Contents

Preface

As one of the largest groups of researchers (and students) working with Environmental and Energy Planning and management in Denmark, we have long felt a need for an integrated tool kit for sustainable development. This book is meant to provide an overview of tools for environmental assessment of products, projects, and plans – as well as methods for promotion and diffusion of cleaner production, cleaner products, environmentally friendly infrastructures, and sustainable planning.

The tools are described in terms of their history, application, definitions, standards, legal requirements and practical application in different contexts. Apart from the descriptive elements, the book provides reflection and critical analysis of the strengths and weaknesses of the different tools.

Too often academic researchers work in isolation without the benefit that can be obtained by a more interdisciplinary approach. In addition to providing an overview of tools, methods, concepts and strategies, this book aims to initiate more collaboration between the different research fields, and between academia and industry, municipalities, NGOs, etc. We believe that interdisciplinary research and teaching, as well as close collaboration with the world 'outside' academia, is very important, if we shall succeed in achieving sustainable development.

The first edition of the book was printed in 2004. After a thorough review, the second version was launched in 2005. The current version is the result of two review processes, including feedback from students and colleagues.

The authors mainly come from Department of Development and Planning, and they teach at the Master Programme. A description of all the contributors is available in the back of the book. Special thanks go to Annelle Riberholt, who has been responsible for editing and proofreading. Without Annelle, the project had never materialized in the real world. Furthermore, Sine Clausen has been of great help during the final editing process.

The target audience was initially students at the Master Programme in Environmental and Energy Planning and Management at Aalborg University, Denmark. We hope that the book, in its current form, can be of value for a broader audience - not only students, but also researchers, and professionals engaged in the promotion of sustainable development.

Lone Kørnøv, Mikkel Thrane, Arne Remmen and Henrik Lund
Aalborg University, September 2007

1

Introduction

Lone Kørnøv, Henrik Lund and Arne Remmen

Environmental management and the aims of the book

Since the early 1970's, most countries have given priority to environmental protection, and although regulations and standards may vary, general environmental legislation is common today. Furthermore, a number of international agreements have been made in order to deal with environmental problems which cannot be solved by the individual countries on their own. The number of both national and international regulations have grown and have influenced the content and number of environmental management tools being applied today. This ongoing development and shift of focus is incorporated in the book.

In today's business community, several enterprises have taken an integrated and holistic approach to environmental management. Sustainable development is seen as part of coherent business strategies and competitive advantages. Such development includes a shift from end-of-pipe solutions towards the use of Best Available Technology (BAT) and eco-efficiency of the entire production system; a shift towards a product and its environmental impacts in a life-cycle perspective; a shift from coping separately with environmental, social and health & safety issues towards integrated management systems; and a shift towards a more open and transparent environmental communication with stakeholders.

Also at governmental level things have changed. Policy and regulatory instruments at international as well as national and local levels play an important role in environmental protection. The understanding and recognition of complex ecological systems – including the transboundary context – in-

fluence the development and use of different planning tools. Environmental assessments at project level are supplemented by assessments at the strategic level of policies, plans and programmes. The analyses of single energy production facilities are supplemented by the modelling of complex energy systems and integrated resource planning. The use of Geographical Information Systems (GIS) primarily as a mapping tool is supplemented by GIS for spatial analysis and modelling for environmental management. And the need for ethical and complex economic studies is recognised.

Furthermore, globalisation has resulted in a growing public and institutional understanding and recognition of the necessity of global long-term social and environmental responsibility For instance, increase in population combined with economic growth result in externalities, such as high resource demands and rising waste generation. Urban environmental degradation with unhealthy air pollution, inadequate sanitation, poor access to safe drinking water etc.; degradation of environmentally sensitive land; improper disposal of waste etc. are all examples of problems calling for global responsibility and solutions.

Tools for a sustainable development is written with the above mentioned shifts in focus. The book presents a comprehensive toolbox with the available procedures and instruments to assist individuals and organisations to undertake a variety of environmental management tasks. Besides presenting and discussing different management tools, the book also shows, through different cases, how environmental management takes place in political spheres. Rights and privileges are limited in order to preserve ecological elements for the community's own sake and to protect not only the wider community but also future generations. Therefore, environmental management and regulation generate conflicts between different stakeholders and interests. To supplement the technical and procedural side of the different management tools, the book also aims at presenting examples of how the management tools do interact and should interact with this political context.

The book is intended for use by students, planners, companies, non-governmental organisations, academics, and others concerned with the use of environmental management tools. The tools together represent a broad concept of environmental management, which will be explored in the following.

The Environmental Management concept

Worldwide the term environmental management has been applied and defined differently. Sometimes, it is used as a narrow term for environmental auditing within an industry, and at times, as a much broader term including public planning activities within several sectors.

Here, the term is defined in accordance with the two Master programmes at Aalborg University, "Environmental Management" and "Sustainable Energy Planning & Management". Consequently, the term is used in a fairly broad way influenced by the strengths and main focuses of the research activities of the Department of Development and Planning.

The field is illustrated in table 1.

	Nature	**Environment**	**Energy**
Ethical and cultural level	Conceptions of nature The culture of nature: perceptions, interpretations, behaviour and institutions Biodiversity and value Nature- and landscape quality	Environmental values and ethics Cultural priorities and environmental issues Sustainability: equity and future generations Environmental movements	Human values and energy consumption Justice and equity assessment of impacts of energy consumption
Policy, planning and public regulation level	Planning and regulation of landscapes Mapping of sensitive areas and of nature and landscape quality (e.g. GIS, bio-diversity accounts) Landscape and nature in environmental assessment (EIA, SEA, LCA, environmental economics, CBA)	Environmental policy, planning, public regulation and technological change Environmental assessments (EIA, SEA, LCA, environmental economics, feasibility studies, etc.) Environmental development assistance and globalisation	Energy politics, planning, public regulation and technological change Policy and project evaluation Energy System Analysis
Company, household and local level	Nature quality plans at the farm level Nature quality and biodiversity as part of environmental management Behaviour and use of nature in households	Cleaner technology and environmental initiatives in firms Environmental management, LCA, eco-design, etc. Environmental strategies and performance of firms and households	Local energy planning and project Energy behaviour Energy conservation in industries and households

Table 1: Definition of Environmental Management in this book

The definition of "Management" is broad and includes both the company level and the wider political, cultural and ethical levels, as indicated in the table below. The emphasis of the book is tools within "Environment" and

"Energy" at the "Policy, planning and public regulation" and "Company, household and local" levels (highlighted in the table).

The definition of "Environmental" is broad as well. Apart from the traditional issues related to environmental planning and public environmental regulation it incorporates issues which are often labelled under the terms of "Nature" and "Energy."

In principle, transportation and urban planning sectors could be included as well, but at Aalborg University these sectors are included in the Master programme of Urban Planning and Management, a sister education to the two other programmes. However, some of the tools have relevance to urban planning and transportation, as well as nature, environment and energy sectors.

The approach to studies as well as research within environmental management at Aalborg University has the following characteristics:

Studies may have a local as well as a national and/or global context: Consequently, the studies may include international relations which influence (or are influenced by) the development in the three sectors: nature, environment and energy. For instance, the development in WTO agreements and related political processes may be of importance even to local energy plans. In such cases, studies may include the analysis of the connexion between such global agreements and the possibilities to implement environmental policies at local and national levels.

Studies may include analyses of the influence of social and political conditions on the environment and the use of resources. Social conditions, such as working environment, access to nature and resources, and economic power positions in relation to exploitation of natural resources, are integrated parts of the research field, which may be included more or less in specific studies.

Studies within the field of energy, nature and environment have a point of departure in the critical global environmental situation, and seek to improve knowledge, which can contribute to a sustainable development. One focus is the development and manufacturing of less polluting and resource consuming technologies within consumption, production and transportation under given market conditions. Another focus is the development of new market conditions, industrial structures and lifestyle concepts involving new and less polluting behavioural and technological systems.

The studies are interdisciplinary and problem- and application-oriented. At all levels or dimensions - from normative and cognitive over institutional to concrete and specific - the studies aim at finding ways to overrun cognitive and structural as well as practical barriers for useful societal and technological changes. Consequently, existing institutional conditions at all levels are not considered final, but are open for discussion.

The above-mentioned characteristics imply that typical research and studies within environmental management will have aims such as:

- Giving high priority to the resource perspective in analyses of the environmental performance of companies.
- Using and improving tools such as LCA (Life Cycle Assessment) in order to make them more useful in the reorganisation of production chains physically as well as institutionally.
- Integrating local, national and global perspectives in the analysis of economic and institutional regulations.
- Analysing financial and time budgets of citizens as well as of companies.
- Analysing relations between people's living conditions and their respective possibilities to contribute to sustainable developments.
- Developing further the analysis of relations between the increasing global environmental stress and the working and living conditions of local people, including relevant political processes.

The studies and research are indeed interdisciplinary and include a wide range of methodologies, such as data-collection, case studies, evaluations, action research, historical and philosophical analyses, as well as the analyses of institutional and organisational conditions. Correspondingly, the studies involve a wide range of natural science theories related to energy and mass flow calculations and energy and environmental system analysis, as well as social science theories within, for instance, economics, public regulation and political science.

Book structure

The focus of the book is environmental management tools and the context in which the tools are being developed and applied. The book is organised in 34 chapters covering business level planning and public planning and policy making. The different tools are covered by two chapters, of which the first outlines the necessary steps and techniques related to the tool (*how to do it?*) and the second shows cases of how the tool has been applied and with which experience (*lessons to be learned?*).

Chapters 2 – 17 present tools primarily applied at the business level covering cleaner production, environmental management systems, employee participation, integrated sustainable reporting, life cycle thinking, eco design, and life cycle management. In chapter 2, a description is given regarding how pollution prevention has become the major strategy in both public regulation and firm strategies, and the following chapters introduce the tools

applied by enterprises when managing environment inside the company. In chapter 11, life cycle thinking is introduced, since both enterprises and regulation have changed towards a greater focus on the environmental impacts of the product life cycle.

Chapters 18 – 35 provide tools primarily used for public planning and policy making covering environmental impact assessment, strategic environmental assessment, energy planning, geographical information systems, energy system analysis, integrated resource management, feasibility studies, and technological innovation, cost-benefits and ethics and public participation.

A concluding chapter discusses decision-making and highlights different aspects of individual and collective decision-making processes and their influence on the development and use of environmental management tools. The chapter subsequently discusses the single planner's role and responsibility regarding social learning and environmental equity. The chapter raises the importance of understanding the context in which different management tools are used by different stakeholders and the importance of being able to manage the context as a professional planner.