

Preface

My goal for writing this book was the need to offer a broader, multidisciplinary picture to energy security professionals and students, so that they better understand the convergence of energy and security.

In our historically significant era, energy and security are becoming increasingly intertwined: The benefits of energy cannot exist without security, whereas homeland security is jeopardized without an energy mix that is sustainable, independent, accessible and affordable. Hence, energy security determines global and national sovereignty, socioeconomic prosperity, and political stability.

A wide array of energy books have been previously written for individual energy segments, or exclusively for energy or security. However, this book was written as a response to the present historical turning point, where governments and energy conglomerates take huge synergistic leaps in science, technology and global operations.

This is an era where governments and energy conglomerates have long been preparing for a more intricate energy mix where both fossil fuels and renewable energy sources serve a nation's strategic energy goals.

Many academic programs around the world have revised their curriculum in response to the increasing significance of energy security, homeland security and supply chain security. This book meets the great demand and offers a multi-disciplinary convergence that includes the most prevailing energy sources (both non-renewables and renewables) covered from an operational, commercial, technological, geopolitical, historical, and regulatory perspective.

Several goals are served in this book: First, to provide energy and security majors with a concrete, in-depth analysis of both energy and security.

Our second goal is to offer professionals and students of security, economics, political science, transportation and other disciplines a panoramic hindsight from a multidimensional, multidisciplinary perspective.

We therefore offer a book that combines the above disciplines, and offers in-depth, advanced scientific information, while remaining comprehensive for every reader.

Each chapter of the book, and each energy segment, has its own voice. However, the reader will soon discover the interconnection among the chapters, and the diverse energy segments that are briefly explained herewith:

- 1 This is an era of rapid developments as to the new research and development in technologies, processes and regulations. Both renewable and non-renewable fuels are shifting to become greener, lighter and of higher calorific value. At the same time, energy security concerns have reshaped our strategic thinking from a geopolitical, economic, commercial and social perspective. To attain its goals, energy security

- must be characterized by sustainability, independence, efficiency, affordability and accessibility (Chapters 1 and 3).
- 2 To address the individual challenges and opportunities, energy security is encompassed from three viewpoints, i.e., from a government, industry and supply chain perspective. Furthermore, the space of security is distinguished into physical, cyber, and holistic, which again encompasses the entire supply chain (Chapter 2).
 - 3 Throughout the authorship of this book, there have been impressive day-to-day developments in the energy realm: The demand for energy increases dramatically as global population and the industrial output needs increase. Thus, energy harvesting gears towards more unconventional methods (Chapter 3).
 - 4 Innovation is reshaping the oil and gas industry: Shale production and natural gas seem to be increasing market share, while transforming into cleaner, greener fuels. Oil and gas companies strengthen their bottom line through an increasing demand for chemical, plastic and petrochemical products (e.g., plastic resin and synthetic fiber, etc.). Thus, they have established this significant safety cushion for profit that alleviates dramatic oil price fluctuations and market uncertainties. The US has assumed a leadership role in the petrochemical industry, thus raising a relentless comparison with OPEC, which has now agreed to boost production. The final winner in this duel will certainly be the oil and gas industry, which remains the top energy segment with vast reserves and high, sustainable demand (Chapter 4).
 - 5 The coal industry is transitioning into a "clean coal era" and grows with a myriad of applications and byproducts: Thermal coal feeds the global electric grid, while metallurgical coal feeds the construction industry. It is also used for electric cars, the food industry, cosmetics, textiles, potable systems, etc. Gas even adsorbs pollutants including gaseous products and chemical odors (Chapter 5).
 - 6 The nuclear industry consists of two different types of reactions, i.e., fission, the traditional atom-splitting technique, and fusion energy, which uses plasma to fuse atoms and thus produces energy. Fusion, the so-called energy of the future, promises inexhaustible power to be used on planet Earth, space exploration and space colonization (Chapter 6).
 - 7 Over the past decades, wind energy has combined onshore and offshore installations, with several global seaports hosting wind turbines as part of their concession agreements with energy companies. Wind energy is now literally taking off, as with recent research and development initiatives, wind turbines will be suitable for harvesting energy on planet Mars (Chapter 7).
 - 8 Hydropower consists of ocean and tidal energy production, and represents the primary renewable source used for electric power, with 71% production. Impressive hydropower facilities generate power from South Korea to England and France, to Egypt, Ethiopia and Laos, promising to harness the global waters (Chapter 8). Certain new generation commercial ships, e.g., in NYK Japan, are using hydropower to harness the power of the waves while the ship is in motion. This will be a most impressive auxiliary energy in the new generation of ships.
 - 9 Solar photovoltaic (PV) power has two unique particularities: Its installations can be used over buildings, thus giving a unique architectural signature to smart buildings. Solar installations on roof tops could well become part of the smart homes of the future. Solar energy can also provide electricity to the most remote structures of the globe. Panels can be installed in roof tops and thus give light and electricity to houses off the electric grid (Chapter 9).
 - 10 Geothermal energy is equally fascinating, as it captures inexhaustible, unbounded underground energy from extremely high temperatures. Impressive installations are

found in the Antarctic, but also in the so-called “Ring of Fire” encompassing the US, Philippines, Indonesia, Mexico, New Zealand and other countries. The USA and New Zealand will collaborate in an ambitious plan dedicated to advanced geothermal energy production. Naturally, geothermal energy is considered a strong candidate to facilitate space colonization, and planet Mars is a suitable candidate (Chapter 9).

- 11 Biofuel is humankind’s attempt to recycle all the humble, unwanted materials on earth. There is a noble, most fascinating quality about the biomass industry, as it generates energy out of garbage and makes usefulness out of waste. The biofuel power generation has come a long way with four generations, or four impactful technological eras of producing fuels. Biofuels are used in the space and transportation industry in the form of fuel additives. The US Navy’s “Great Green Fleet” consists of biofuel-powered warships. Also, commercial airlines and courier entrepreneurs have adopted the use of biofuels as the sole fuel in dedicated flights. The use of aquatic flora, especially algae, is a cornerstone in the history of biofuel. Recent scientific breakthroughs by companies like ExxonMobil yielded genetically-modified algae with very high calorific value, suggesting a very promising future for algae-based biofuel (Chapter 10).
- 12 And while covering the aspects of physical security, the energy industry’s cyber space is also covered in the book. What are the alarming rates of attack on cyber security in the modern energy industry? How do hackers operate, and what is their operational footprint? Most importantly, what are the benefits of companies adopting a proactive security culture, and what are the risks of more optimistic, complacent cultures where companies are “strategically inactive”? In our era of large-scale data sharing via big data and blockchain schemes, cyber security is a significant segment of energy security (Chapter 11).
- 13 Strategic planning, forecasting, risk management, and training comprise a set of inter-related tools that can be used to attain optimum performance and energy security (Chapter 12).

Prof. Maria G. Burns

Director, LTPP and Faculty SCLT, University of Houston
Honorary Member, US Coast Guard Auxiliary