

# **BUILDING SYSTEMS ANALYSIS AND RETROFIT MANUAL**



**SHEET METAL AND AIR CONDITIONING CONTRACTORS'  
NATIONAL ASSOCIATION, INC.**

[www.smacna.org](http://www.smacna.org)

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SECOND EDITION – MARCH, 2011



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by

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## FOREWORD

This second edition updating and revision of the Retrofit manual comes at a time when green building guidelines, standards and codes are either recently finished or nearing completion. These guidelines, standards and codes are markers on the road to a sea change toward new approaches in new building construction. While these new green guidelines, standards and codes also apply to major renovation of existing buildings the focus is on new construction and little has been published to address the much larger issue of energy efficiency in existing buildings.

Historically, new buildings have added less than two percent to the total inventory of commercial buildings in the United States on an annual basis. For meaningful energy use reductions to occur on a national scale, the energy efficiency of thousands of existing buildings must be improved significantly. For the United States to make major progress in reducing its national energy consumption, most, if not all of the existing buildings must use far less energy.

Characteristics of all the green codes and standards are that public transportation be accessible nearby and that new land—greenfields—development is discouraged. Existing buildings are often located near public transportation and development typically occurs on a building's existing footprint. These two "greening" drivers may combine with basic economic factors to produce a compelling incentive for many prospective building owners to choose renovation of an existing building over the construction of new facilities.

The other factors that will help drive the retrofit and upgrade of existing buildings is the rising cost of energy and fuel. As other countries compete more fervently for the world's available fuels, higher prices are inevitable. Payback periods and return on investment intervals will shrink sufficiently to more easily justify capital outlays on the most energy efficient buildings; resulting in modifications to building envelopes, HVAC, plumbing and electrical systems.

The members of the *Building Systems Analysis and Retrofit Manual* task force have shared their expertise in the belief that other contractors will consider and enter the promising field of retrofitting and upgrading existing buildings. Readers of this manual are encouraged to submit additional thoughts and ideas to SMACNA's Technical Resources staff to further add to the building science and art presented in this manual.

SHEET METAL AND AIR CONDITIONING CONTRACTORS'  
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## **CHAPTER 1**

# **INTRODUCTION**

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## 1.1 RETROFIT CONTRACTOR REQUIREMENTS

Contractors interested in the retrofit market should consider taking on the role of general contractor (GC). Building owners will prefer one point of contact and it needs to be the retrofit contractor. The retrofit contractor should arrange for and coordinate any subcontracting work needed to complete all the upgrades of the retrofit project. Many retrofit projects will require drawings that are sealed by a registered professional engineer (PE). If a PE is not employed by your firm, consider establishing a business relationship with one.

The costs of retrofit projects will have to be justified to the owner. Become familiar with return on investment (ROI) and life-cycle cost (LCC) analysis by reading the chapter on that topic in the SMACNA's *Energy Systems Analysis and Management* manual. An excellent resource for computer programs related to building energy and retrofit analysis can be found on the Department of Energy (DOE) website. Use one of the online computer programs to show the owner the impact of recommended retrofits. Keep it simple. Explain and show the operational and reduced maintenance benefits, life-cycle costs, monthly and annual energy or water savings, and return on dollars invested in building upgrades.

## 1.2 RETROFIT MARKET

The retrofit market is a multibillion dollar opportunity that has great upside potential as building owners become familiar with concepts such as sustainability, green building, energy savings, and commissioning. Take a look at the existing buildings in your community and service area. What is the general age and condition of those buildings?

In the commercial market retrofit opportunities are most likely to arise during or because of the following events: equipment failures, equipment obsolescence, energy savings initiatives, building purchases, tenant improvements, rebuilding, and building renovation.

### 1.2.1 Equipment Failure

Equipment failure accounts for over 85 percent of the retrofit market. Repairing or replacing equipment is an opportunity to expand into other retrofit opportunities. How the customer perceives the results and is treated will dictate whether this is a one-time or an ongoing business relationship with recurring opportunities.

### 1.2.2 Equipment Obsolescence

The size of the equipment obsolescence market is unknown since it falls in both categories of equipment failure and energy savings. Equipment obsolescence may be a leaking chiller that uses a CFC refrigerant, it may be a high-energy user like an old multizone system, or it could be a VAV system with failed or poorly functioning pneumatic actuators.

It is unlikely the customer will consult an HVAC contractor specifically about equipment obsolescence. This opportunity is more likely to reveal itself to the retrofit contractor when performing an energy savings walk-through, during an equipment repair, or when replacing equipment or controls due to failure or comfort complaints. There is great opportunity for the retrofit contractor to profit from obsolete equipment if the retrofit contractor trains its staff to recognize equipment that is outdated or inefficient and to bring that to the owners' and contractors attention. Equipment obsolescence is essentially an energy savings retrofit that is identified by the retrofit contractor instead of the customer.

### 1.2.3 Energy Savings

This accounts for less than 15 percent of the retrofit market but represents one of the areas of greatest potential growth. Approximately 80 percent of owners that have had an HVAC equipment retrofit had the retrofit due to an energy audit or commissioning. Therefore, the retrofit contractor should be familiar with the process of conducting an energy audit and the commissioning process.

### 1.2.4 Building Purchases

When a building is purchased it is very likely that it will at least undergo changes and possibly substantial upgrades to match the requirements of the new owner. This is a key opportunity for HVAC contractors to meet the new owner and spend a few minutes looking at the facility and offering preliminary suggestions regarding HVAC system enhancements and equipment upgrades. *Note: Certain future Model Building and Energy Codes may mandate an energy audit and commissioning be conducted within one year of the sale of an existing building.*

### 1.2.5 Tenant Improvements

Tenant improvements are often "invisible" from outside the building. The improvements may be a simple reconfiguration of existing space or the addition of a loading or staging area to serve growing material man-