

A Manual for the Economic Evaluation of Energy Efficiency and Renewable Energy Technologies

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Preface

A Manual for the Economic Evaluation of Energy Efficiency and Renewable Energy Technologies provides guidance on economic evaluation approaches, metrics, and levels of detail required, while offering a consistent basis on which analysts can perform analyses using standard assumptions and bases. It not only provides information on the primary economic measures used in economic analyses and the fundamentals of finance but also provides guidance focused on the special considerations required in the economic evaluation of energy efficiency and renewable energy systems.

The Analytic Studies Division (ASD) of the National Renewable Energy Laboratory (NREL) developed this manual for the Office of Planning and Assessment (OPA) in the U.S. Department of Energy (DOE). It is envisioned that this manual will serve as a standard reference on economic evaluation within DOE's Office of Energy Efficiency and Renewable Energy.

Several NREL staff members contributed to this manual through valuable input and review. Outside of NREL, many people provided information for and reviewed drafts of the manual. Among the latter are Fred Abel of the Office of Planning and Assessment at DOE, Geopalachari Ramachandra of the Electric Power Research Institute, Jonathan Koomey of Lawrence Berkeley Laboratory, Lisa Chalstrom of the Iowa Utilities Board, Marshall Wise of Pacific Northwest Laboratory, Peter Bos of Polydyne, Inc., and Rosalie Ruegg of the National Institute of Standards. Their help, especially that of Rosalie Ruegg and Peter Bos, who provided many detailed comments, is very much appreciated.

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1 Introduction

This manual is a guide for analyzing the economics of energy efficiency and renewable energy (EE) technologies and projects. It is intended (1) to help analysts determine the appropriate approach or type of analysis and the appropriate level of detail and (2) to assist EE analysts in completing consistent analyses using standard assumptions and bases, when appropriate. Included are analytical techniques that are commonly required for the economic analysis of EE technologies and projects.

The manual consists of six sections: Introduction, Fundamentals, Selection Criteria Guide, Economic Measures, Special Considerations for Conservation and Renewable Energy Systems, and References. A glossary and eight appendices are also included. Each section has a brief introductory statement, a presentation of necessary formulae, a discussion, and when appropriate, examples and descriptions of data and data availability.

The objective of an economic analysis is to provide the information needed to make a judgment or a decision. The most complete analysis of an investment in a technology or a project requires the analysis of each year of the life of the investment, taking into account relevant direct costs, indirect and overhead costs, taxes, and returns on investment, plus any externalities, such as environmental impacts, that are relevant to the decision to be made. However, it is important to consider the purpose and scope of a particular analysis at the outset because this will prescribe the course to follow. The perspective of the analysis is important, often dictating the approach to be used. Also, the ultimate use of the results of an analysis will influence the level of detail undertaken. The decision-making criteria of the potential investor must also be considered.

In some cases, it is possible to use shortcuts that reduce the amount of detail needed and permit use of averages rather than detailed year-by-year calculations. Very gross analytical approaches may be suitable for instances in which the results are clear or the validity of detailed studies is questionable. For example, the economic value of an industrial conservation investment may be so clear that a complex analysis of annual savings, given the uncertainties of future production plans, is not warranted. This manual addresses these types of considerations.

This manual cannot provide an exhaustive and complete exposition of the theory and practical pitfalls of particular economic methods. For example, using this manual for developing a detailed economic analysis of a site-specific energy-related project would be difficult. In some cases, references to more extensive resources are provided, but even these may prove insufficient to answer certain detailed questions. This is particularly true when dealing with some of the special circumstances that relate to the application of energy efficiency and renewable energy technologies. A few of these special circumstances are addressed in Section 5 of the manual, Special Considerations for Energy Efficiency and Renewable Energy Systems. Although there may not be a specific right or wrong way or a specific formula for handling some of these cases, the issues are brought to the attention of the analyst.

No analysis will be valid if it is not based on sound and consistent data. If, for example, an EE technology is being evaluated in comparison with a conventional technology, analyses of both technologies must be based on comparable characterizations (the *Energy Efficiency and Renewable Energy Technology Characterizations* sets forth the basis for developing valid and consistent technology characterizations) (Carasso 1995). Similarly, the analysis should be conducted on relevant and consistent macroeconomic and microeconomic bases. This manual does not directly address these data input *quality* considerations.