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BOOK REVIEWS

Global Energy Fundamentals. Economics, Politics, and Technology by Simone Tagliapietra (Cambridge University Press, 2020). 270 pages, ISBN: 978-1108817707.

After human creativity, energy is perhaps the second most universal input into human activity. In the preface to *Global Energy Fundamentals*, Simone Tagliapietra observes that energy “is a key prerequisite for modern life and it represents the lifeblood of modern societies” (p. xvii). The diverse energy resources and technologies that fuel modern societies are themselves products of human creativity, and have evolved over millennia. Tagliapietra’s work introduces this diverse portfolio and discusses it in a comparative global context. He also takes an interdisciplinary approach that synthesizes economics, politics, history, and technology to stimulate new insights for energy professionals as well as policymakers and students new to energy topics. Understanding these dimensions is crucial to a full understanding of energy issues and energy policy.

As an overview of energy issues and current trends, the first chapter lays foundations and provides comparative country-level data to set the global context. Tagliapietra emphasizes two defining characteristics of energy systems: the role of large, complex infrastructure networks, and the role that governments have played in developing and regulating those networks, both domestically and internationally. From their modern origins all energy systems have confronted issues of safety, security of supply (including national security and geopolitics), and affordability. In this chapter Tagliapietra also introduces two focal current issues: climate change and energy access in developing countries.

Seven energy resource chapters follow. Each of them focuses on a specific fuel or resource category, discussing briefly its historical development, its technological fundamentals, and the political economy of its production in a global context. The chapters vary in their focus depending on the specific details of the resource; the oil and natural gas chapters, for example, discuss the geopolitical aspects of their production, transport, and exchange, topics that are not as relevant to energy efficiency and consumption. Importantly, all of the resource chapters start with a brief historical overview, conveying to the reader the very long relationship that people have had with energy and how those technologies and relationships have evolved, in some cases over millennia. The last two chapters contain overviews of two timely topics in energy economics previewed in the introduction: energy and climate change, and energy access in Africa.

The first three of the resource chapters—oil, natural gas, and coal—explain the extraction and production processes, provide data on their production and consumption over time, and compare these trends across countries. They also emphasize that these resources are not distributed uniformly across the planet, a fact that has contributed to geopolitical conflicts. Taking these three chapters as a whole, Tagliapietra paints a clear picture of the interdependence of these resources, although he could have discussed more some of the market implications of the co-location of natural gas with oil in both conventional and unconventional deposits (in economics, the joint production problem). He explains well the interdependence of increasing natural gas supply and declining coal demand in the U.S., and discusses the effects of economic growth in China on both supply and demand for the three fossil fuels.

The nuclear energy chapter highlights the technological details of this relatively young technology, illuminating the differences in reactor types across countries. Here Tagliapietra

also discusses recent developments in small modular reactor designs and mentions the quest for ever-elusive fusion technologies. One topic he could have discussed in further detail is the financial challenge facing nuclear plants participating in competitive wholesale power markets. A cross-country comparison here would be useful, particularly for American readers, to see how policymakers and market designers elsewhere are grappling with communicating the greenhouse gas emission benefits of nuclear so they are reflected in market prices.

The chapter on established renewable energy technologies includes bioenergy, hydroelectric, and geothermal, with descriptions of these diverse technologies, production trends, and cross-country comparisons. The hydroelectric discussion is particularly valuable and will come as a surprise to some readers who may think that its use is on the decline, while the data Tagliapietra presents shows a more varied experience. The discussion of hydro technologies (pp. 130-136) is a treat for readers who enjoy learning about the fascinating technologies comprising our energy system (the same holds for natural gas, with the schematic of a combined-cycle gas turbine in Figure 3.6).

The wind and solar chapter, similarly, explains the technologies in clear and accessible terms and presents comparative data on the recent growth in wind and solar generation. The final section of the chapter contains a crucial discussion of the challenges of integrating these intermittent resources into transmission and distribution systems with architectures designed for the one-way flow of current from large central generators to smaller end users.

Following that chapter with one on consumption and energy efficiency makes sense, as demand flexibility is an essential component of mitigating those integration challenges. The discussion of demand flexibility and demand response could have mentioned the transformational role that digitalization (beyond smart meters) is starting to play in enabling such flexibility, through automation in response to price signals (transactive energy). The discussion of energy efficiency is excellent, making the important distinction between efficiency (providing the desired output with less energy) and conservation (reducing energy use), but missing an opportunity to discuss Jevons' Law and rebound effects. The discussion of energy efficiency in transportation provided in this chapter is valuable, and it ties in to the mention, earlier in the oil chapter, of transportation as the sector using the most oil and the challenge of decarbonization in transportation.

At this point there is a gap in two related areas that I wish Tagliapietra had covered. Interconnection and integration of distributed and renewable resources has implications for both transmission and distribution system operations, and for power markets. Institutional frameworks for these vary greatly internationally. A chapter on T&D systems presenting those issues and comparisons would be useful. So, too, would a discussion of recent developments and the potential for storage, at various scales.

The final issue chapters on climate change and energy access in Africa are valuable primers for readers unacquainted with these topics. In my case, I was unfamiliar with many of the details of energy systems in Sub-Saharan Africa, and Tagliapietra discusses the economic growth challenges, the health effects of poor air quality from indoor cooking using biomass, and the capital financing challenges for increasing energy access.

This short book covers a wide range of energy topics at a fairly high and general level, and is written in an accessible voice aimed at non-specialists. The narrative conveys the important data and analysis concisely without going into great detail, and the extensive bibliography gives the interested reader resources to pursue for further depth of study. Each chapter concludes with a list of key insights that summarize the chapter's content effectively.

Tagliapietra's book provides an invitation to further exploration and learning, and as such would be useful as a text in a wide variety of economics, politics, public policy, law, engineering, and management courses. It will also be a valuable resource to policymakers and their staff, who often have to familiarize themselves quickly with the economic and technological fundamentals of a topic, a task that can be daunting with global energy systems, particularly in this time of technological dynamism.

*L. Lynne Kiesling
University of Colorado-Denver
Denver (Colorado)*



The Evolution of Electricity Markets in Europe by Leonardo Meeus (Edward Elgar Publishing, 2020). 192 pages, ISBN: 978 1 78990 546 5.

The central question of this book is how to integrate the European power market successfully.

The first part of the volume discusses the different issues and solutions involved in organizing electricity trade within Europe. Chapter 1, written by Leonardo Meeus and Valerie Reif, explores the question of why electricity markets were established in Europe and provides a historical perspective of the political process that led to the regulatory framework for enabling the integration process. The subsequent three chapters, co-authored by Leonardo Meeus and Tim Schittekatte, explain how power trade is organized across Europe. Chapter 2 treats the delicate subject of how to allocate the rights to trade across borders. It explains how to transform a system of historical privileges assigned to utilities into a more transparent and less discriminatory allocation of transmission rights. Chapter 3 describes methods of cross-border trade calculations. Measuring constraints in transmission lines requires in particular platforms for efficient data exchange and collaboration between transmission system operators (TSOs). Chapter 4 discusses the critical question of assessing network tariffs for cross-border trade, especially when network investment costs have to be shared among countries. Despite converging national network tariffs, this is a complex issue given some country-specific context (e.g., bidding zones or storage capacities compensation).

The second part of the book deals with issues related to security of supply in the context of cross-border trade. Chapter 5, co-authored by Leonardo Meeus, Valerie Reif and Tim Schittekatte, discusses how to share the responsibility for balancing the system when national markets are integrated at a European level. In particular, it focuses on the different design options available to limit shortages. Chapter 6 lists detailed (but often dismissed) technicalities needed to allow for market integration. Chapter 7 discusses the well-known "missing money" problem connected to investments in power plants. Interestingly, it also discusses the "missing markets" problem, which jeopardizes a proper "long-term hedging across borders and market for reliability".

Finally, the last chapter written by Leonardo Meeus and Athir Nouicer constitutes the third part of this book. It focuses on potential consumer involvement in providing flexible services to the grid which would enable a smooth integration process.

Meeus and co-authors provide a comprehensive overview of the European electricity market. Although it is not the first book reviewing the different challenges and opportunities

related to the European integration process, it provides in a condensed way a simple and yet relatively complete approach. In my opinion, the added value of this book is its pedagogical approach, one of the main appealing features being the book's format. It offers a concise description of the current European power market and has additional outputs that expand the comprehension of the different issues. Most notably, each chapter has an annex with valuable insights into the legal and regulatory context. In addition, the book provides numerous examples.

To conclude, this book is intended for a relatively diverse audience. Readers looking for a general perspective over the European electricity market will find an accessible overview of the complex issues at stake. While readers with background knowledge on the functioning of the European electricity market will enjoy the discussion about the necessity to improve the regulatory framework so as to achieve an efficient integrated European market.

Chloé Le Coq
University of Paris II Panthéon-Assas (CRED)
Paris (France)
Stockholm School of Economics (SITE)
Stockholm (Sweden)



The New Map: Energy, Climate, and the Clash of Nations by Daniel Yergin (Penguin Press, 2020). 512 pages, ISBN: 9781594206436.

The New Map: Energy, Climate, and the Clash of Nations demands our attention both because of its author, Daniel Yergin, and because of its promising title.

Yergin needs little by way of introduction. He is a Pulitzer Prize winner and a well-known energy analyst. His books, *The Prize: The epic quest for oil, money & power* and *The Quest: energy, security, and the remaking of the modern world*, are masterpieces and are particularly fascinating for anybody interested in the role of energy in society. His books are wonderfully written and are based squarely on real-life stories. His books do not 'get old' as often happens with titles dedicated to geopolitics. Their dynamism comes from the way Yergin captures different events in a logical sequence and so explains changes in the energy world. The writing in this new volume is of the same high standard as his previous books: a perfect reading pleasure.

The New Map is a worthy successor to his previous books. Yergin updates his analysis of energy and geopolitics in the twenty-first century. The first four chapters are dedicated to America, Russia, China and the Middle East, the regions dominating energy sector development. The last two are thematic analyses on the impact of climate change mitigation policy and the technologies challenging oil supremacy. *The New Map* provides an overview of the complex relationship between politics and technological developments. The historical events and biographies that appear in the book make it colourful and entertaining for readers.

The world's energy map is less and less influenced by geology. The main message of *The New Map* is that political choices are now the dominant driver of energy policy. There is China's drive for supremacy in the South China Sea and its expansion through the Belt & Road Initiative. There is Russia's aggression in Ukraine and its willingness to assert itself as a superpower. There is the "arc of confrontation" between Iran and Saudi Arabia in the Middle East. All of these are changing the energy world. The US shale revolution has also revolutionized

matters: it is, in the author's opinion, the most important geostrategic event in recent history. As a result of the shale revolution, the US has re-emerged as a major oil and gas exporter. The shale revolution has made the United States a major oil producer on the same level as Russia and Saudi Arabia. Yergin believes that "oil will maintain a preeminent position as a global commodity" and will be "still the primary fuel that makes the world go round". At the same time the author recognises that the oil sector is changing. OPEC's influence is decreasing. New configurations like OPEC+ have been needed for the stabilisation of the oil markets. And it isn't, any longer, only about oil. While tensions in the South China Sea could affect oil and gas delivery routes or access to potential gas and oil deposits, fossil fuels are not central there. Systemic changes based around the promotion of political systems are becoming more important. Democracy as a political system is being seriously challenged by China's one-party system and by Russia's willingness to change its borders. The book is about power: specifically, the political power necessary to influence your neighbours. Energy proves to be important in the geopolitics of today but it is no longer decisive. Skeletons in the closet like "the century of humiliation for China" are making their presence felt. The book indicates the points of tension that could overturn the world. Too much attention, the author argues, is being given to President Putin's and President Xi Jinping's converging views. They can prepare pancakes for each other in a publicity stunt, but the divisions between Russia and China are also significant. Both challenge America's leadership - they have that in common. But on other issues, including energy, they are far from united. China's Belt & Road initiative isn't particularly welcomed by the Kremlin since Russia and China are competing for power and influence in Central Asia. Unfortunately, *The New Map* focuses less on the ambitions and actions of other world leaders, including the most recent Presidents of the United States. Putin and Xi are definitely influential, central even. But there are other leaders whose opinions matter as well. Despite this shortcoming Yergin manages to deliver throughout the book the message that we are living in the "era of rising tensions and a fragmenting global order". He predicts—the words are sinister—a "clash of nations".

Yergin believes that the energy transition will be neither quick nor easy. He reminds the reader that the share of fossil fuels in the global energy mix hasn't changed much in the last 30 years. The concern about climate change hasn't made a substantial impact. His scepticism becomes evident when he talks about the EU's race to reach carbon neutrality by 2050. To achieve this goal Europe's *per capita* emissions will have to decline to the level of India today, despite having a much higher level of wealth *per capita*. It isn't that Yergin opposes green policies, but he is evidently sceptical about a fast transition. The book brings a lot of interesting statistics to justify this scepticism. China, for instance, builds eight new airports a year and between 2011-2013 China laid down more concrete than the United States did in the entire twentieth century. Let us be clear. There is no denial of climate change, but there are doubts about the development of clean technologies. Yergin underestimates perhaps the can-do spirit available here. To be fair to him, he dedicates a chapter to the innovations that will help to achieve our climate goals. He recognises that the electric vehicle has become an existential question both to the global automobile industry and to oil producers. He asks the question "Will the power that moves people still emanate from oil wells, or will it be from electric power lines?" He also draws attention to new options for mobility using digital technologies – self-driving cars or "mobility as a service". Still Yergin doesn't give enough emphasis to the climate emergency. He doesn't analyse what it means to the energy industry. There is not much

on the multibillion-dollar investments in solar and wind energy or on the oil industry giving way to renewable energy. The trend towards sustainability isn't rendered very well.

Yergin believes in human ingenuity to provide new technologies. Stories about Harold Hamm, the fracking pioneer, or "Idea-a-minute" McLean, who developed the concept of container shipping, which revolutionised international trade, are good examples. Yergin is less well disposed towards environmental activism. He seems biased in favour of ever greater energy industry development, like the controversial Dakota Access Pipeline. He even speaks sarcastically about the ban imposed on hydraulic fracking in New York State. In his book more attention might have been expected on methane emissions from the oil and gas value chain. There is a paragraph about how reducing heat-trapping methane emissions "is now a priority for both regulators and industry", but without any further elaboration. Methane emissions today are responsible for a quarter of man-made climate change and the oil and gas sector together with coal is a major contributor. Without major decreases in methane emissions, it is difficult to imagine the role of fossil fuels in the energy transition even using CCUS (Carbon Capture, Utilisation and Storage).

Yergin's style of writing makes the reading experience a pleasant one. There are many curious stories. The strength of the book is in bringing these stories together in a logical sequence and with a strong narrative and analysis. Yergin knows and loves oil and the people who drive this industry. His heroes are George P. Mitchell, Mark Papa and other fracking pioneers. In explaining the geopolitical challenges that we face today, he recalls certain historical events: the explorations of Zheng He, the fifteenth-century Chinese admiral; Mark Sykes and François Georges-Picot drawing up post-Ottoman maps; tensions between the US and Europe in the early 1980s about gas deliveries from the Soviet Union; and the Iranian Revolution and Iraq under Saddam Hussein. Most of the stories are well known, but they have been told in a different context. They are employed here to explain today's energy problems.

The reader has an interesting feeling after reading *The New Map*. You have unquestionably enjoyed the book, but something was missing. This wasn't the case after reading *The Prize* or *The Quest*. Perhaps this is a question of the challenging times we live in and the complexity of change in the energy sector. To get the full picture, you need to look not only at the events of today but also at a broad swathe of history. You have to be able to anticipate what will come. I wish that the last chapter of the book "The disruptive future" had been more courageous in bringing all of Yergin's experience to bear on predicting the future. A more ambitious analysis might have been proved wrong, but it would have increased the value of this magnificent volume. The foundations of the global energy system are shifting. There is also an important new question: "Will the Covid-19 crisis speed an energy transition or slow it?" In Yergin's opinion, it could inspire a "green" recovery. What happens next? Now that would be another book...

Andris Piebalgs
Florence School of Regulation
European University Institute
Florence (Italy)