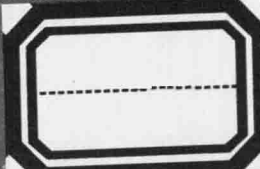


LEED-New Construction Project Management

Vijaya Yellamraju

LEED-新型建造项目管理





A GreenSource BOOK 影印版

LEED-NEW CONSTRUCTION PROJECT MANAGEMENT

VIJAYA YELLAMRAJU

LEED—新型建造项目管理



哈尔滨工业大学出版社
HARBIN INSTITUTE OF TECHNOLOGY PRESS

黑版贸审字08-2014-025号

Vijaya Yellamraju

LEED-New Construction Project Management

ISBN 978-0-07-174445-4

Copyright © 2011 by McGraw-Hill Education.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including without limitation photocopying, recording, taping, or any database, information or retrieval system, without the prior written permission of the publisher.

This authorized English reprint edition is jointly published by McGraw-Hill Education (Asia) and Harbin Institute of Technology Press Co. Ltd. This edition is authorized for sale in the People's Republic of China only, excluding Hong Kong, Macao SAR and Taiwan.

Copyright © 2014 by McGraw-Hill Education (Asia), a division of McGraw-Hill Education (Singapore) Pte. Ltd. and Harbin Institute of Technology Press Co. Ltd.

版权所有。未经出版人事先书面许可，对本出版物的任何部分不得以任何方式或途径复制或传播，包括但不限于复印、录制、录音，或通过任何数据库、信息或可检索的系统。

本授权英文影印版由麦格劳-希尔（亚洲）教育出版公司和哈尔滨工业大学出版社合作出版。此版本经授权仅限在中华人民共和国境内（不包括香港特别行政区、澳门特别行政区和台湾地区）销售。

版权 © 2014 由麦格劳-希尔（亚洲）教育出版公司与哈尔滨工业大学出版社有限公司所有。

本书封面贴有 McGraw-Hill Education 公司防伪标签，无标签者不得销售。

图书在版编目（CIP）数据

LEED-新型建造项目管理 = LEED-New construction project management: 英文 / (美) 耶拉姆拉什 (Yellamraju, V.) 著. — 哈尔滨: 哈尔滨工业大学出版社, 2014.3

ISBN 978-7-5603-4507-9

I. ①L… II. ①耶… III. ①建筑工程-工程项目管理-英文 IV. ①TU71

中国版本图书馆CIP数据核字（2014）第000219号



责任编辑 杨 桦

出版发行 哈尔滨工业大学出版社

社 址 哈尔滨市南岗区复华四道街10号 邮编 150006

传 真 0451-86414749

网 址 <http://hitpress.hit.edu.cn>

印 刷 哈尔滨市石桥印务有限公司

开 本 787mm × 960mm 1/16 印张 31.25

版 次 2014年6月第1版 2014年6月第1次印刷

书 号 ISBN 978-7-5603-4507-9

定 价 146.00元

（如因印刷质量问题影响阅读，我社负责调换）

LEED-NEW CONSTRUCTION PROJECT MANAGEMENT

VIJAYA YELLAMRAJU, LEED AP



New York Chicago San Francisco Lisbon London Madrid
Mexico City Milan New Delhi San Juan Seoul
Singapore Sydney Toronto

McGRAW-HILL'S GREENSOURCE SERIES

Attmann

Green Architecture: Advanced Technologies and Materials

Gevorkian

Alternative Energy Systems in Building Design

Solar Power in Building Design: The Engineer's Complete Design Resource

GreenSource: The Magazine of Sustainable Design

Emerald Architecture: Case Studies in Green Building

Haselbach

The Engineering Guide to LEED—New Construction: Sustainable Construction for Engineers, 2d ed.

Luckett

Green Roof Construction and Maintenance

Melaver and Mueller (eds.)

The Green Building Bottom Line: The Real Cost of Sustainable Building

Nichols and Laros

Inside the Civano Project: A Case Study of Large-Scale Sustainable Neighborhood Development

Winkler

Recycling Construction & Demolition Waste: A LEED-Based Toolkit

Yellamraju

LEED—New Construction Project Management

Yudelson

Green Building Through Integrated Design

Greening Existing Buildings

About GreenSource

A mainstay in the green building market since 2006, *GreenSource* magazine and GreenSourceMag.com are produced by the editors of McGraw-Hill Construction, in partnership with editors at BuildingGreen, Inc., with support from the U.S. Green Building Council. *GreenSource* has received numerous awards, including American Business Media's 2008 Neal Award for "Best Website" and 2007 Neal Award for "Best Start-up Publication," and FOLIO magazine's 2007 Ozzie Awards for "Best Design, New Magazine" and "Best Overall Design." Recognized for responding to the needs and demands of the profession, *GreenSource* is a leader in covering noteworthy trends in sustainable design and best practice case studies. Its award-winning content will continue to benefit key specifiers and buyers in the green design and construction industry through the books in the *GreenSource* Series.

About McGraw-Hill Construction

McGraw-Hill Construction, part of The McGraw-Hill Companies (NYSE: MHP), connects people, projects, and products across the design and construction industry. Backed by the power of Dodge, Sweets, *Engineering News-Record (ENR)*, *Architectural Record*, *GreenSource*, *Constructor*, and regional publications, the company provides information, intelligence, tools, applications, and resources to help customers grow their businesses. McGraw-Hill Construction serves more than 1,000,000 customers within the \$4.6 trillion global construction community. For more information, visit www.construction.com.

To Sai, my parents, and my family.

About the Author

Vijaya Yellamraju, LEED AP, is Principal at Green Potential, a multinational *green building* and LEED consulting firm based in Austin, Texas. She is responsible for leading the technical and operational aspects of the business, providing direction to developers, architects, contractors, and other project team members for successful integration of green strategies into the design process. Ms. Yellamraju has worked on numerous green and LEED projects, with a focus on multifamily and commercial buildings. She is a trained architect and earned an M.S. in architecture, specializing in *Energy and Sustainable Design*. She has several years of experience in the architecture and construction industries and has managed many multimillion-dollar projects in the United States and India.

The **U.S. Green Building Council®** is committed to a prosperous and sustainable future for our nation through cost-efficient and energy-saving green buildings. With a community comprising 78 local affiliates, more than 20,000 member companies and organizations, and more than 140,000 LEED® Professionals™, USGBC® is the driving force of an industry that is projected to contribute \$554 billion to the U.S. gross domestic product from 2009 to 2013. USGBC leads an unlikely diverse constituency of builders and environmentalists, corporations and nonprofit organizations, elected officials and concerned citizens, and teachers and students. USGBC is the developer of the LEED green building certification program and the convenor of the Greenbuild® International Conference & Expo.

LEED®—an acronym for the phrase “Leadership in Energy and Environmental Design”—is a registered trademark of the U.S. Green Building Council. The LEED green building certification program is the nationally accepted benchmark for the design, construction, and operation of green buildings.

FOREWORD

JERRY YUDELSON, PE, MS, MBA, LEED AP BD+C/O+M

In the second half of the 1990s, the nascent U.S. Green Building Council (USGBC) began to formulate a new rating system that would define a *green building* so that building teams could actually design and construct one. That system, piloted in 1998 and 1999, was introduced in March 2000 as LEED for New Construction (LEED-NC), version 2.0. In the annals of sustainable design, this date will be remembered for a long time. It was a revolution in green building thinking and a major incentive for progressive architects, engineers, and contractors to push forward with new initiatives in creating sustainable buildings.

Within the span of a decade, the product of that group effort, the LEED®—Leadership in Energy and Environmental Design—green building rating system, had become by 2010 the de facto national sustainable design standard in the United States and had been formally adopted as the national certification standard by green building councils in Canada, India, Italy, and several other countries. By insisting on a rigorous, third-party-verified minimum standard, LEED effectively took the guesswork out of designing and certifying a green building, one that would use fewer scarce natural resources and generate less waste than a conventional building and be more *user friendly* in the process.

LEED defined a major challenge to the conventional practice of architecture, engineering, and construction. It said, effectively, that a *standard* building, one built merely to meet building code minimums, was *not good enough* to prevent unnecessary resource depletion and environmental contamination. As uncomfortable as this was initially for the construction industry professions, by 2005 many large architecture, engineering, and building firms had begun to compete on the basis of how many LEED-registered projects they had begun and how many LEED Accredited Professionals they employed.¹ By 2010, it was impossible for most design and construction firms to compete for sustainable design projects without having completed a substantial number of

LEED-certified projects. Effectively, within 10 years, LEED certification had overwhelmed most initial opposition from building owners, developers, architects, engineers, and builders to become the widely expected outcome of a high-performance construction project.

I first became aware of the USGBC during 1997, helped organize the first USGBC chapter in the Pacific Northwest in 1998, and attended my first USGBC national meeting in 1999. At that time, all attendees could introduce themselves to each other during the course of a few hours, and they did. In 2000, I visited my first LEED-certified project, the LEED Platinum Chesapeake Bay Foundation headquarters in Annapolis, Maryland. By 2001, it had become impossible for LEED members to self-introduce themselves at national meetings, as the USGBC enjoyed the beginnings of a decade of rapid growth that reached 20,000 corporate members by 2008. Contrast those early meetings of a small cabal of green building zealots to the USGBC's 2009 annual *Greenbuild* conference and expo, attended by more than 25,000 people, and you will see that what was a fringe movement 15 years ago has become the *new normal* for the work of designing, constructing, owning, and operating commercial buildings and homes.

In 2000, I helped organize a green building consulting group, one of the first in the country, within a large electric utility in the Pacific Northwest. Our group managed the certification application for the first LEED Gold project in the western United States (and only the second in the country) and the first LEED-certified project in Oregon. In 2001, I became one of the original ten national LEED trainers for the USGBC. At the time, we had a rating system that included requirements for achieving various credits, but no detailed manual on how to proceed and very little in the way of organized procedures. All LEED project documentation was submitted in hard-copy form, in very large three-ring binders, to the USGBC and was then sent to outside reviewers, who were not identified to project participants or allowed to communicate with anyone on the design/construction team. By the end of 2004, only 118 projects had been officially certified, and many professionals complained about the cost and complexity of LEED certification.²

Starting in 2001, the USGBC began certifying LEED Accredited Professionals (LEED APs), who had to demonstrate knowledge of one of the four major LEED rating systems, particularly LEED-NC, laying the groundwork for the rapid expansion of the LEED certification process. Mighty oaks from little acorns grow—by 2010, more than 150,000 LEED APs!

By early 2010, LEED certification had grown tremendously! More than 5,000 projects had already been certified, and more than 25,000 had registered to receive eventual certification.³ LEED Platinum (the highest rating) projects now span the globe, from the United States and Canada, to Dubai (UAE), India, Australia, Brazil, China, Spain, Korea, Saudi Arabia, Sweden, and Germany.⁴ Leading U.S. multinationals routinely request LEED-certified office space in other countries and often build their own U.S. headquarters now to LEED Gold and Platinum standards.⁵

In 2009, my firm helped to certify the first LEED retail project in Arizona, using the LEED for Core & Shell (LEED-CS) rating system, one that I had helped develop dur-

ing my tenure on the national *core committee* for LEED-CS from 2004 to 2006. By 2009, certifying a project under a LEED system had become a well-organized process, and the USGBC had spun off the Green Building Certification Institute to manage the system for project certification and LEED AP accreditation.

LEED version 3, introduced in 2009, contained many upgrades and adjustments that have made LEED a workable method for certifying green building performance claims. Nevertheless, based on my own experience, LEED certification is still an intricate dance, one with its own melodies, lyrics, scales, steps, and rules of engagement. Even as more than 150,000 LEED APs have joined the roster since the first 100 (of which I was one) were accredited in 2001, the process of communicating LEED requirements to building teams remains one of hands-on engagement.

So, the question remains: how do you actually make the LEED certification process work? My firm is currently managing the LEED certification for a new 250,000-ft² corporate headquarters building in Arizona, and I can attest to the fact that the system is still cumbersome in actual application, requiring continual monitoring and management through the entire design, construction, and start-up process.

That's why a book such as this one is badly needed.

Each project team struggles with managing the design, construction, and certification process, as LEED requirements and submittals are laid on top of an already intricate building process. Even when teams are using BIM (building information modeling) tools such as Revit®, the LEED process is not well integrated with the balance of the building team's work. For this reason, many building teams find it useful to hire specialists to manage the LEED certification process, just as they might hire experts in geotechnical analysis, vertical transportation, code compliance, and cost estimating. Even when the work is done *in-house* at larger architectural firms, the LEED project management specialist has typically been hired just to perform that function.

In 2008, I wrote *Green Building Through Integrated Design* (McGraw-Hill) as an attempt to show how to manage an integrated design process through asking the right question at the right time, so as not to preclude good solutions from consideration. I've also written extensively on the use of project *eco-charrettes* as an early-stage design tool to bring sustainable design considerations to the forefront early enough in the process to have an influence on architectural and engineering choices. But nowhere in my research and writing have I tackled how to manage the LEED process in such detail and so carefully laid out a manner as in *LEED—New Construction Project Management*, a masterful effort by the Texas-based expert Vijaya Yellamraju.

Judging by the numbers, most of the 155,000-plus LEED Accredited Professionals have yet to take a project all the way to LEED certification (5,000 projects certified by April 2010), so they truly need a good guide to LEED project management.⁶ This book should fill that requirement for the foreseeable future. It's worth a place on every LEED management professional's bookshelf.

Notes

¹ See, for example, my book, *Marketing Green Buildings: Guide for Engineering, Construction and Architecture*, 2006 (Taunton, GA: The Fairmont Press), 128.

² USGBC LEED Matrix, personal communication, USGBC staff, June 2010.

³ Ibid.

⁴ www.usgbc.org/LEED/Project/CertifiedProjectList.aspx (accessed June 3, 2010).

⁵ www.environmentalleader.com/2009/04/22/mcdonalds-hq-achieves-leed-platinum-status/ describes how McDonald's built its own LEED Platinum headquarters building in Oak Brook, IL in 2009 (accessed June 3, 2010).

⁶ http://www.gbci.org/org-nav/announcements/10-04-11/GBCI_Certifies_5_000th_LEED_Project.aspx (accessed June 3, 2010).

ACKNOWLEDGMENTS

This book would not have been possible without the guidance, contribution, advice, and encouragement of many friends, family members, peers, and colleagues.

I am grateful to the team involved with Harvard Divinity School's Rockefeller Hall—Ralph DeFlorio, Nancy Rogo Trainer, Cecilia Wan, and Nathan Gauthier—for sharing information and granting permission to feature the school as a case study. I am also thankful to the team involved with GRE headquarters, specifically Michael Finley and Douglas Pierce, for granting me access to their project. I would also like to acknowledge Barbara Erwine, Maggie Santello, and Tom Paladino at Paladino and Company for their case study contribution. I am also thankful to my colleagues—Dan Alexander, Sam Pate, Lindsey Rose, Anica Landreneau, and Don Brooks—for extending their support.

I would like to specially thank my friends—Shilpa Malik for inspiring me to write a book in the first place; Karen Poff for patiently reviewing my manuscript and providing valuable feedback that helped shape the book; Laura Carter for designing the cover photograph in an amazingly short time frame; Varun Chandra for offering timely advice regarding the content of the book; and Shilpi Burman and Rohit Dhamankar for their encouragement as I worked my way through the book.

I am also deeply indebted to my family—parents, parents-in-law, siblings, and siblings-in-law—for their support throughout the book-writing process. They were my *cheerleaders*. I am also thankful to my husband, Kaushik Valluri, for his unconditional support, love, advice, encouragement, and belief in me.

Finally, I am grateful to Joy Bramble at McGraw-Hill for responding to my proposal within hours of receiving it and agreeing to publish my book. Her encouragement and direction were invaluable throughout the process of writing this book. I would also like to thank Stephen Smith at McGraw-Hill and Nancy Dimitry at D&P Editorial Services for patiently responding to my queries and helping me through the editorial and production processes.

Last but not least, it is a privilege to have the book open with a Foreword by renowned green building authority Jerry Yudelson. I am very thankful to Jerry for his kind words.

Vijaya Yellamraju, LEED AP

LEED-NEW CONSTRUCTION PROJECT MANAGEMENT

CONTENTS

Foreword	xv
Acknowledgments	xix
PART 1 PROCESS	1
Chapter 1 Introduction	3
From <i>Green</i> to <i>LEED</i>	3
The Fundamentals of the LEED Rating System	6
LEED-NC Credit Categories	8
Impact of LEED Buildings	13
Energy Performance	13
Financial Returns	14
Occupant Productivity	15
CO ₂ Emissions Reduction	15
What This Book Is About	17
What This Book Is Not	18
Why Manage LEED Projects Differently?	18
How to Use This Book	20
Part 1: Process	21
Part 2: Implementation	22
Notes	23
Chapter 2 LEED Project Management Process	25
Introduction	25
Process	26
The Traditional Architectural Design Process	26
The Integrated Design Process	28
The GBCI LEED Certification Process	30
The LEED Project Management Process	35
People	39
Project Team	39
LEED Project Team Roles and Responsibilities	40
Planning	62
Schedule	62
Budget/Costing LEED	63
Quality	65
Notes	66

Chapter 3 Stage I: Project Definition and Goal Setting 67

Introduction	67
Step 1: Collect and Compile Preliminary Data	69
Activity 1.1—Identify Owner's Project Requirements	69
Activity 1.2—Collect Preliminary Site Data	71
Activity 1.3—Gather Preliminary Project Data	74
Activity 1.4—Perform LEED Occupancy Calculations	76
Activity 1.5—Create Project Team Directory	77
Activity 1.6—Obtain Preliminary Project Schedule	77
Activity 1.7—Research <i>Green</i> Incentives	78
Activity 1.8—Compile All Data	79
Step 2: Prepare a Preliminary LEED Assessment	80
Activity 2.1—Review Credit Requirements to Assess Feasibility	80
Activity 2.2—Identify Potential Implementation Strategies	82
Activity 2.3—Identify Next Steps	83
Activity 2.4—Prepare a Credit Responsibility Matrix	83
Step 3: Register the Project on LEED Online	87
Activity 3.1—Register Project on <i>LEED Online</i>	87
Activity 3.2—Assign Credit Responsibilities Online	89
Step 4: Organize a LEED Vision Workshop	90
Activity 4.1—Prepare Workshop Outline	90
Activity 4.2—Facilitate the Workshop	91
Step 5: Prepare a LEED Project Workbook	96
Activity 5.1—Update Preliminary Documents	96
Activity 5.2—Prepare LEED Project Workbook	96
Summary	97
Notes	97

Chapter 4 Stage II: Design Phase Integration 101

Introduction	101
Schematic Design (SD)	
LEED Phase	103
SD LEED Phase	
Step 1: Perform Credit Analyses	104
Activity 1.1—Perform Credit Calculations	104
Activity 1.2—Prepare Energy Simulation Model	108
Activity 1.3—Perform Lighting Analyses	112
Activity 1.4—Perform Ventilation and Thermal Comfort Analyses	114
SD LEED Phase	
Step 2: Research and Identify <i>Green</i> Products	118
Activity 2.1—Research and Identify <i>Green</i> Products	118
SD LEED Phase	
Step 3: Integrate <i>Green</i> Requirements into Design	123
Activity 3.1—Prepare a Cost-Benefit Analysis	123

Activity 3.2—Organize an SD-Phase LEED Coordination Meeting	125
Activity 3.3—Integrate LEED Credit Requirements into Drawings	126
SD LEED Phase	
Step 4: Review Schematic Design Drawings	127
Activity 4.1—Review SD Drawings	128
Activity 4.2—Provide Review Feedback	128
Design Development (DD)	
LEED Phase	130
DD LEED Phase	
Step 5: Update Credit Analyses and Drawings	131
Activity 5.1—Update Credit Analyses and Drawings	131
Activity 5.2—Begin Online Documentation	132
DD LEED Phase	
Step 6: Prepare for Construction Phase	133
Activity 6.1—Review Budget to Set Targets for MR Credits	133
Activity 6.2—Prepare <i>Green</i> Specifications	135
Activity 6.3—Prepare LEED Construction Reporting Forms	138
DD LEED Phase	
Step 7: Develop Building Management Policies	146
Activity 7.1—Develop Management Policies	146
Activity 7.2—Identify Innovation Opportunities	147
DD LEED Phase	
Step 8: Review Design Development Drawings	149
Activity 8.1—Review DD Drawings	149
Activity 8.2—Conduct a DD Phase LEED Coordination Meeting	151
Construction Documents (CD)	
LEED Phase	152
CD LEED Phase	
Step 9: Prepare Documentation for <i>Design Credits</i>	153
Activity 9.1—Update Credit Analyses, Drawings, and Specifications	153
Activity 9.2—Finalize <i>Innovation</i> Credits Documentation	154
Activity 9.3—Complete Online Credit Forms	155
Activity 9.4—Prepare Exhibit Drawings for Submission	155
CD LEED Phase	
Step 10: Submit to GBCI for Design Review	156
Activity 10.1—Review CD Drawings and Specifications	156
Activity 10.2—Review LEED Online Documentation	156
Activity 10.3—Complete Project Information Forms on LEED Online	157
Activity 10.4—Submit Credits for Preliminary Design Phase Review	158
Activity 10.5—Respond to GBCI's Preliminary Design Review Comments	159
Activity 10.6—Accept or Appeal Final Design Review Comments	159
Summary	159
Notes	164