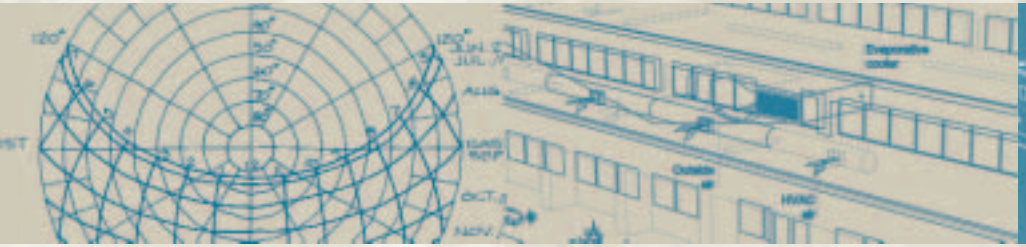
LANL Sustainable Design Guide



Los Alamos
NATIONAL LABORATORY

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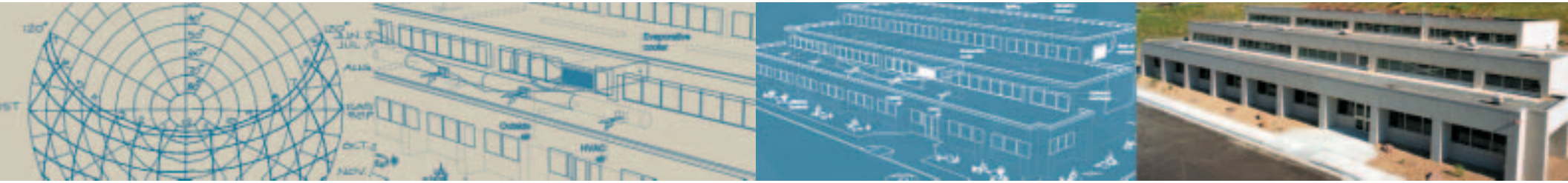

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Produced under the direction of
the Site Planning and Construction
Committee

by the

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Foreword

The principle of sustainability provides us with a path to balance protecting the environment with our other mission responsibilities. We should feel confidence and pride in our use of land, space, energy, and renewable and sustainable resources.

This year the Department of Energy formally embraced sustainable design in DOE Order 430.2A. The Order provides us the direction to engineer and build sustainable facilities. Successful private-sector and government facility projects committed to sustainable principles can be observed throughout the country. The numerous examples assure us that success in this endeavor is achievable and desirable.

This *LANL Sustainable Design Guide* enhances our ability to inform the design and construction community about the added value that sustainable design can provide in architecture, facility construction, operation, and maintenance. I feel you will find this guide to be a valuable tool for improving the way we manage our Laboratory's natural and built environment.

James L. Holt
Associate Director for Operations
Los Alamos National Laboratory

Preface

By Dr. J. Douglas Balcomb, *Research Fellow, National Renewable Energy Laboratory*

These guidelines, focused on the issues and design process for energy-efficient buildings at the Los Alamos National Laboratory (LANL), provide a powerful overview of important ways that LANL can make a difference in the future sustainability of the Laboratory and the nation. As a 27-year staff member of LANL, I urge the Laboratory to heed them wisely.

Energy efficiency has historically and rightfully been considered the most important attribute of a sustainable building. Although the impact on the environment from constructing the building can be significant, the accumulated environmental impact of energy consumption, which repeats year after year throughout the lifetime of the building, usually adds up to several times the consequences of its initial construction. These impacts include on-site emissions that result from burning fuel and off-site emissions at the power plant as a consequence of generating the electricity used in the building. Furthermore, there is more at stake than just saving energy and reducing emissions – good design can improve the productivity of staff who work in Lab facilities, improve creativity, and increase health.

Los Alamos is a uniquely suitable facility for instituting sustainable design for several reasons. The climate is particularly conducive to climate-sensitive design, sometimes called passive solar design. The potential for energy saved per square foot ranks as one of the highest in the nation. The Los Alamos climate is favorable to passive solar strategies, such as daylighting, natural cooling, and solar heating. Lighting is often the single most expensive energy load of a commercial building. Using natural light instead of electric lighting systems in LANL buildings is an attractive solution to save energy costs.

Although there may be a few hot days, summer daytime temperatures are usually in the comfort range and all evenings are cool. With good attention to solar gain control, minimizing internal heat gains by effectively using daylighting, and perhaps some pre-cooling of the building using cool night air, most of the cooling load can be avoided.

Few locations in the United States exhibit the combination of high heating loads resulting from the cold winter temperatures and the presence of ample winter sun that Los Alamos experiences. Daytime temperatures on sunny winter days are often pleasant, but plummet at night. In an office building with typical daytime internal gains, little if any heat is needed on winter days. This means that those considering passive solar designs should look to indirect system approaches to augment daytime direct gain – thermal storage walls and sunspaces in particular. These designs carry over heat from day to night effectively.

Another way that Los Alamos is unique is the low utility rates paid for natural gas, negotiated from the beginning years of the Lab. Unfortunately, this can make it difficult to justify any added expense to save energy. This picture changes if we take a national perspective – domestic natural gas is a limited resource that has passed its peak production rate. Sustainability must be viewed from a wider perspective than the Pajarito Plateau.

Many of the recommendations in this guide, particularly about passive solar design, stem from work that actually began at LANL. Jim Hedstrom, Stan Moore, Bob MacFarland, and I started the Los Alamos passive solar group. The work the solar group completed between 1974 and 1984 was the foundation for tools and documents that have become universally standard references for passive solar building design. I have continued to work to advance state-of-the-art climate sensitive building design through my work at the National Renewable Energy Laboratory.

One of the most important findings of our experience is that applying a whole-building design process to design and construct sustainable buildings results in buildings that cost no more to construct, yet use much less energy to operate. Significantly, peak electrical loads are also reduced. One needs to look at the final design as a package, comparing the end product with a fair reference case, rather than try to take it apart piece by piece, trying to justify each individual step along the way. The whole is greater than the sum of the parts.

It has been a distinct pleasure to help in the preparation of this *Sustainable Design Guide.* This guide is uniquely tailored to LANL's site, climate, and mission. I am heartened to see LANL continue to be a leader in sustainable design. So many buildings, and so many people, have already benefited from the work in this field that began there. As we come full circle, so many more will benefit from the Laboratory's willingness to implement the evolving design strategies we have recommended in this guide. It couldn't possibly be more appropriate for the Laboratory charged to protect the nation's security to lead the way in setting a precedent for energy-efficient building design.

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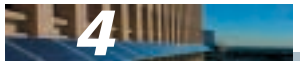

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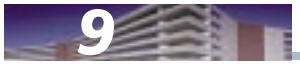
Chapter Seven: **Landscape Design and Management**

Chapter Eight: **Constructing the Building**



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