Preface

This book is based on lectures on circular economy, life cycle analysis and determination of CO_2 – and material footprints as well as eco-design given at INP Grenoble at the Department of Paper and Biomaterials between 2015 and 2020.

The industry's recent orientation towards ecologically sustainable production without neglecting economic necessities seems comparatively new, but goes back to a longer development. Therefore, the following text begins with a brief historical overview in which social, economic and ecological developments are placed in a context. The approach taken here leans heavily on Fridell's considerations, according to which social, economic and technical developments must always be seen in context. An understanding of the background is essential to understand the direction of current public and political opinion and the resulting actions.

The second chapter aims at understanding basic concepts describing the flow of products in a linear and closed-loop economy. It also describes the eco-design of products as an enabler for a closed economy.

Chapter 3 focusses on different concepts for ecologically oriented business models.

Chapter 4 introduces life cycle assessments and material and energy accounting along the phases within life cycles. Balancing, recording and calculation of environmental footprints (Chapter 5) corresponds to balancing consumption. The ultimate goal is to design products and processes in such a way that consumption is minimised. Concepts for this are often accompanied by more or less major changes in the design of production routes, products and their use. Priorities often have to be set, leading to the disadvantage of one parameter over the other. Chapter 5 provides examples of such assessments and Chapter 6 offers tools and an example of priorities in eco-design.

The previous chapters have only dealt with material products. Chapter 7 introduces the organisational environmental footprint that arises as a result of people working together in dedicated organisations. Of course, footprint reduction is necessarily closely tied to what is produced and the processes used – still some approaches are useful to keep in mind when looking for potentials. Chapter 8 offers general approaches to reduce material and energy footprints.

Internally, larger organisations have different teams and departments working together. The reduction of footprints poses new challenges for the cooperation and management of departments. Chapter 9 presents examples of issues that need to be discussed between teams in order to optimise internal cooperation. In the external cooperation with partners along the supply chains, strategies have to be implemented and the contributions to the reduction of material and energy have to be checked – audits serve this purpose. Chapter 10 deals with such audits.

In order for a company to be successful with a "greener" approach, it is important that accurate and rather than greenwashed messages are communicated from the beginning of the change process until well after implementation. Chapter 11

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therefore addresses the communication aspect of the efforts going along with the reduction of CO_2 and material footprints.

Instead of a conclusion, Chapter 12 discusses various forecasts for climate development and accompanying circumstances until 2050 – given what is known today it does not and cannot present an optimistic forecast.

As indicated, this book is based on lectures held at INP Grenoble and, as always in teaching and writing, aside of students many persons contributed in various ways making the lectures and this book possible. In particular, it is a pleasure to thank

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- Dr Barbara Heikel for drawing my attention on items I did not look at before, her willingness to share scientific and technical expertise and often challenging positions expressed in the manuscript.

Literature

I have provided many references that I hope readers will find useful. I hope I succeeded in giving a reasonable summary of the findings presented by the source. Should some of the ideas presented here be not referenced or repeat those of others without being cited, I apologise and can only ask that the relevant work be brought to my attention so that appropriate mention can be made in any subsequent editions of this book.