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Energy Systems Analysis and Modelling towards Decarbonisation

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The Paris Agreement establishes a process to combine Nationally Determined Contributions with the long-term goal of limiting global warming to well below 2 °C or even to 1.5 °C. Responding to this challenge, EU and non-EU countries are preparing national and regional low-emission strategies outlining clean energy-transition pathways. The aim of this book is to provide rigorous quantitative assessment of the challenges, impacts and opportunities induced by ambitious low-emission pathways. It aims to explore how deep emission reductions can be achieved in all energy supply and demand sectors, exploring the interplay between mitigation options, including energy efficiency, renewable energy uptake and electrification, for decarbonising inflexible end-uses such as mobility and heating. The high expansion of renewable energy poses high technical and economic challenges regarding system configuration and market organisation, requiring the development of new options such as batteries, prosumers, grid expansion, chemical storage through power-to-X and new tariff setting methods. The uptake of disruptive mitigation options (hydrogen, CCUS, clean e-fuels) as well as carbon dioxide removal (BECCS, direct air capture, etc.) may also be required in the case of net-zero emission targets, but raises market, regulatory and financial challenges. This book assesses low-emission strategies at the national and global level and their implications for energy-system development, technology uptake, energy-system costs and the socioeconomic and industrial impacts of low-emission transitions.



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