
THE VIRGINIA ENERGY SAVERS HANDBOOK

A Guide to Saving
Energy, Money,
and the Environment

THIRD EDITION

Prepared for



Division of Energy

First Edition, 1993

Prepared by
Energy Design Associates, Inc.
P.O. Box 1709 Ansonia Station
New York, NY 10023

Written by
Ned Nisson and Alex Wilson
Technical Assistance by Tom Wilson

Designed and illustrated by
Office of Graphic Communications,
Virginia Department of General Services

Second Edition Revisions, 1996

Prepared by the
Virginia Department of Mines, Minerals and Energy

Third Edition Revisions and Additional Material, 2005

Prepared by
Department of Mechanical Engineering
Virginia Tech
Blacksburg, VA 24060

Additional Text and Illustrations by
Billy Weitzenfeld, Association of
Energy Conservation Professionals
Al Kornhauser, Virginia Tech

2008

THIS PUBLICATION IS DISTRIBUTED WITH THE SUPPORT OF:

Virginia Cooperative Extension

Virginia Cooperative Extension programs and employment are open to all, regardless of race, color, religion, sex, veteran status, national origin, disability, or political affiliation. An equal opportunity/affirmative action employer.

Issued in furtherance of Cooperative Extension work, Virginia Polytechnic Institute and State University, Virginia State University, and the U.S. Department of Agriculture cooperating.
Dr. Mark McCann, Interim Director, Virginia Cooperative Extension, VA Tech, Blacksburg, VA;
Dr. Alma C. Hobbs, 1890 Extension Administrator, Virginia State University, Petersburg, VA.



VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY



VIRGINIA STATE UNIVERSITY

ADDITIONAL COPIES OF THIS PUBLICATION CAN BE OBTAINED
BY CONTACTING
YOUR CITY OR COUNTY COOPERATIVE EXTENSION OFFICE

Disclaimer

This book was prepared with funds provided by the United States Department of Energy. The Virginia Department of Mines, Minerals & Energy and the U.S. Department of Energy make no warranty, expressed or implied, or assume any liability for the use of information described herein.

TABLE OF CONTENTS

INTRODUCTION

Why and How to Become a Smart Energy Consumer

CHAPTER 1

Assessing Your Home's Energy Fitness

Your House as a System	1
How Does Your Home Rate?	1
Calculating Your Home Energy Rating	3
Inspecting for Flaws	4
Obtaining a Professional Energy Audit	13
Energy Tips and Recommendations	15
Know Your BTU's	15

CHAPTER 2

Controlling Air Leakage

Before You Begin: Health and Safety	17
Air Sealing Materials	22
Attic Work	24
Basement Work	26
The Living Space	28
Radon	29
Energy Tips and Recommendations	30

CHAPTER 3

Insulation Materials Selection and Installation

R-value – The Power of Insulation	31
Five Categories of Insulation	31
Protecting Your Insulation From Moisture	36
Insulation Techniques and Applications	37
Energy Tips and Recommendations	44

CHAPTER 4

Windows and Doors

Types of Windows	45
------------------------	----

Energy Efficient Windows	47
Window Replacement	54
Doors	55
Energy Tips and Recommendations	56

CHAPTER 5

Heating and Cooling Systems

Four Ways to Improve Your Heating and Cooling Systems' Efficiency	59
Understanding Heating and Cooling Systems	59
Cooling Systems	63
How to Make Your Heating and Cooling Systems More Efficient	64
Upgrading to High Efficiency Heating and Cooling Equipment	69
Operating Your System for Maximum Efficiency	72
Wood Burning Appliances	73
Un-Vented Heating Systems	76
Energy Tips and Recommendations	77

CHAPTER 6

Water Heating

Types of Residential Water Heaters	78
Energy Efficient Water Heating	82
Buying a New Water Heater	85
Energy Tips and Recommendations	86

CHAPTER 7

Appliances

Energy Use for Appliances	87
Shopping for New Appliances	87
Choosing and Using Appliances	90
Energy Tips and Recommendations	105

CHAPTER 8

Energy Use for Lighting

How Light Output, Energy Use, and Efficiency of Lights are Measured	106
The Spectrum of Light	107
Energy-Efficient Lighting Options	108
Lighting Strategies for Your Home	116
Energy Tips and Recommendations	116

CHAPTER 9

Water Conservation

Drought	117
Water-Saving Practices	117
Low-Flow Water Saving Fixtures and Appliances ...	118
Fixing Water Leaks	119
Stormwater Management	127
Water-Saving Tips and Recommendations	128

CHAPTER 10

Energy-Efficient New Construction

High Levels of Insulation	130
High Performance Windows with Proper Solar Control	130
Low Air Leakage Rate	131
Fresh Air Ventilation for Indoor Air Quality Control	132
High Performance Mechanical Systems	133
Advantageous Use of Available Solar Energy	134
Other Features for Energy Efficiency and Comfort	134
Energy-Efficient Landscaping	137
Green Building Technology	138
Energy Tips and Recommendations	139

CHAPTER 11

Reducing Your Transportation Energy Use

Driving Tips	141
Automobile Maintenance	142
Buying a New Vehicle	145
Alternative Transportation	146
Alternative Fuels and Vehicles	146
Energy Tips and Recommendations	148

CHAPTER 12

Renewable Energy and other Alternative Energy Sources

What are Renewable and Alternative Energy?	149
Types of Renewable and Alternative Energy	149
Residential Renewable and Alternative Energy Systems	151
Virginia Programs that Promote Renewable Energy	156
Energy Tips and Recommendations	157

CHAPTER 13

Your Home and the Environment

Saving Energy is Good for the Environment	159
Global Warming	159
Houses and the Environment	162

Recycling Strategies for Your Home	165
Energy and Environmental Education are Keys	165
Energy Tips and Recommendations	166

Buiding Envelope	167
Appliances	168
Wood Heat	168
Alternative Energy	168
Water Conservation	168
Tree Planting and Preservation	168

APPENDIX

Where to Go For More Information

General Information	167
---------------------------	-----

ACKNOWLEDGEMENTS

Acknowledgements are due the following people who helped review the Handbook for appropriate revisions and updates:

- | | | | | |
|----------------|-----------------|-----------------|---------------|---------------|
| • Lil Weston | • John Langford | • John Bodtmann | • R.W. Davis | • Frank Early |
| • Annette Osso | • Matt Heck | • Ken Jurman | • Andy Farmer | • Anthony Cox |

Acknowledgements are due to the following organizations and resources for information and use of illustrations:

- U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy
- Environmental Building News
- *Clean Energy Choices* – Tips on Buying and Using Renewable Energy at Home
- New Mexico Office of the State Engineer – Water Use and Conservation Bureau - *Don't Waste a Drop*
- *Small Wind Electric Systems* – A U.S. Consumers Guide
- ACEEE - *Consumer Guide to Home Energy Savings*
- Sustainable Buildings Industry Council - *Green Building Guidelines*
- National Fenestration Rating Council
- National Renewable Energy Laboratory
- U.S. Environmental Protection Agency
- U.S. Department of Energy
- Efficient Windows Collaborative
- Federal Trade Commission
- State Corporation Commission of Virginia
- American Lung Association