The background of the cover features a photograph of an industrial facility with several tall, white smokestacks emitting thick white plumes of smoke against a clear blue sky. The smokestacks are supported by a complex network of metal scaffolding. In the foreground, a large, flowing, multi-colored graphic in shades of blue, green, and purple curves across the page, partially obscuring the lower part of the factory image.

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Dušan D. Gvozdenac

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Zoran K. Morvay

UNDP, Croatia

Dušan D. Gvozdenac

Faculty of Technical Sciences, University of Novi Sad, Serbia



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To Jehona, Boran and Ljiljana
They have let me borrow the time to prepare this book!
Z. Morvay

To Nevena, Nenad and Branka,
For their understanding
D. Gvozdenc

About the Authors

Dr. Z.K. Morvay, holds a PhD in electrical engineering and has more than 20 years of teaching experience at universities in Croatia, the UK and Thailand. During the early 1990s he worked for a UK energy and environmental consultancy firm, managing projects for international development banks and aid organizations, technical assistance projects for governments and consultancy projects and feasibility studies for industry. He moved to Thailand to manage the local office just before the economic crisis in South East Asia in 1997. He developed, designed and managed the implementation of a number of energy and environmental management projects for large industrial international companies from Japan, the USA, the UK and Thailand, which often evolved into cost management projects because the theme of the day at that time was cost cutting. In addition, he has practical experience of change management, training needs assessment and support for organizational learning. He is the author of a number of professional papers and of a handbook and manuals on energy and environmental subjects. Currently, he manages a national energy efficiency project in Croatia.

Dr. D.D. Gvozenac is Professor and Chairman of Thermal Engineering at the University of Novi Sad, Serbia. He holds a PhD in mechanical engineering and has more than 20 years of teaching experience in Serbia and Thailand. This is complemented by having spent the last 15 years as an international consultant working on energy projects in Europe, Africa, South East Asia and China. He was also the director of a national energy efficiency agency and a regional energy efficiency centre. He has managed a number of energy audits in industry, solving the problems of energy performance improvement and designing and managing the implementation of solutions. He has also designed and delivered training courses for the operators of industrial energy and utility systems, and has developed best practice and preventive maintenance manuals for industrial equipment and machines. He is the author of a number of professional papers, editor of conference proceedings and author of training manuals. Currently, he is working on the development of a national cogeneration project in Thailand.

Preface

Energy and environmental management starts with people!

Owing to concern with regard to globalization and climate change, the rules of business are changing fast and frequently. Each day seems to bring new technology, a new partner or competitor, or a new way of working. Against such a dynamic and complex backdrop, some things remain constant: a need for the developed and developing world to manage their energy resources and impacts on the environment and to improve energy efficiency continuously and to reduce harmful emissions. Companies operating in either world are required to achieve continual improvement of their energy and environmental performance.

The motivation for this book was initiated by years of experience, firstly of teaching and training energy and environmental management subjects and then by working internationally as consultants for development banks, international aid organizations, large multinational companies, as well as for small local businesses. This experience has evolved over the last two decades through work on energy efficiency and environmental projects in Europe and Asia. The last decade was marked by economic crises and market meltdown in South East Asia, the liberalization of energy markets, industrial globalization, a surging appetite for energy in the developing world, increasing and constantly high energy prices, energy security concerns, a growing awareness of climate change, the introduction of emissions trading, green financing and voluntary and compulsory arrangements designed to combat climate change.

The second half of the 1990s was a particularly instructive period when we were working in South East Asia at a time of well-publicized economical upheaval. This has given us inside experience of the impact of a sudden economical downturn on business performance in general and energy performance in particular.

When businesses slow down, cost cutting becomes imperative and energy costs and energy and environmental performance suddenly attract greater interest from management. Although energy efficiency and environmental management were supposed to be familiar terms at that time, the implementation of a successful energy and environmental management program in a real industrial environment still proved to be a difficult task for any team assigned to it. Its complexity arose from the need to bring together *people, procedures* and *technologies* in order to achieve consistent and lasting performance improvement.

The context of energy and environmental management is changing fast, but the basic principles and knowledge that have been essential for years, are still relevant today. The underlying know-how remains stable and valid and provides a solid grounding that needs to be refined from time to time in order to reflect the impact of the changes that occur. This generates a need for continuous learning and creation of new knowledge in order to cope with the challenges of an ever changing business environment.

One of the most useful lessons that we have learned from the years spent working with people is about the range and breadth of issues of which they are not aware, do not understand or are not confident about, which in turn hinders them in implementing energy and environmental management programs. These issues range from queries about simple technical details or how to do some calculations, on up to missing the entire concept or context for energy and environmental management. But the questions are always about the practical aspects of evaluation of current performance or implementation of some improvement measure, rather than about the theoretical foundations.

At the top management level, energy performance is often considered to be a more technical than management topic and the cross-functional character of energy and environmental management has not been sufficiently appreciated. Consequently, there is no management structure to deal with energy performance continuously and consistently. Energy and environmental management has of course a strong technical component, but if the focus is on technical aspects only, the results will be limited. Energy and environmental management needs to *focus on people* because technical expertise and sophisticated equipment will fail to produce results unless people are committed and receptive to the changes needed for performance improvement.

Normally, people involved in energy and environmental management are from various educational backgrounds and from all levels of management. What they have in common is that they are assigned responsibilities to operate and manage an *existing plant* efficiently!

Working with people with diverse backgrounds united by common goal has always presented the challenge of finding the most effective way of helping them to understand and implement Energy and Environmental Management System (EEMS) procedures and techniques. We have been searching for an important element of knowledge in the vast amount of technical and managerial know-how that will have the so called ‘Ah-hah . . .’ effect, i.e., an element that will trigger understanding and that will result in practicable knowledge. In other words, it has been a search for the appropriate level and content of knowledge relevant to a given application context.

Figure 1 illustrates the basic idea that the required knowledge in an industrial environment will be less detailed but more conceptual or general as we move from the technical to the management level. The opposite works for an academic environment where the higher up the pyramid one moves, the more specialized is the knowledge that is required. Of course, there are always links and feedback between

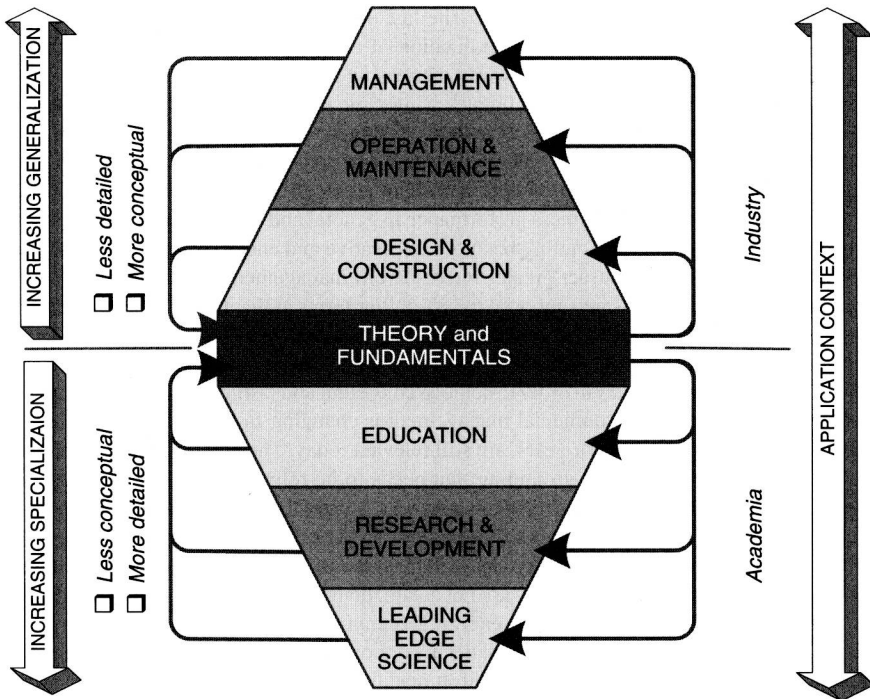


Figure 1 Knowledge levels for a given application context

the different levels that hold the body of knowledge together and stimulate its growth in both the applied and scientific areas. In industrial energy and environmental management, the focus is not on theory and fundamentals, not even on design considerations, but on *managing performance of an existing plant*. As one moves up the managerial ladder, the required knowledge will shift from the more detailed to the more conceptual.

Many environmental management issues in industry are closely related to energy use and therefore are also covered in the book from the perspective of performance management. This approach is based on the fact that the environmental impacts of industrial operations are the consequences of energy use and the processing of raw materials. Hence, improving the efficiency of energy and raw material use, followed by waste avoidance and minimization, are the logical first steps and most cost effective means of environmental management.

Successful EEMS must provide a framework not only for managing companies' energy and environmental affairs, but also for enabling and stimulating continuous learning, creation and management of knowledge, which is the key asset in maintaining a company's competitiveness. Companies that can learn and manage their knowledge effectively are the foundations of the knowledge economy.

The focus on people and performance management of existing plants is the guiding principle for establishing the scope, depth and style of presentation in this book. Therefore, in its scope, the book will cover the management aspects of energy and environmental performance improvement in Part I and the technical aspects in Part II.

Regarding the depth of considerations, the book does not develop detailed principles and theories, but rather stresses the application of these theories to specific performance improvement solutions. If we consider the required knowledge level related to an application context (Fig. 1), then the book aims at providing support to practitioners in the field involved with developing and implementing solutions for industrial energy and environmental management problems. However, anybody who has completed a basic management or engineering course will also find this book to be a useful guide in resolving practical operational efficiency improvement problems.

We have resisted the temptation to make the book an energy management encyclopedia. Therefore, a number of relevant subjects (lighting, heating, degree days, industrial water systems, drying process, environmental abatement technologies) are deliberately omitted, but references are given to other books where these subjects are well covered. Our aim is to focus on the management aspects and technical issues which are more specific to an industrial environment.

In its structure, the book acknowledges the fact that energy and environmental management are highly interdisciplinary subjects; hence few people will attempt to read it from cover to cover with the same level of interest and attention. Therefore, it consists of three parts and some modules that can be studied independently.

The book starts with the introduction of a framework for energy and environmental management in industry. It is followed by Part I which explains the context and concept of energy and environmental management, focusing on practical methods for performance assessment, evaluation and improvement at industrial plants. It also recognizes the need for an adequate understanding of the production processes which are the main users of resources in a company. It follows a systematic approach to identify the significant internal and external interactions and key factors affecting performance within a company. It emphasizes the importance of and gives guidance for dealing with people, i.e., management aspects, as a prerequisite for lasting energy and environmental performance improvement and it proceeds with practical guidelines on how to introduce energy and environmental management systems in an industrial environment. Part I is concluded by a proposal for an integrated performance management approach that can be easily built onto an EEMS when established and operational.

Part II deals with the technical aspects of industrial energy and environmental performance management, starting with a definition of industrial energy systems. This is followed by the analysis of five industrial energy systems: (1) Industrial Steam System, (2) Electrical Energy System, (3) Compressed Air System, (4) Refrigeration System and (5) Industrial Cogeneration. Industrial cogeneration as

a system differs from the classical understanding of Industrial Energy Systems. Today, the trend of using cogeneration in industry, as a means of improving the overall performance of energy use, is very significant and for that reason it is considered separately. Each chapter contains a section on the environmental impacts of the considered industrial energy system.

Part III is a special feature of this book. It includes a 'TOOLBOX' and a set of software to be found on the accompanying website at www.wiley.com/go/morvayindustrial. It contains many useful 'tools' for the implementation of energy and environmental management programs. These 'tools' are: data on materials' and fuels' properties, analytical methods, definitions, procedures, questionnaires and software that support the practical application of the methods elaborated in the first two parts of the book. The software we have developed and used during our consulting practice facilitates the calculations and problem solving for specific solutions for energy and environmental performance improvement, financial evaluation and performance monitoring. It will help readers to understand the relevant topics and assess their own industrial energy systems. The context of why, when and how to use the tools and software is provided consistently throughout the book but, again, a knowledgeable reader should be able to use the tools directly without referring to the book. The TOOLBOX also contains definitions of terms or basic explanations of the subjects that are used in the book but which could divert the reader's attention if explained in the main text.

This book embodies our philosophies and consulting experience in developing and applying energy and environmental management solutions for performance improvement in industrial plants. As with our endeavors in training and implementing specific solutions, where we have also learned from the very people we have trained or assisted, we welcome comments and suggestions, in this case from our readers.

In closing, we express our appreciation to Luka Lugaric and Aleksandar Vukojević who have edited the text and illustrations and have made the software more user friendly.

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