Foreword

In May 1999, during an IEA Workshop in Stuttgart, scientists and policy analysts called for empirical studies of experience curves to design energy technology deployment programmes and to explore low-CO_2 energy scenarios (Wene et al., 1999; IEA, 2000). The IEA Committee on Energy Research and Technology (CERT) supported the findings of the Workshop and initiated an international collaboration. The last ten years have seen a steadily increasing number of studies on technology learning as measured by experience curves, initially on renewable technologies and now also including fossil, nuclear and end use technologies. The overview presented in this book pulls together the findings of these studies and answers to the original call of the 1999 Workshop for a quality-controlled database of experience curves including assessment of measurement methodology.

This book therefore offers tools for finding low-cost paths to a low-CO_2 future – a task that spurred the 1999 Workshop but that has taken on a new urgency over the last ten years.

The experience curves demonstrate the double action of government deployment programmes. The immediate effect of such programmes, for example, of feed-in tariffs, new building codes, labelling or standards, is to increase market uptake of new technologies. However, the experience curves show that deployment in competitive markets leads to decreasing cost and increasing technical performance, starting a virtuous circle with increasing deployment and steadily decreasing cost. Experience curves therefore point to deployment programmes as key factors beside public R&D in any strategy to realize both low-cost and low-CO_2 energy systems. As a result, technology learning is required to reach the much publicized EU goals of 20-20-20, that is 20 per cent less greenhouse gas emissions, 20 per cent better energy efficiency and 20 per cent renewable energy by the year 2020.

The double action of deployment makes future technology options for the energy system firmly dependent on our present actions. The coupling between our investments today and the cost of technology choices available tomorrow is described by a factor in the experience curves referred to as 'progress ratio' or 'learning rate'. It measures how market deployment reduces cost or increases performance. The value of this factor is one of the major points of discussion in this book. The large spread in progress ratios among technologies is presently not well understood. The distribution functions presented in this book therefore provide much-needed empirical basis for further work.

The double action fostering the virtuous circle provides the policy maker and the industrial strategist with a powerful tool, but also with a great dilemma. There is a risk in picking the wrong winner and ending up locked-in to inferior technologies. The choices confront the policy maker with a very complex decision. There is the already mentioned uncertainty about the future progress ratio for desired technologies. The learning investments for new technologies are scarce and the opportunities for learning in the actual energy system are limited. There are also economic and industrial considerations, including interactions between global, regional and national energy systems, technology learning and deployment.

A great many energy and climate models have been developed to aid the policy maker in this complex decision process. The challenge is great and the analytical pitfalls are many. This book presents the reader with an overview of existing models and a short manual to aid the policy maker in critically assessing model results.

Two challenges for the future emerge from this book, one for the policy maker and one for the scientist.

The challenge for the policy maker is how to manage concerted and coordinated action among governments to foster efficient technology learning for environmentally-friendly and low-CO_2 technologies. This book shows how concerted but uncoordinated actions have led to scarcity and higher prices for materials needed to produce wind power plants and PV modules and have therefore resulted in unnecessary extra costs for taxpayers and consumers. As technologies mature, technology learning becomes global but deployment remains local. Transforming the energy system in this global learning environment requires an institutional set-up to coordinate deployment programmes on an international scale.

The challenge for the scientific community is to provide theoretical understanding of technology learning and the experience curve phenomenon. Chapter 5 views experience curves from the perspective of systems of innovation. Such cross-over to other scientific fields will be fruitful. There are many questions that remain to be answered by scientists in order to provide the policy maker with a reliable tool to design and assess deployment programmes. The constancy and dispersion of progress ratios are examples. The efficient balance between government R&D and deployment programmes is another. Answers to these and other research questions have a potentially great impact on society.

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