACTURING STANDARDS

Equipment category	Estimated full load efficiency improvement (in percent)
Unitary Air Conditioners and Condensing Units	7
Unitary and Applied Heat Pumps	9.2
Electrically Operated Water Chillers	16.8
Absorption Chillers	5.2+
Packaged Terminal Air Conditioners and Heat Pumps	22.4
Room Air Conditioners	10.1
Furnaces, Duct Furnaces, Unit Heaters	0+
Boilers	0

The absorption chillers 5.2 percent estimated full load efficiency improvement is based on double effect chillers. The 1989 edition had no efficiency requirement for absorption chiller equipment. Based on an industry derived market baseline for double effect chillers provided during the development of the 1999 edition, the 1989 edition's performance coefficient is 0.95. Therefore, selection of the 1999 edition's coefficient of performance of 1.0 will provide improved efficiency. Improvements of up to 25 percent above market minimums are estimated for single effect equipment.

The full load efficiency improvement in room air-conditioners in the 1999 edition were adopted from the Department's manufacturing standard requirements, effective October 1, 2000 (10 CFR 430). These efficiency improvements cannot be attributed to the improved requirements of the 1999 edition.

For furnaces, duct furnaces, and unit heaters, changes were made to test procedures and efficiency descriptors for unit heaters, but no net change was made in efficiency in the 1999 edition. Improved prescriptive requirements in the 1999 edition for warm-air furnaces such as requirements for intermittent ignition or interrupted device and jacket loss limits, will improve annual efficiency.

For boilers, the full load thermal efficiency descriptor was improved in the 1999 edition, but not the boiler efficiency requirements. The 1999 edition's requirements for thermal efficiency will remove some boilers from the market that currently meet the single 80 percent combustion efficiency requirement in the 1989 edition, and have thermal efficiencies of less than 75 percent. This is particularly true of steam boilers.

In addition to providing updated efficiency requirements for most commercial equipment, the 1999 edition subdivides several of the original 1989 edition product categories and adds new efficiency requirements for heat rejection equipment that were not covered under the 1989 edition. The 1999 edition provides coefficient of performance and integrated part-load value requirements for centrifugal chillers operating at other than nominal test conditions. It also expresses efficiency requirements, for boilers less than or equal to 2.5 million Btu per hour input rating, using true thermal efficiency, as opposed to combustion efficiency requirements in the 1989 edition. The 1999 edition provides separate efficiency requirements for packaged terminal air conditioner and packaged terminal heat pump equipment. The 1999 edition also updates efficiency requirements to reflect changing test procedures and mandates the use of either intermittent or interrupted ignition devices and power venting or flue dampers on forced air furnaces. Finally, the 1999 edition restricts jacket losses on gas and electric furnaces located outside the conditioned space.

The 1999 edition provides significant improvement to cooling equipment efficiencies, and minor increases in average oil or gas space heating equipment efficiency due to a change in either efficiency designator or shell loss requirements. It also provides for a moderate increase in heat pump heating side efficiency. All of these requirements (except for room air-conditioners) will improve the general efficiency of commercial space conditioning products beyond that required in the 1989 edition and will thus contribute to energy savings with the 1999 edition.

19. Service Water Heating Equipment Efficiency

The 1999 edition sets service water heating (SWH) equipment efficiencies for gas and oil fired equipment at, or moderately higher than, the 1989 edition levels. It improves thermal efficiencies from two to three percentage points for gas water heaters with integral storage, and improves thermal efficiencies one percent for oil fired instantaneous water heaters with integral storage, as well as for the similarly defined category of ''hot water supply boiler.''

For the 1999 edition, the general form of the equations for standby loss for oil and gas water heaters were slightly modified and rewritten to include a fuel input rating variable and the definition of the volume in the equation. In the 1989 edition, the standby loss was purely a function of volume. With the modification in the 1999 edition of the standby loss equation, standby loss is now a function of both volume and input rating. For gas and oil water heaters, the stringencies of each standard are roughly the same within each of the individual product categories. This allows somewhat more standby loss for large input rating products and allows somewhat less standby loss for smaller input rating products. Without very detailed information about the shipped quantity of products within a size category, it is unknown whether there is a net change in efficiency. For electric water heaters greater than 12 kilowatt input, the 1999 edition does appear to allow marginally greater standby loss, as the formula is based on rated as opposed to measured volume. This allows a ten percent variation between the rated and measured volume. However, since this product is covered by a Federal national manufacturing standard that is more stringent than the requirements of the 1999 edition and the federal standard preempts state or local regulation, the reduced stringency in the 1999 will not reduce energy efficiency.

20. Service Water Heating Controls

Both the 1989 and 1999 edition have requirements for a minimum service hot water temperature control capability set point, as well as a maximum control temperature requirement for public restrooms of 110 degrees Fahrenheit. Since these are only capability and not set point requirements, no change in net building energy use is expected or assured. The 1989 edition also has a requirement that booster heaters be installed where outlet temperatures of more than 120 degrees Fahrenheit were required, which is absent in the 1999 edition. The energy impact of dropping this requirement is highly dependent on the fuel source used by the booster heater. Generally, a slight increase in site energy use in specific applications might be expected, however, there may also be a corollary reduction in source energy use occurring from the reduced use of electric booster heaters (a cheap first cost alternative to meeting the 1989 edition requirement). The net impact on hot water energy use is expected to be minimal.

D. Energy Cost Budget

For both editions, the Energy Cost Budget section provides a whole-building tradeoff methodology to allow innovative or unique buildings to comply with the standard. The Energy Cost Budget section requires the designer to simulate both a baseline building that complies with the standard and the actual design being proposed. The design building is not allowed to have a greater energy cost than the baseline building that complies with the standard. Neither edition of the standard allows designs to exceed the base standard, and as such, the stringency of the Energy Cost Budget method in each edition is roughly equivalent to the stringency that would be achieved if the building complied with the prescriptive requirements of the respective editions of the standard.

E. Conclusion About Detailed Textual Analysis

Our assessment of seven areas of change in the Lighting and Power sections of the two editions leads us to conclude that there will be a net positive increase of efficiency in commercial buildings from these revisions. Conversely, our assessment of the eleven areas of change in the Envelope section of the two editions leads us to conclude that there will be a net decrease in efficiency of commercial buildings due to these changes. Finally, our review of the 22 areas of change in the Mechanical Equipment and Systems sections of the two editions leads us to conclude that these revisions will produce a net positive increase in the efficiency of commercial buildings.

We therefore conclude from our detailed textual analysis that there will be a modest net gain from the changes.

IV. Filing Certification Statements with DOE

A. Review and Update

On the basis of today's DOE determination, each State is required to review and update the provisions of its commercial building code to meet or exceed the provisions of the 1999 edition for any ''building'' within the meaning of Section 303(2) of the Energy Conservation and Production Act, as amended. This action must be taken not later than two years from the date of today's notice, unless an extension is provided. Section 304(b)(2)(B)(i) and (c).

The Department recognizes that some States do not have a State commercial building code or have a code that does not apply to all commercial buildings. If local building codes regulate commercial building design and construction rather than a State code, the State must provide for review and update of those local codes to meet or exceed the 1999 edition. States may base their certifications on reasonable actions by units of general purpose local government. Each such State must still review the information obtained from the local governments and gather any additional data and testimony for its own certification.

States should be aware that the Department considers high-rise (greater than three stories) multi-family residential buildings and hotel, motel, and other transient residential building types of any height as commercial buildings for energy code purposes. Consequently, commercial buildings, for the purposes of certification, would include high-rise (greater than three stories) multi-family residential buildings and hotel, motel, and other transient residential building types of any height.

B. Certification

Section 304(b) of ECPA requires each State to certify to the Secretary of Energy that it has reviewed and updated the provisions of its commercial building code regarding energy efficiency to meet or exceed the 1999 edition. The certification must include a demonstration that the provisions of its commercial building energy code regarding energy efficiency, meet or exceed Standard 90–1999 for any ''building'' within the meaning of Section 303(2) of the Energy Conservation and Production Act, as amended. If a State intends to certify that its commercial building code already meets or exceeds the requirements of the 1999 edition, it would be appropriate for the State to provide an explanation of the basis for this certification, e.g., the 1999 edition is incorporated by reference in the State's building code regulations. The Department believes that it would be appropriate for the chief executive of the State (e.g., the Governor) to designate a State official, such as the Director of the State energy office, State code commission, utility commission, or equivalent State agency having primary responsibility for commercial building codes, to provide the certification to the Secretary. Such a designated State official could also provide the certifications regarding the codes of units of general purpose local government based on information provided by responsible local officials.

C. Request for Extensions

Section 304(c) of ECPA requires that the Secretary permit an extension of the deadline for complying with the certification requirements described above if a State can demonstrate that it has made a good faith effort to comply with such requirements and that it has made significant progress toward meeting its certification obligations. Such demonstrations could include one or more of the following: (1) A plan for response to the requirements stated in section 304; or (2) a statement that the State has appropriated or requested funds (within State funding procedures) to implement a plan that would respond to the requirements of section 304.

D. Submittals

When submitting any certification documents in response to this notice, the Department requests that the original documents be accompanied by one copy of the same.

Issued in Washington, DC, on July 8, 2002.

David K. Garman,

Assistant Secretary for Energy Efficiency and Renewable Energy.

Appendix A. Description of Proposed Analysis

At the February workshop we explained that the proposed analysis would provide qualitative comparisons of the stringencies between the two editions of Standard 90.1 in: (1) The scope of the standard; (2) the building envelope requirements; (3) the building lighting requirements; (4) the building mechanical equipment requirements; and (5) the paths to compliance.

We stated that the proposed emphasis of the qualitative comparison would differ between the envelope, lighting, and mechanical sections. In the building envelope section, the comparison would focus on the impact of the different building envelope requirements on the building heating and cooling loads for different building types and climates. The envelope comparison would examine requirements for all envelope components, including roofs, walls, floors, and fenestration as well as explore variations in construction types and in the window-to-wall ratio.

In the lighting requirements comparison, we explained that the proposed focus would be primarily on the impact the different lighting requirements have on lighting energy use, as well as on building loads. The comparison would look separately at the whole building and space-by-space lighting requirements in a variety of commercial building types, as well as examine the effect of any ''additional lighting power allowances.''

We proposed that the mechanical requirements comparison be divided into comparisons of equipment efficiency requirements and system design requirements. We explained that the system design requirements affect both the system efficiency and system load impacts, and may have direct energy impacts as well. We also proposed that tables of relative stringency and estimated positive or negative national energy impact be prepared based on practical application of the system design requirements in each standard.

We explained that each standard has multiple ways to demonstrate compliance. We proposed to enumerate the multiple paths to compliance, but did not propose to perform a detailed comparison of the relative stringency of alternate paths internal to a single standard or between standards. We explained that the large quantity of variables among the alternative compliance paths would make such analysis prohibitive to undertake. Further, we explained that we knew of no data on which to base the selection of representative requirements for such an analysis. Assignment of requirements would be arbitrary. Rather we proposed to focus on what we believed is the most common approach to using the standard in question for particular building types.

Addressing the quantitative analysis, we proposed to base the quantitative comparison of energy codes on whole building energy simulations of buildings built to each standard. We proposed to simulate seven representative building types in 11 representative U.S. climates. The simulated buildings would utilize the 15 zone building prototypes used in previous DOE building research, and the energy use intensities for each zone from the simulations would be scaled to correctly reflect variations in characteristic building sizes and shapes for each representative building type. Energy Use Intensities (EUIs) developed for each representative building type would be weighted by total national square footage in each representative building category to provide an estimate of the national energy savings.

We noted that only changes to requirements for new buildings would be considered in this quantitative analysis.

Appendix B. Description of the Quantitative Analysis

The analysis methodology is briefly described below. This is followed by a description of the input assumptions.

I. Analysis Methodology

To determine the aggregate impact of changes to the envelope, lighting, and mechanical sections of 90.1, a series of building simulations were made using the BLAST (Building Loads Analysis and System Thermodynamics) building simulation software. Seven building types, shown in Table 15, were used in the analysis. These seven building types used represent approximately 80 percent of commercial building energy consumption, according to the Energy Information Administration's 1995 Commercial Building Energy Consumption Survey (CBECS95) data. (The Office building type includes Outpatient Health Care at 76.6 thousand Btu per year.)

TABLE 15.—ENERGY CONSUMPTION BY PRINCIPAL BUILDING ACTIVITY (TRILLION BTU)

Building types simulated	Annual energy use	Percent of total
Office	1,095	20.6
Mercantile and Service	973	18.3
Education	614	11.5
Lodging	461	8.7
Public Assembly	449	8.4
Food Service	332	6.2
Warehouse and Storage	325	6.1
Total for above Categories	4,249	
Total for all commercial buildings	5,323	79.8

Construction variation within each building category was simulated using four different window to wall area ratios, both mass (such as dense masonry) and light frame wall construction types, and gas and electric heating fuel types. Two scenarios of economizer usage were simulated in each climate to account for the variation of economizer usage requirements in combination with equipment size. The buildings were simulated in 11 different climate locations (Table 16). The climate locations were chosen based on statistical cluster analysis of 234 Typical Mean Year weather data tapes and were chosen to be representative of the variation in climate found in the U.S. Several of the more significant climate parameters are shown in Table 16. These include, Heating Degree Days, base 65 degrees Fahrenheit (HDD 65); Vertical Solar radiation, in the North (VSN), East/West (VSEW), and South (VSS) orientations; Cooling Degree Day, base 50 degrees Fahrenheit (CDD 50); minimum recorded outdoor temperatures for 99.6 percent of the time for heating design calculations; maximum recorded Dry Bulb (DB) outdoor temperatures exceeded 1 percent of the time for cooling design calculations; and maximum recorded Wet Bulb (WB) outdoor temperatures exceeded one percent of the time, also for cooling design calculations.

TABLE 16.—CLIMATES LOCATIONS USED

Location	HDD 65	VSN	VSEW	VSS	CDD 50	Heating design 99.6	Cooling design (1% DB)	Cooling design 1% WB)
Denver, CO	6083	428	971	1321	2611	−3	90	59
Detroit, MI	5997	390	676	858	3199	0	87	72
Fresno, CA	2700	459	1029	1199	5070	30	101	70
Knoxville, TN	3818	446	762	898	4455	13	90	74
Los Angeles, CA	1494	482	962	1146	4456	43	81	64
Minneapolis, MN	8060	380	709	972	2751	−16	88	71
Orlando, FL	532	511	881	974	8288	37	93	76
Phoenix, AZ	1382	488	1116	1310	7830	34	108	70
Providence, RI	6022	393	677	874	2756	5	86	71
Seattle, WA	5281	350	621	828	1683	23	81	64
Shreveport, LA	2265	484	843	954	6022	22	95	77
Tampa, FL	575	518	890	974	7985	36	91	77

In addition to simulating buildings that complied with the 1989 and 1999 editions, the changes in envelope, lighting and mechanical requirements were each separately simulated, without changing the 1989 edition's requirements for the other components. Then, because the lighting and envelope requirements impact each other, particularly in the 1989 edition, the combined lighting and envelope requirement differences were analyzed, again without changing the 1989 edition's requirements for the other components. Calculating the difference between this combination and all 1999 edition requirements allowed an assessment of the impact of the mechanical changes after adjusting for this thermal load shift. In all, six separate sets of requirement changes were simulated.

In total, 2464 simulations were performed for each set of requirement changes. A prototypical 48,000 ft^2, 15-zone, slab-on-grade building was used for all the simulations. Simulation results for this prototypical building size were then scaled to reflect aggregate energy use in buildings across a wide range of sizes and shapes using Commercial Building Energy Consumption Survey building data. Single zone air-conditioning and heating systems were assumed in the building model to permit this scaling. This simplification should result in a lower-bound estimate of energy savings with the standard as explained in mechanical system characterization below.

II. Simulation Input Characterization

A. Envelope

The building envelope characteristics examined in the analysis were the opaque wall and roof U-factors, the fenestration U-factors, either the fenestration Shading Coefficient requirements (in the 1989 edition) or Solar Heat Gain Coefficient requirements (in the 1999 edition), and the effective slab U-factors for slab on grade construction. These characteristics were determined for each set of requirement changes, building type, and climate combination simulated.

The 1989 edition's envelope requirements simulated were based on the 1989 edition's Alternate Component Packages (ACP) tables. These tables represent the prescriptive compliance path for the 1989 edition's envelope requirements. Because the 1989 edition's requirements do not necessarily reflect the performance of typical building assemblies, the actual U-factors used in the simulations were chosen to reflect the U-factors of real building assemblies which best approach, without being less stringent than, the U-value requirements of the standard. This is expected to be more representative of the real envelope performance resulting from application of the 1989 edition. Note that by being more stringent than the U-factor requirements, this procedure provides a conservative estimate of the envelope energy savings.

In addition, the 1989 edition's ACP tables represent more stringent envelope requirements than that specified for most climates or buildings, using these equations outlined in Chapter 8 of the 1989 edition. The equations are embodied in the ENVSTD, version 2.4, software. For this reason, the use of the ACP tables as the basis for the 1989 edition's envelope provides a lower boundary to the estimate of energy savings from the building envelope requirements.

B. Lighting

The lighting power density requirements were developed from the whole building lighting requirements for both the 1989 and 1999 editions, for comparable building types, where available. The 1999 edition provides single value whole building lighting power density values for 31 different building types. The 1989 edition provides whole building lighting power density values for only 11 different building types. However, it provides different lighting power densities for six different building size categories within each building type. In neither case do the whole building lighting power density values correspond perfectly to the building types simulated. The following procedure was used to develop whole building lighting numbers for each of these categories.

1. Lighting Power—1989 Edition

For office and warehouse building types, where there is a direct match with the 1989 standard whole building lighting power categories, the lighting power density was estimated by weighting the whole lighting power density across the six building size categories by the fraction of each building type's floor space in each size category using CBECS95 data.

In the case of Food Service and Education, the 1989 edition provides lighting power density values for subcategories of these building types. Food Service is composed of Fast Food/Cafeteria and Leisure Dining/Bar subcategories, Education is composed of Preschool/Elementary, Jr. High/High School, and Technical/Vocational subcategories. In these cases, first the lighting power densities for the different building sub types were averaged together for each building area category. Then, a weighting of these new lighting power densities by building size category was made, using CBEC's data for Food Service or Education building types, as appropriate.

In the case of retail type buildings, the 1989 edition has three basic retail building subcategories, Retail, ''Mall Concourse, and ''Service. Commercial Building Energy Consumption Survey floor area data is categorized as Enclosed Shopping Center/Mall, Retail (except Mall), Service (except Food), and Strip Shopping. To make a realistic weighting by retail type the following allocation of Commercial Building Energy Consumption Survey retail type floor area was made.

TABLE 17.—ALLOCATION OF CBECS95 RETAIL TYPE FLOOR AREA

Retail building categories—1989 edition	Allocation of CBECS95 building category floor area
Retail	Retail (except Mall) plus Strip Shopping plus half of Enclosed Shopping/Mall.
Mall Concourse	Half of Enclosed Shopping/Mall.
Service	Service (except Food).

Then a weighted average of the allowed lighting power densities was constructed, using the 1989 edition's lighting power density values and the CBECS95 floor area data for each building type and size category.

For Lodging and Public Assembly building types, the 1989 edition has no direct match in the whole building lighting power density tables. For a comparison of these building types, the 1989 edition's whole building lighting power density values were developed by applying the appropriate 1989 edition's space-type lighting power density values (with appropriate Area Factor adjustments) to the building specific space type square footage data used in the development of the 1999 edition lighting power densities. The 1989 edition building specific space type data models the actual weighting of space type square footage, within a specific building type, based on actual current U.S. construction data. The lighting power density value for the Lodging category is made up of the average of the whole building lighting power densities constructed for the 1999 edition's building categories: Dormitory, Hotel, and Motel. The lighting power density value for the Public Assembly categories is similarly made up of the average 1999 edition's whole building lighting power density values for Convention Center, Motion Picture Theater, Performing Arts Theater, Town Hall, Sports Arena, Museum, and Gymnasium.

2. Lighting Power—1999 Edition

The 1999 edition provides single value, whole building, lighting power density requirements for Office, Retail, Education, and Warehouse buildings, and these requirements were used in the simulations. The 1999 edition does not provide single lighting power density values for Food Service, Lodging, or Public Assembly buildings. For these cases, the average whole building lighting power density requirements, for building types falling in each category, was taken to form a single lighting power density requirement. In these cases, the same specific building types used to develop the 1989 edition's lighting power density values were used to derive the 1999 edition's lighting power densities for Lodging and Public Assembly building types. The 1999 edition's Food Service value was derived as the average of the 1999 edition's three whole building food service building type values.

Table 18 shows a comparison of Whole Building lighting requirements under both editions.

TABLE 18.—LIGHTING POWER DENSITY

[Watts/ft²]

Building type	1989 edition	1999 edition
Education	1.79	1.50
Food Service	1.62	1.73
Lodging	1.53	1.73
Offices	1.63	1.30
Public Assembly	1.72	1.53
Retail	2.36	1.90
Warehouse/Storage	0.53	1.20

C. Mechanical Equipment

Single zone cooling and heating systems were used in the analysis. The choice of single zone system in the analysis is expected to provide a lower boundary to our estimate of cooling energy savings. First, this is because the improvement in the 1999 edition's average efficiency requirements, for single zone cooling systems (typically unitary equipment), is relatively small compared to that for typical central system cooling equipment (typically water chillers). This is more obvious when one realizes that shipments of all products to commercial buildings includes residential type cooling products shipped to small commercial buildings. Additionally, modeling single zone systems does not take into account the fact that the 1999 edition has introduced requirements for central system heat rejection equipment, where none existed in the 1989 edition. There is relatively little improvement in heating equipment efficiency requirements, in the 1999 edition, for equipment used in single zone systems (typically furnaces), or central systems (typically boilers). The impact of the 1999 edition on heating energy use will typically be determined principally by changes in heating loads rather than heating equipment efficiency.

1. Cooling Equipment

Cooling equipment efficiencies were developed by weighting the energy efficiency rating for each of 20 categories of single zone cooling equipment in the standard, by an estimate of shipped cooling capacity for each category. The primary source of shipping data was 1998 U.S. Census Data. In the case of the less than 65,000 Btu per hour unitary air source heat pumps and air conditioners, this census data was augmented by our interpretation of Air-Conditioning and Refrigeration Institute and Lawrence Berkeley National Laboratory data on single phase air-conditioners and heat pumps shipped to commercial buildings. Using the weighting information and equipment efficiencies in each edition, the average unitary equipment efficiency requirement for commercial buildings increased 7.5 percent, from an average energy efficiency ratio of from 9.28 to 9.98. This improvement was simulated for all building types except Lodging. For Lodging, it was assumed that the majority of single zone cooling equipment would be packaged terminal equipment. The average efficiency requirement for packaged terminal equipment increased 22 percent, from 8.4 to 10.28, based on a shipped capacity weighting. These efficiencies were used in the Lodging simulations for the respective Standard levels.

2. Space Heating Equipment

No change in heating equipment combustion efficiency is required in the 1999 edition. However, for commercial furnaces, a reduction in the loss through the equipment casing from 1.5 percent to 0.75 percent was modeled to reflect differences in the requirements in the two editions. No change in furnace casing losses was assumed where electric resistance heat was assumed.

3. Economizers

For each building type, simulations were made both assuming economizer operation and not assuming economizer operation. Based on the economizer requirements in each edition and the available cooling equipment shipment data, shipped cooling capacity weights were developed for systems requiring economizer usage in each climate.

4. Service Water Heating Equipment

Service water heating equipment efficiencies increased from 78 percent to 80 percent for most tank-type gas fired water heaters. This was reflected in the input assumptions. We did not account for shipments of residential size water heating equipment (regulated by manufacturing standards under Subpart C of 10 CFR 430) to commercial buildings. While these units may be used in some commercial buildings, increased efficiencies are the result of regulatory actions under 10 CFR 430, not Standard 90.1. Nor did we account for the use of tankless instantaneous water heaters in commercial buildings. Correctly accounting for shipped capacity of both the residential size and tankless equipment to commercial buildings would reduce the average efficiency improvement somewhat, but accurate shipment data to commercial buildings is largely unavailable.

No change in water heater standby loss efficiencies was modeled. For fossil fuel fired equipment, the standby loss efficiencies within a given size category are essentially the same. While a different formulation of the standby loss equations was used in the 1999 edition, there are both standby loss increases and decreases in any given product category. We are unaware of a data base that categorizes this data to permit accurate estimation of a net result. For electric water heaters, there appears to be a reduction in standby loss efficiency in the 1999 edition. However, the Energy Policy and Conservation Act, as amended, does not permit the manufacture or sale of these lower efficiency products. Therefore, there is no predicted impact on actual buildings.

D. Aggregation of Results

Aggregation to a national estimate of energy use is based on energy use intensities (EUI) developed from simulations, under each edition. Aggregation of energy use intensity from the simulations was done as follows: (1) Extract zone-based energy use intensities from simulations; (2) aggregate results by required economizer usage in each climate; (3) map simulation results by climate to 11 geographical areas (augmented census divisions); (4) scale simulation results to existing building stock floor area by building type and census region; (5) weight results for frame and mass wall construction by appropriate building type and census region weights for these types of construction; (6) weight results for heating fuel by augmented census division weights for electric resistance heating usage in commercial buildings (Commercial Building Energy Consumption Survey data); (7) convert energy use intensities by fuel type to site energy, source energy, and energy cost intensities, by building type, and augmented census division; (8) weight energy use intensity results by building construction floor area estimates, by building type and in each augmented census division. The building construction data was derived from the Energy Information Administration's National Energy Modeling System data sets.

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DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. ER02–2126–001]

Consolidated Edison Company of New York, Inc.; Notice of Filing

July 9, 2002.

Take notice that on June 28, 2002, Consolidated Edison Company of New York, Inc., (Con Edison) submitted for filing a revised unexecuted Interconnection Agreement between Con Edison and PSEG Power In-City I, LLC (PSEG Power) making a minor correction to the filing made on June 20, 2002. This filing is made to correct a formatting error in the table of contents of the agreement.

Any person desiring to intervene or to protest this filing should file with the Federal Energy Regulatory Commission, 888 First Street, NE., Washington, DC 20426, in accordance with rules 211 and 214 of the Commission's rules of practice and procedure (18 CFR 385.211 and 385.214). Protests will be considered by the Commission in determining the appropriate action to be taken, but will not serve to make protestants parties to the proceeding. Any person wishing to become a party must file a motion to intervene. All such motions or protests should be filed on or before the comment date, and, to the extent applicable, must be served on the applicant and on any other person designated on the official service list. This filing is available for review at the Commission or may be viewed on the Commission's web site at *http://www.ferc.gov* using the ''RIMS'' link, select ''Docket #'' and follow the instructions (call 202–208–2222 for assistance). Protests and interventions may be filed electronically via the Internet in lieu of paper; see 18 CFR 385.2001(a)(1)(iii) and the instructions on the Commission's web site under the ''e-Filing'' link.

Comment Date: July 19, 2002.

Linwood A. Watson, Jr.,

Deputy Secretary.

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