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Nota di contenuto	Introduction -- Reliability modelling framework of energy systems with uniform gas composition -- Optimal operation of energy systems with uniform gas composition using linepacks -- Reliability evaluation of integrated energy systems considering gas flow dynamics and demand-side flexibilities -- Steady-state optimal energy flow in hydrogen-integrated energy systems -- Transient-state optimal energy flow in hydrogen-integrated energy systems considering gas composition dynamics -- Long-term reliability of hydrogen-integrated energy systems considering hydrogen embrittlement -- Short-term reliability of hydrogen-integrated energy systems using universal generating function -- Resilience definition and evaluation of gas

interchangeability in hydrogen-integrated energy systems -- Nodal energy price and market clearing in carbon emission-embedded hydrogen-integrated energy systems.

Sommario/riassunto

This book explores the hydrogen integration in energy systems from a whole system optimisation perspective. The book introduces new modelling, optimisation, and reliability evaluation approaches that support the net zero transition. Global warming has been witnessed in the past few decades—as caused by the emission of greenhouse gases, such as carbon dioxide, it not only affects the habitat of animals but also threatens the lives of mankind in modern societies. Around the world, resulting from the excessive consumption of fossil fuels, such as natural gas, the energy sector is the culprit behind carbon dioxide emissions and climate change. To achieve net zero ambitions, energy systems worldwide urgently call for cleaner energy sources. Green hydrogen, produced through power-to-gas facilities using surplus renewable energy generation, has emerged as a promising solution. However, because hydrogen shares distinguished properties with natural gas, many fundamental questions, including how to smoothly integrate hydrogen into the existing energy systems, how to operate such a new structured energy system, and what is the systematic impact, remain unclear. To answer these questions and bridge the research gap, this book aims to develop new modelling, optimization, and reliability evaluation approaches that support the transition of current energy systems to hydrogen-integrated energy systems (HI-ES). This book sets the theoretical foundations for developing more advanced control strategies and application scenarios for HI-ES, and inform policy makings through bespoke advice on hydrogen integration road maps.