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LIGHTING TECHNOLOGY SPECIFICATIONS FOR RELIGHTING FEDERAL BUILDINGS

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LIGHTING TECHNOLOGY SPECIFICATIONS FOR RELIGHTING FEDERAL BUILDINGS

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INTRODUCTION

The Federal Energy Management Program (FEMP) of the U.S. Department of Energy has established the Federal Relighting Initiative (FRI) -- a broad-based, multiyear effort to help agencies modernize lighting systems in all Federal buildings and facilities. The theme for this Federal initiative is Relighting for Energy Efficiency and Productivity. Its goal is to encourage the retrofit of high-quality, life-cycle cost effective lighting systems in all Federal buildings. Through the initiative, DOE will provide agencies with technical and management assistance in a number of areas, including project screening and identification, staff training, technology demonstration, utility negotiation support, and direct modernization assistance. In addition, DOE is developing an integrated package of easy-to-use tools to help agency managers with the relighting process:

* A standard Federal process for identifying, characterizing, and prioritizing agency relighting opportunities
* An approach for characterizing the existing lighting in a facility to assist with project design
* A lighting technology screening matrix to quickly focus upon a limited number of appropriate lighting technology options
* Simplified approaches to calculating minimum life-cycle costs for lighting retrofit configurations
* Technology data sheets to assist with technology evaluation
* Equipment and systems specifications that can be employed

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* Equipment and systems specifications that can be employed by these agencies to ensure relighting bids that feature quality lighting systems.

A key element of this initiative is the development of a set of Master Lighting Technology Specifications that permit the designer, specifier, and/or Government Contracting Official to accomplish the following:

1. Identify and understand performance criteria for new, energy-efficient technologies that have been developed for lamps, fixtures, and ballasts, as well as lighting controls and control strategies

2. Understand the influence of the specifications on lighting quality and other related performance characteristics

3. Identify manufacturers that make products that can meet the requirements

DISCUSSION

Under an FRI project, a set of Master Lighting Technology Specifications was developed for use by the Federal sector in relighting buildings. The specifications were to cover all major lighting technologies. The initial set was developed and issued for extensive peer review in December 1991. Extensive comments were received from industry, Federal sector participants (DOD, GSA, NASA, DOE, etc.), national laboratories, professional lighting organizations, private lighting professionals, and recognized experts in the lighting community. The document underwent extensive revision and was reissued in June 1992 for a second round of peer review.

The current FRI Lighting Technology Specifications are organized into two sections: (1) Technical Notes and (2) Master Specifications. The Technical Notes contain explanations that enable the users to understand the background and reasons for specification requirements. The Master Specifications are organized in the Construction Specifications Institute (CSI) format and are intended to form the basis for competitive bidding and contracting to undertake relighting initiatives.

1. Technical Notes

The Technical Notes have been developed to assist the designer, specifier, or government representative in specifying cost-effective energy efficient lighting technologies contained in the Master Specification. Technical Notes include background information, recommended requirements for bidders, a glossary, a discussion of products, and a section covering commissioning and

maintenance and operations. They deal with common misapplication of technologies and are not intended to be used as design guidelines or replace professional design expertise. They are not part of the actual Master Specifications.

The technical notes portion of the specification tool first provides background and perspective to the users. Federal energy managers have widely varied backgrounds experience and training. The Technical Notes are designed to present a broad overview of lighting issues to provide a "leveling" effect for the agency team and users thus ensuring at least a minimum level of understanding for the team members. This understanding of terms and technical issues will allow the managers to make more informed decisions when dealing with bidders and suppliers. The notes provide a background that will be useful to managers at all levels and provide guidance for preparing the project specifications as well as detail and justification for specific elements and sections of the specification.

The Technical Notes also provide some guidance and recommendations about what should be required in a contractor submittal. The recommended requirements include documentation on computer generated plots of illuminance, for example, to determine that maintained light levels are being considered rather than just initial light levels. This will help ensure that maintained levels do not fall below the minimum requirements in critical areas.

The Technical Notes include a glossary of terms to provide users explanations and references when using and editing the Master Specifications. The glossary includes such terms as Ballast Efficacy Factor, Ballast Factor, Color Rendering Index, and total harmonic distortion. While the list is not totally comprehensive, it does provide the basics and additional references are given to provide sources for additional terms or more detailed definitions.

In the "Products" section are discussions of fluorescent luminaires, reflectors, ballasts, and lamps. These cover broad areas of what to evaluate and expect in using and specifying each of the various products required for a project. The discussion on reflectors is particularly detailed and includes a recommended procedure for measuring their performance when installed.

Also in the "Products" section is a "Manufacturers Product Certification" form. This will enable manufacturers to be included on the List of Acceptable Manufacturers by certifying that a specific product meets the performance requirements of the Master Specifications in all aspects. This List of Acceptable Manufacturers will be maintained by the Department of Energy, and the updated list can be obtained by the specification writer on request. DOE will keep the list updated as new certifications are received from the manufacturers.

The final discussion in the Technical Notes briefly covers the basic aspects of commissioning and operations and maintenance

requirements. Since the commissioning area for lighting often receives less emphasis then the equipment installation, it needs to be discussed and implemented as part of the project. A strong, comprehensive operations and maintenance manual is vital if the system is to continue to operate as designed (and commissioned) and achieve the long-lasting energy efficiency desired.

The notes are intended to be used by the Federal manager to provide background; in conjunction with other FRI material, the notes will enhance their understanding of the entire project as well as the requirements for specifications development.

2. Master Specifications

The Master Specifications are intended to be used in preparing project specifications at the conclusion of the design process, which is the eleventh step in the FRI process (see fig 1), preceded by economic studies and existing condition surveys which verify the building as a suitable candidate for relighting. If the agency does not have sufficient lighting design expertise in-house, the project managers are expected to add such expertise to the project team to assist at several stages in the process; one of these stages is preparing project specifications.

The master lighting specifications are intended to provide default values and a common qualitative and economic benchmark for all Federal projects. If detailed analysis and specific project requirements favor different technologies or strategies, an appropriately qualified lighting professional may modify the specifications. While the specifier can modify the specifications to include products or technologies not currently contained, this should only be done following a thorough evaluation of energy conservation goals, lighting quality, and life cycle cost analysis. Lighting technologies which reduce energy further or cost less than those included in these specifications may do so at the expense of lighting quality. In the absence of such technical justifications, however, the nature of the FRI process discourages capricious changes.

The characteristics of the technologies and strategies included in the specifications are intended to define a minimum level of acceptable standards for product quality and lighting quality. The Master Specifications comprise only one element in the FRI integrated tool kit to address lighting design. The development and use of these specifications is intended to spur product development by providing a large market for high quality, energy efficient technologies acceptable to users.

The specifications section contains state-of-the-art, energy efficient interior fluorescent lighting technologies that are intended to fulfill the general relighting requirements for existing Federal facilities as part of the FRI. Currently, the specifications include a range of components and product performance characteristics for typical 4' fluorescent luminaires,

reflectors, lamps, and ballasts. The subsequent updates to these specifications will incorporate the energy efficient lighting technologies of compact fluorescent, exit signs, occupant sensors, daylight sensors, time controls, and HID sources.

The specifications section has been developed as a combination of descriptive, performance, and reference standard specifications in order to accommodate the varying levels of technological development and testing. Reference standards have been utilized when applicable to establish acceptable performance characteristics. The specified product requirements are intentionally stringent in order to achieve maximum value for Federal expenditure and to encourage research and development in energy efficient products.

To be included in the Master Specifications, a product needs to meet several criteria, including the following:

* wide application potential
* maintenance of minimum standards of lighting quality
* energy efficiency
* cost-effectiveness
* production by three (3) U.S. manufacturers.

Many manufacturers of conventional products, even those who had previously supplied products for government facilities, will not be able to meet these specifications without improvement in the performance of their products. These specifications will also be updated on a regular basis in order to capture the benefits of technology and market advancements.

To further enhance the utility of the specifications, editing comments providing instruction to the specifier are inserted as capitalized statements or italicized comments; these are to be removed by the specifier during preparation of the specification. Additionally, the Master Specifications reference the List of Acceptable Manufacturers. This list will contain the manufacturers' names and product designations of those products that are certified by their manufacturer as being in compliance with specific portions of the Master Specifications.

SUMMARY:

The Department of Energy's Federal Relighting Initiative, under the Federal Energy Management Program (FEMP), now offers a comprehensive process to assist agencies in meeting the DOE energy mandate that states that Federal facilities shall use 20% less energy by the year 2000, based on 1985 consumption, and shall improve lighting to increase productivity with relighting projects.

The process provides a systematic approach in the screening, selection, design, implementation and evaluation of relighting projects. The Master Specifications help assure the acquisition of high-quality, life-cycle cost-effective lighting systems.

The process begins with the screening of the agency's building stock to identify the most promising relighting candidates and concludes with implementation support and system performance assessment. The tools developed by FRI are designed to assist agencies during each phase of the relighting process. The tools are based upon the Federal life-cycle cost approach, thereby complying with 10 CFR, part 436, and the Federal life-cycle cost requirement.

The specifications are one of the main tools in the FRI process and are intended to promote technologies which exhibit the highest level of performance and quality which is typically cost justified. To ensure adequate cost competition, that level of performance is set at the highest level that will still allow three U.S. manufacturers to compete. As products improve, the performance standards will be set at increasingly higher levels.

The specifications contain very stringent criteria and will require manufacturers to certify that their products meet the specifications when they submit bids on projects. The specifications are designed to assist the Federal manager or specifier in quickly developing solicitation packages that will result in Federal buildings being relighted in the most life-cycle cost effective manner with the highest quality energy efficient lighting available on the market. The ultimate goal of the FRI is to improve energy efficiency and productivity.

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Federal Relighting Process

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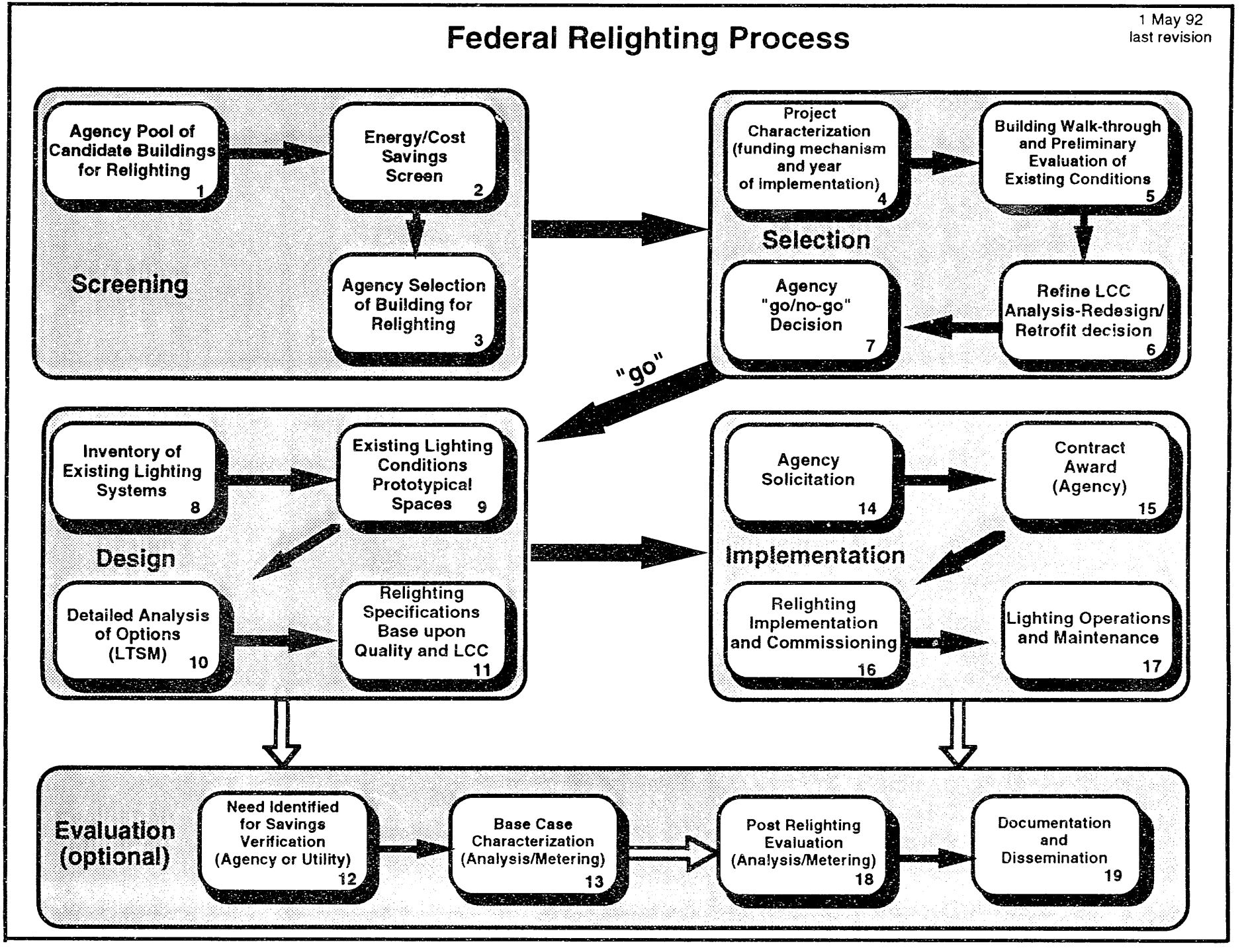

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