BOOK REVIEWS

Electricity Distribution Networks in the Decentralization Era. Rethinking Economics & Regulation by Rahmatallah Poudineh, Christine Brandstätt, Farhad Billimoria (PalgraveMacmillan, 2022). 138 pages, ISBN 978-3-030-98068-9.

When a new reality is born, one has to acknowledge it in an organized manner. This is what books are good at; they are better than articles – when they are good books. Is "*Electricity Networks in the Decentralization Era. Rethinking Economics & Regulation*" (Palgrave, 2022), by R. Poudineh, C. Brandstätt, F. Billimoria, such a good book? What does it do?

It is not an advocacy book, trying to convince the reader that its authors are the very first pioneers identifying a new promised land. It is rather a guidebook, intending to give the reader a map, a compass, and a few survival kits to navigate a field whose basics are already changing. This is done in three steps.

Step 1 covers the first two chapters. It reminds that the whole electricity system has changed, is changing, and will continue to change all along the current energy transition, under two tremendous forces of transformation: the digitalization push and the decentralization pull. It shows how much the so-called electricity distribution area is one of the most impacted parts of the electricity system, with distributed energy resources, individual generation and storage, electric vehicles, demand response plus smart appliances, and platforms for local or decentralised trade.

Step 2, in a five-chapter tour, revisits the tasks of the distribution industry, and the attributes of its various components in such a transformed electricity system. First, distribution grids are discovering bidirectional flows that rapidly vary within the day. Distribution networks have therefore four system requirements to manage (resource adequacy, frequency, voltage and restoration) in a "sandwich position" made of transmission constraints at upper level, and peer-to-peer operations at the lower level. Which coordination model will emerge to deal with that? Second, charges for distribution access were thought to finance the network, but are becoming a frame of incentives for prosumers and prosumagers to invest, to behave and to coordinate. How to differentiate charges among the various categories of grid users? Third, how to combine charges and contracts for access or interruptible access? How to revisit access allocation processes with more differentiation among usages and more market-based tools revealing the access value? Fourth, how to define the new or already existing local markets, as tied to the distribution grids as the central wholesale markets or retail markets are tied to transmission operation? How to design their products and the corresponding market rules, including their interaction with central markets? Fifth, electricity used to be thought as both a sector and a vector. The extension of electrification is questioning this habit, with electric mobility being a quite new and different service, as are massive electric heating and cooling, with new vectors arriving, like green hydrogen or biogas. How to conceive an effective system integration in the new "multi-energy distributed systems" exhibiting various "fuel interactions", "service interactions", "spatial interactions", "temporal interactions", and "network interactions"?

Step 3 reviews the distribution regulatory framework starting, firstly, with the dogma of "unbundling", conceived to facilitate competition in the wholesale and retail markets at the end of the 20th or the beginning of the 21st centuries. Due to the very small size of the assets connected to the distribution network, the gains of facilitating retail competition have to be

compared with the burden of losing all scale and scope economies. However, the growing decentralized generation (like wind and solar power) and the increasing digitalisation of individual consumption (and storage) create such a high value to information and data, that all new business models for energy services will face a barrier and many forms of discrimination if the management of distribution information and data is not made strictly independent and open access to all categories of professionals. Secondly, step 3 reviews all the basics of the economic regulation of electricity. It is more or less the most difficult part of today's reality. Distribution networks were a simple collection of assets, transferring power flows from the transmission grid, fed by big plants, to millions of consumers. Decentralization of generation via renewables changes these flows; digitalisation of consumers and their consuming devices, plus individual storage, does the same. Any decision relating to distribution grids or distribution regulation influences further investments or future behaviour by distribution users. In addition, society values new dimensions of electricity services, being decarbonisation and interactivity. Both innovation and "renewed outputs" have to enter the core of distribution regulation; but no strong regulatory models have emerged yet to guarantee that distribution grids will adequately deliver on all new society's expectations.

Yes, the three parts of the book do the job, and it is an excellent book that will rightly update your mindset and your research compass in this "very complex sub-system" of the electricity world. Is it perfect? Books are rarely perfect because authors have rarely all the skills to be perfect. Two topics are missing to reach perfection. One is an organized review of the new business models revolutionizing the distribution industry (which characteristics of tasks and products are now being targeted? Which assets are created or activated? Which revenue streams are being built or secured?). The other one is the influence of ownership structures on innovation and behaviour in the distribution industry (for example: public vs private; incumbent vs pioneers; local vs national vs global; etc.).

But, very frankly: yes, getting this excellent book, digital or printed, is obviously the perfect decision to be made this year.

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Global Warming Science. A quantitative Introduction to Climate Change and its Consequences by Eli Tziperman (Princeton University Press, 2022). 315 pages, ISBN 9780691228792.

This is the first part of an unconventional book review of a handbook for STEM undergraduates, offering a quantitative survey of the science involved in the study of anthropogenic global warming and its consequences. This reviewer is an economist, interested in understanding climate change and in discussing policies to mitigate it. The purpose of this review is not to assess the book's worth as a teaching tool, for which tasking a different reviewer would be appropriate.

My purpose is to extract from this clear and well-organized volume some clarifications which may be useful to economists and political scientists who debate on the issue and have a partial and superficial understanding of the available scientific knowledge of it. Indeed, a bet-

ter understanding would improve both the debate among social scientists and the level of the political discussion on how to confront the threat of climate change.

This book offers a complete overview of climate change, summarized in chapter 1. It then addresses the greenhouse effect in chapter 2 and continues with a detailed description of its most debated implication, global warming. The present review deals with these three chapters of the book.

The following chapters cover all the other visible consequences of this effect: sea level rise, ocean acidification and circulation, clouds and hurricanes, melting ice in the Arctica and in Antarctica, mountain glaciers, droughts and precipitations, heat waves, forest fires. A separate review will follow in September 2023, covering these chapters.

A "believe it or not" issue?

The first clarification that a climate economist needs is about the scientific certainty of climate change, which allows to better confront skeptical objections: the content of the first 3 chapters of the book provides the basis for this certainty.

Among all climate change effects, global warming comes first, and it gives the book its title. It strictly depends on the greenhouse effect which, in turn, is linked to the concentration of GreenHouse Gases (GHGs) in the atmosphere: mainly carbon dioxide (CO2), but also methane (CH4), nitrous oxide (N2O) and chlorofluorocarbons (CFCs). CO2 concentration is estimated to have increased from an average of 280 parts per million (ppm) in preindustrial times to around 400 ppm in year 2020. Adding in the other GHGs, the combined CO2-equivalent mixing ratio due to all greenhouse gases reaches level 500 ppm, almost doubling the pre-industrial level. The size and acceleration of emissions, which are producing such exceptional increases in GHGs concentration, can only be explained by human activities.

Global warming is a consequence of such increase. The observed globally averaged surface temperature shows a slightly declining trend from year 500 a.d. to year 1700, then an initially mild increase which accelerates dramatically in the last 100 years, up to an unprecedented level in these 17 centuries, measured at 1.1 °C above preindustrial average in year 2020. Predictions by climate models that are run under a CO2 doubling scenario vary between 2 and 4 °C for the same year. Such a lower increase is related to the existence of negative feedbacks; for example, the heat retained in the lower layer of the atmosphere (troposphere) creates a relative cooling of the stratosphere (the outer layer) and this has the effect of reducing the warming of the Earth.

Another cause of the apparently lower temperature increase is heat absorption by the oceans. In fact, models correctly predict a long-run equilibrium temperature, to be reached in hundreds or thousands of years, depending on the local depth of the ocean.

The variety of models, and the complex set of both positive and negative feedbacks, explain why the interpretation of global warming phenomena is less simple than usually understood. The author, Eli Tzipermann (henceforth: ET), clearly distinguishes two tasks. One is the detection of the changes which have an anthropic origin (namely, temperature increase, reduction of the Arctic Sea ice area): this requires a proof that the observed change is inconsistent with natural variability.

A separate issue deals with individually observed events (such as the strong Arctic ice melting in 2012 or the Siberian heat wave in 2020). These can only be attributed to climate change, due to greenhouse gases increases, if they are not consistent with alternative, plausible explanations based on other (anthropic or natural) causes (e.g., a change in ozone concentration, aerosols, land use or volcanoes).

This looks like a sound methodology. An ordinary citizen, or a social scientist, cannot do the job of a climate scientist. Nor should one give up on having an opinion, or base one's opinion simply on local evidence or on media messages. One can question climatologists: is your model based on statistically adequate testing? Does it take into account all relevant feedbacks, positive and negative (e.g., increasing water vapor in the atmosphere due to warming, acting as a GHG itself, but with a different time profile according to its increasing saturation)?

Global, but differentiated, warming

The average increase in surface temperatures, the "magic" number we know and anxiously monitor, summarizes many effects.

Average warming hides different developments according to latitude: polar areas are warming faster because melting ice and snow cover reduce the albedo effect, i.e., the reflection of solar radiation, which is much higher in the case of white surfaces.

Other complications arise, firstly, from the interplay of short-wave radiation incoming from the sun and long-wave radiation emitted in response by the Earth's surface; secondly, from the different reflection/absorption behavior of different greenhouse gases present in the atmosphere, including water vapor; thirdly, from the fact that all these actions vary according to the distance from the Earth's surface. Various consequences stem from these interactive effects, which can be represented by equations (and equations can be composed into systems, i.e., models), and, since the equations which are best representative of the phenomena, i.e., turning out to best fit the real data, are not linear, in some cases they provide an "explanation" of facts which appears to be the only possible elucidation. This is the case for the simultaneous surface warming and stratospheric cooling, and the apparent pauses in the rise of average global surface temperature ("hiatus" periods, such as in 1940-1970 and in 1998-2013). ET observes that "*natural climate variability leads to oscillations in the globally averaged temperature, and when these oscillations are superimposed on a warming trend, the two combine to give what seems to be hiatus periods*". The observed existence of pauses in warming, and even temporary cooling, is one source of climate skepticism.

An invitation to know better

Global warming and the other highly disturbing aspects of the present climate trend are accurately described in this book, and, for each of them, a clear illustration of the existing measurements and of the analytical apparatus which is used in research is provided. Numbers and equations open the way to numerous exercises so that students can become familiar with applied research.

Even a more limited approach, with only a superficial involvement into the calculations and none into the exercises, which is the experience of the present reviewer, can be greatly beneficial to any reader's understanding of these issues, which are still misunderstood by many and ignored by many others: attention seems mainly paid to the local consequences of climate change itself, and of the tentative remedial policies.

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Making Energy Markets by Ronan Bolton (PalgraveMacmillan, 2021). 360 pages, ISBN: 978-3-030-90074-8.

Making Energy Markets (subtitle: *The origins of electricity liberalisation in Europe*) describes and discusses electricity liberalisation in a few European countries (mainly Britain and Norway, including brief references to other Nordic countries, and to a lower extent France and Germany), as well as at European Union level, from the late 1980s until the late 1990s. The author's purpose is twofold:

- Filling a void by providing a pioneering *"systematic historical account of the origins and establishment of these* [competitive electricity] *markets in a European context"*, focusing *"on how technological, political and economic factors shaped the transition to markets in particular national contexts"*, also taking into account *"broader international and structural factors"*.
- Providing *"a bridge between the early histories of electricity systems and contemporary approaches to the analysis of 'system transitions' in the context of energy decarbonisation"*, acknowledging both that *"Traditional markets designed around marginal costs and valuing energy output are no longer fit for purpose"* and that *"Energy markets no longer drive investment decisions"*.

The very title underlines the fact that electricity markets (actually, all markets) are man-made social constructions, reflecting different political projects, economic trends, technical developments, cultural climates and societal aspirations. The first book sentence – *"The introduction of competition to western European electricity supply industries during the 1980s and 1990s was a political act"* – leaves no room for oversimplifying and for technocratic interpretations and puts the reader on the right track. Markets are not "technical" constructions existing in apolitical or depoliticized contexts; they may be "engineered" according to some abstract economic and technical principles, but their creation, financial or institutional life support (cf. Europe 2022) and, eventually, disassembling (cf. California 2000/1) always result from political decisions.

Although the book *"is not intended as a structured cross-national comparison"* of electricity liberalisation paths, it clearly shows why different market designs were adopted in different countries and, within the same country, why different models were embraced at different points in time. There is no such thing as "the" electricity market: markets, including electricity markets, are an attempt to solve concrete coordination and allocation problems according to some overarching, more or less explicit, political principles. The book clearly shows how different national problems led to different market solutions and structures in terms of ownership, unbundling, relation between system and market operators, pace of retail liberalisation, etc.. The European Internal Energy Market imagined in the late 1980s (in Brussels, in London or in Paris…) is very different from today's reality and this reality is about to change radically, well before 2030.

Following a brief introductory chapter describing the author's approach and major methodological choices, three parts, divided into 8 chapters, take the reader through the early electricity liberalisation stages in Britain, in continental Europe and in the Nordic region. The last chapter *"draws out lessons for our understanding of the governance of low carbon energy transitions, emphasizing the need to pay attention to the politics of electricity pricing and the distributional effects of market reforms."* Written in June 2021, just before the current European energy price crisis started, this chapter (and the whole book) could hardly be timelier.

It should be highlighted that the book is extremely accurate, with an unusual level of detail and meticulousness. As an example, the author carefully designates the present Energy Union according to the respective historical context, i.e.: "European Economic Community", when referring to the period from the Treaty of Rome to the Treaty of Maastricht, and "European Community" when analysing the phase from the Treaty of Maastricht to the Treaty of Lisbon. The sequence of political events and legislative proposals is described with great detail – in Britain, in the European Union and in Norway - resulting in extensive chronicles.

Although a few books[1] and many papers have been written about liberalisation of electricity markets, as well as on the politics of markets and market regulation,[2] Ronan Bolton succeeds in providing a comprehensive, well structured, well written and innovative narrative. His book is strongly recommended to people interested in knowing why and how Europe built an Internal Electricity Market: the largest, fully liberalized and interconnected electricity market in the world. Non-energy experts may feel sometimes overwhelmed by the amount of detail and microhistory, but readers will be rewarded with the accurate, multidisciplinary description of one of the most complex chapters in the construction of the European Single Market.

Some readers may miss references to important developments in some relevant countries: for instance, the crucial role of Switzerland before and during the initial phase of electricity liberalisation is not analysed; the creation of *Red Eléctrica de España* in 1985, as the first independent Transmission System Operator worldwide, subsequently a model for transmission unbundling, is also not mentioned. However, such omissions are understandable given the (geographical) scope of the present book.

The only serious omission in *Making Energy Markets* concerns the future, not the past – i.e., what happened after the - very well described in the book - first phase of electricity liberalisation? There is a small subchapter (*An evolving market*) dedicated to this question within chapter 7 (*The political market*), but unfortunately it is too short and can be even misleading. For instance, it is written there that *"the European Commission sought to provide further impetus to the electricity liberalisation project and decided in 2001 to table new proposals to accelerate the timeline towards full competition"*; the reader not familiar with the European Union political evolution may think this was a result of electricity market progression, following implementation of the 1996 Electricity Directive. In fact, the European Commission had been asked by the European Council, back in 2000, within the framework of the so-called "Lisbon Agenda", to accelerate liberalisation of many economic sectors, including electricity (and gas, telecommunications, transport, etc.). Therefore, these Commission proposals were nothing more than the answer to a new *"political act"*.

From the reader's point of view, the most satisfactory way to fix this limitation would be having the author writing a new book, following the same approach, applying the same style of the present one, but covering the second phase of liberalisation, from the late 1990s until today. No doubt, the European energy community would be grateful.

Making Energy Markets provides an accurate and comprehensive historical reconstruction of the introduction of electricity liberalisation in Europe. Truly, it assembles an impressive and extremely useful number of documents, dates, figures and ideas in a persuasive and elegant way. However, this historical reconstruction is highly relevant also in the present: *"A study of the*

1. Namely the *Handbook on electricity markets*, edited by Jean-Michel Glachant, Paul L. Joskow and Michael G. Pollitt (Edward Elgar Publishing, 2021)
2. For instance, *Handbook on the politics of regulation*, edited by David Levi-Faur (Edward Elgar Publishing, 2011)

inception of electricity markets is not merely a historical exercise therefore, but crucial for (…) exploring alternative ways of configuring the relationship between energy systems, politics and society".

In her State of the Union speech on the 14th of September 2022, European Commission President Ursula von der Layen stated:

> *"The current electricity market design – based on merit order – is not doing justice to consumers anymore.*
>
> *They should reap the benefits of low-cost renewables.*
>
> *So, we have to decouple the dominant influence of gas on the price of electricity. This is why we will do a deep and comprehensive reform of the electricity market. (…)*
>
> *Not just a quick fix, but a change of paradigm, a leap into the future."*

Again, a political act triggers an electricity reform. This process will not be swift, and it will not be smooth. Thirty-five years ago, monopolists were not willing - and many were not even able - to conceive electricity liberalisation, i.e., how to *make* electricity markets. Nowadays, market ideologues (jointly with some traders, large vertically integrated undertakings and other vested interests) are not willing – and some genuinely not able – to imagine how to *transform* electricity markets, how to enable the large-scale deployment of *"disruptive innovations which radically and rapidly transform energy markets"*.

Making Energy Markets does not deliver *"the contours of a new market framework*", but it clearly shows that a) flawed pricing mechanisms are always a major driving force for change; b) competition is *"not a natural outcome of the liberalisation process"*, rather it requires *"ongoing regulatory oversight and political intervention"*; c) scale matters and it *"is particularly important today because of the increasing electrification of transport and heating demands, and the uptake of distributed energy resources"*. *Making Energy Markets* reveals how a non-ideological historical reconstruction fosters a non-ideological vision of the future. Let's hope that decision makers in the European institutions and in Member States get this message in time.

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