

# Introduction: Modelling Sustainability – The TranSust Project

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## INTRODUCTION

This book collects contributions on sustainable development (SD) in its more operative and applied sense. Although many papers have been written to elaborate on the potential interpretations and definitions of the concept of sustainable development, many of these papers are too abstract, and policy-makers and researchers alike call for more practical, and effective, guidelines. If we want to develop actual policies that aim at sustainability, we first need to find practical means that can help us to assess whether policy proposals, specific decisions or targeted scenarios are sustainable. Assessment of sustainability is often approached through various indicators and aggregate measures, and one wants to know whether and how these can be included in models that are used for decision-making support.

## PART I: DEFINING SUSTAINABILITY

In the first part the book starts with a brief address of broader issues related to the application of the sustainable development concept to the policy process and to economics. Its contributors are Richard Tol, Barbara Buchner and Ray Kopp. Tol discusses the connections between sustainable development as a policy issue and economic models as tools for policy analysis. With a wide view and clear opinion he discusses differences in objectives and the meaning of the terms we use in the sustainability debate. An important element in his chapter is the distinction between strong and weak sustainability, and their counterparts in applied terms as cost-effectiveness analyses and cost-benefit analysis. Tol takes the argument beyond a simple listing of the two visions by showing how both concepts face similar problems when confronted with the uncertainty that is

characteristic for real global sustainability issues. Also, Tol links the environmentally oriented concepts with the broader sustainability concept that includes social justice. He concludes that from a theoretic point of view, economics seems capable of addressing the major sustainability issues. In practice, it is still to be seen whether an applied economic analysis can be sufficiently broad to capture all issues while at the same time being sufficiently specific to do so rigorously.

Barbara Buchner discusses the design of sustainable policy from a European perspective. She describes the need for sustainability policy in EU policy design and the trade-off between detailed specification of (sub) targets versus setting ‘good examples’ that invite broad imitation. She is concerned with changes in the economic structures and the policy settings that can support sustainability and economic welfare in the long run, and as a case study she analyses the EU Sustainable Development Strategy (SDS), adopted in 2006. She finds that the EU SDS acknowledges the need for a broad interpretation of welfare, it integrates different issues in common policy, it recognises the need to first capture so-called low-hanging fruit, and it correctly understands the role of technological change for long-term sustainable development. At the same time, the EU SDS often does not reach beyond recommendation and its effectiveness is still unproven.

Ray Kopp provides us with some practical counterweight, presenting a fine explanation of the US perspective on sustainability. In the US, though many understand and appreciate the concept of sustainability well, it is not deployed in policy language as it is in the EU. Also, the concern for sustainability is typically restricted to environmental and resource issues, whereas social concerns are considered to be part of a different domain. Sustainability is understood to be about (correcting) market failures, and most of US legislation that we could interpret as part of the sustainability agenda is directed to the inclusion of prices for environmental resources in other economic markets. As an example, the proposed Lieberman and Warner legislation for climate change requires deep cuts in US greenhouse gas (GHG) emissions through auctioning decreasing amounts of emission permits. Notably, the term ‘sustainability’ only enters the proposal when referring to sustainable energy, meaning renewable energy. Yet, the proposal echos the concept of sustainability as it makes an implicit balance between present costs and long-term benefits.

## PART II: ISSUES IN MODELLING SUSTAINABILITY

The second part of the book is devoted to specific issues that arise when sustainability is incorporated in applied models and the concept is used for

assessing policies. It discusses the choice of indicators, their role in different models, the relevance of the sustainability concept for the broader debate on climate change and the interpretation of costs of environmental policy, the relationship between sustainable development and new technologies, the role of revenue recycling in reducing costs of environmental policy, and the role of carbon capture and storage in climate policy. Many of these issues have been analysed as part of the TranSust project, and this part of the book reflects the outcomes of the process of ongoing discussion between colleague researchers. It starts with a central concept in the applied sustainability literature: the use of indicators.

The first chapter in Part II by Christoph Böhringer and Andreas Löschel presents a comprehensive survey of different indicators that the EU has outlined and that, together, are supposed to capture the concept of sustainability. The authors discuss these indicators and their inclusion in those models that have been used in the TranSust project.

The second chapter, by Jean-Charles Hourcade and Frédéric Gherzi, discusses the intricacies surrounding the definition and meaning of climate policy costs. The meaning of policy costs has been much debated following the publication of the Stern Review and the recent 4th IPCC Assessment Report WG3. Each model predicts different types of policy costs depending on model structures and key assumptions underlying the model baseline. To compare cost calculations from different models, it is essential to have a common understanding of the measurement and meaning of costs and the main drivers for each specific model. The difficulties that arise when comparing annual costs with one-time costs, on the basis of net present value analysis, has received considerable attention; one only needs to think of the heated debate on ethical versus positive discounting that followed the presentation of the Stern Review. Hourcade and Gherzi, however, show that the problem of discounting is only one of many problems encountered when comparing results from different model calculations.

Technological progress, its implications for the prospect of sustainable development and how it can be modelled, is the subject of the third chapter by Valentina Bosetti and Marzio Galeotti. The chapter provides a comprehensive review of modelling efforts in this area. A key area of research in this field is the potential of technological change to decouple economic growth from GHGs emissions.

The fourth chapter in Part II, by Terry Barker, Sebastian De-Ramon and Hector Pollitt, focuses on green tax recycling and labour markets, a subject that has gained popularity as part of the double dividend literature. This subject is of direct relevance to policy-makers who can choose between various green fiscal and non-fiscal instruments, each with different potential for recycling. In some circumstances, a win-win solution is feasible where

the environment benefits, employment rises and costs are spread evenly, leading to an improvement in equity. The subject has gained much attention in the theoretic literature, and this chapter provides an overview of its cover in applied models, its relation to various modelling techniques and how these issues are treated in different models used within the TranSust project.

The last chapter in this second part of the book is by Bob van der Zwaan. He addresses a timely issue, the modelling of carbon dioxide capture and storage (CCS) and renewable energy technologies. Indeed, if a greenhouse gas emissions reduction policy is to be successful, then both CCS and renewables will probably need to play a crucial role in the process of decarbonising our energy infrastructure. Introducing these technologies into energy–environment–economy (EEE) models is thus essential, and allows for more accurately estimating the costs associated with reducing the carbon intensity of economies. Somewhat surprisingly, however, CCS and renewable energy technologies have not been integrated to many of the TranSust project models. This chapter reviews some CCS and renewables modelling techniques as well as main results, and thereby presents a concise guide to modellers for future CCS and renewables simulation.

### PART III: MODEL DESCRIPTIONS

The third part of the book has a more technical focus. In this part of the book all models used within the TranSust project are described in detail, thus providing an easy technical guide for anybody interested in using or simply better understanding any of these models. Rather than a mere appendix, this accessible description of some European models that are used to integrate the science of climate change with economic policy represents a major merit of the book. The model described are MARKAL, DEMETER, IMACLIM-S, E3ME, FEEM-RICE and PACE.

### PART IV: SYNTHESIS OF TRANSUST

Part IV of the book concludes. Reyer Gerlagh, Stefan Schleicher, Walter Hyll and Gregor Thenius present an overview on a set of climate change policy exercises performed with the TranSust models and discuss the differences in outcomes based on different models. Specifically, the first chapter in this part explores the effects of CO<sub>2</sub> taxes on CO<sub>2</sub> emissions, energy use, and gross domestic product (GDP) in the different TranSust models. The book ends with a conclusion by Valentina Bosetti and Carlo Carraro who wrap up the main policy conclusions drawn from the project.