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BOOK REVIEWS

Transactive Energy in California. A platform for 100 percent clean energy and electrification by Stephen Barrager and Edward Cazalet (Baker Street Publishing, 2020). 131 pages, ISBN: 978-0991505227.

Books are not all the same. This one is short—only 131 pages—and nearly conceptual in terms of content. It describes a *proof of concept* performed for three years in the suburbs of Los Angeles, California. Hence, the three parts of this review: 1- A concept; which one? 2- A proof of concept; what proof? 3- A proof of concept; not a business model?

1- A concept; which one?

The book talks about a fairly new concept in the industry: *Transactive Energy*. It means automating consumers' reactions to a highly granular pricing of energy. In electricity systems, the integration of variable renewable energy sources increases the value potential of demand flexibility, be it coming from distributed storage or direct load-shifting. A deeper digitalisation of the key consumption devices and the use of cloud computing permit to control how each device, at the consumer's premises, delivers the particular service expected by its users, while taking into account many particular data and the series of granular and dynamic price signals sent to the consumer's devices by the professional entities cooperating to supply them.

As demand response is fully automated, and individually performed for each key consumption device of each consumer, it can be quite sophisticated. It can consider the particular preferences of each consumer for each device service, the technical characteristics of each device and of the space and buildings in which they operate, the changing weather and environmental conditions, the effective occupancy rate of the premises in which the devices are located, and any other pattern detected as relevant by machine learning. It can also consider the granular and dynamic price signals sent by the three connected professional entities that enable a continuous and secure supply of energy: the transmission system operator, the distribution system operator, and the energy supplier. This sophisticated automation of demand response can also easily manage self-generation via solar photovoltaic panels, storage via batteries, hot water tanks, or premises used as air conditioning tanks, electric vehicle smart charging, etc. Even very special cases as mini grids for university campuses, military bases, shopping malls and leisure parks can be considered.

Transactive energy organises an optimal usage of each key consumption device, potentially promising to guide the self-dispatch of millions of decentralized devices, while the bigger energy generation units are still centrally dispatched.

2- A proof of concept; what proof?

The proof that it works. According to the authors of the book, the concept of transactive energy has been successfully tested in a three-years long experiment, performed in the suburbs of Los Angeles, within a single substation area of the company being both the distribution operator and the energy supplier: Southern California Edison.

On the consumer side, automation means that four types of consumer devices have been transformed in automated agents, able to self-manage and to dialogue with the different parts

of the entire transactive system. These four types of automated agents are: heating & air conditioning systems, swimming pool pumps (it is California), electric vehicle charging, and battery storage. Of course, other devices could have been taken on board (as PV units, clothes dryers, washing machines, etc.), but they were not as this was only supposed to be a first pilot. Each *device-agent* is equipped with its own *sensors*, measuring key variables influencing its operation, and an *actuator*, controlling both its use of electricity (as input) and the flows of services it delivers (as output). These four types of agents are submitted to a single “Home Automation Controller,” which is both a central unit of analysis and calculation for all the agents belonging to the same consumer, and a gateway to exchange and interact with the rest of the transactive system. The home automation controller combines the information collected by the individual agents’ sensors, with general environment and electricity information sent by the transactive system, as to generate a “machine learning” experiment for each home’s agents. This controller also keeps record of the preferences expressed by the consumer for each of the home agent’s services. Each consumer can adapt at will her preferences via a dedicated smart phone and computer application, or an interactive Amazon home smart speaker.

Fed with all these information and calculation capabilities, the home automation controller is ready to interact with the dynamic price signals sent by the three professional entities enabling the supply of energy to the consumer: transmission (with locational marginal prices), distribution (with congestion and marginal losses within the same substation area), and energy supply (according to a regulated generation cost function agreed by the Californian regulator, and distinguishing generation fixed costs and generation variable costs). Each day, the home controller buys energy for each of the following 24 hours. Each hour, it also buys for each of the 15- and 5-minutes intervals in the coming hour. To limit risks for consumers and facilitate investments decisions (like equipping with a PV unit, a heat pump or a home storage unit), consumers are offered year-long subscriptions, with a regulated tariff calculated on their average consumption profile recorded in the past. Since this subscription refers to an average energy use, consumers will nevertheless have to face the changes triggered by different weather conditions or a different occupancy of their premises.

In the same vein, uncertainty and risks incurred by the three categories of professional entities are limited because of these yearly contracts. To guarantee the liquidity of the many daily, hourly and sub-hourly transactions, the energy supplier is also acting as a “market maker,” which means always providing a counterpart to any bid made by any agent of any consumer, at any time within any time horizon. All these transactions are made upon a single digital platform, located into the cloud and called TeMix, built by the authors of the book, under the authorization and financial support of the California Energy Commission. This platform delivers automated services for payments, settlement and billing; and it works as a central and certified ledger of all actions and interactions in the transactive system.

3- A proof of concept; not a business model?

The concept worked. And thousands of real transactions have been automatically agreed and executed within this transactive process, between the many agents of the consumers and the three professional entities being the transmission and distribution grids, and a regulated energy supplier.

The concept worked but was applied only to one hundred consumers. Who will invest into its scaling up, in order to cover the almost 40 million people living in California?

The concept worked with the regulated generation cost functions of a single energy supplier. Is it supposed to stay integrated with a given regulated supplier, or open to a variety of competing suppliers, be they generators themselves or, alternatively, pure intermediaries buying energy on the wholesale market?

The concept worked with the distribution company acting as a “metering hub,” its sister supplier company as a “market maker,” and the TeMix platform as a single “trading venue.” Will it work also with competing sub-metering systems, linked to competing “service managers” (being different companies for different services, such as heat pumps, EVs, etc.)?

The concept worked while giving no choice to consumers, except opting in or opting out. Will consumers be allowed to choose between alternative platforms, offering alternative treatments and processes?

Last, but not least: this remarkable proof of concept does not provide any kind of measure of its costs and benefits: for the consumers, for the three professional entities managing transmission, distribution, and energy supply, and for the digital platform itself. One would need to know more before concluding why and how to jump into this brightly innovative new world, which is as big and as attractive as the opening of wholesale electricity markets in the 1990s or the introduction of competition in retailing in the 2000s.

Despite these shortcomings, I recommend this small book to the reader, so that she can make her own mind. Indeed, it is a very interesting first view of the new digital and highly interactive electricity world we are all entering in.

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Engendering the Energy Transition, edited by Joy Clancy, Gül Özerol, Nthabiseng Mohla-koana, Mariëlle Feenstra and Lillian Sol Cueva (Springer, 2020). 323 pages, ISBN: 978-3-030-43512-7 and ISBN: 978-3-030-43513-4 (eBook).

This book addresses Sustainable Development Goal 5, one of the key SDGs that will help unlock the full potential of us transitioning into a cleaner and more equitable future. What makes this book even more interesting is the fact that it is penned by “women in energy,” coming from both the global north and south, who bring their experiences and expertise on gender nexuses.

The journey of this book started with experts from academia, policy and practice wanting to learn from each other. Given gender mainstreaming in the energy sector was not taking place at the same pace globally, the authors focused on the importance of learning from both the global north and south experiences. While the issue of transitioning to low-carbon energy systems is a wide subject, this book focuses on social and political aspects of the transition in the energy system and the nexus with gender roles and relations. The first half of the book investigates the various dimensions to gender and its role in the energy transition including methods and tools, while the second half brings forward reflections from discussants who examine the various chapters from varied perspectives. Given that the book addresses multi-dimensional aspects across multiple sectors and geographies, already including detailed views

from external experts, I will use this opportunity to bring forward some highlights from the book which are engaging enough to dig deeper into the pages.

In Part 1, the authors address a wide range of aspects. For instance, in the chapter on “Energy Transition and Gender in the Informal Street Food Sector in Africa,” the authors highlight that although access to affordable and clean energy services can change women’s lives when linked to productive uses of energy, the energy for productive uses remains one of the least documented areas of debate on energy access. Combining this with the failure to include gender in the design of projects, policies and programs, deters equitable access to energy and energy services in the informal food sector in sub-Saharan Africa. Through evidence-based research, the authors present possible solutions for gender integration in the informal street food sector, which can help in the subsequent stages of formulation and planning of energy policies and programs, thereby channeling the right incentives, innovation and finance.

In the chapter on “Gender, Firewood and Health: The Potential of Ethnography to Inform Policy and Practice,” the authors highlight the fact that quantitative research alone won’t help design better policies, as issues such as the energy-health-gender nexus is embedded in complex socio-cultural and economic interactions which are shaped by the users’ context, practices and beliefs. For instance, how rural people perceive a problem cannot be brought out by just applying quantitative research, as this approach limits our understanding and possibilities of change behavior. Combining qualitative methods, specifically ethnography, along with embedded engagement can help reveal why people behave in a particular way in a particular region.

In the chapter on “Gender-Sensitive Analysis of Water Governance: Insights for Engineering Energy Transitions,” the authors highlight that most studies adopt the definition of gender as a binary difference between women and men. Nevertheless, increasing attention to intersectionality and non-binary gender differences can help engage in a nuanced debate on water governance. The field of water governance extends beyond the formal institutions and decision-making process to include socio-political and everyday decision-making on the use and management of water resources. The authors examine this aspect and reveal four themes that emerge from the literature. First, access to and use of water is differentiated by the rights and responsibilities assigned to each gender and this requires a contextualized view on water use, distribution and the decision-making process. Second, production and use of water knowledge and expertise are important themes that need gender inclusivity. Third, while participation of women in the decision-making process is making progress, it is still questionable if this is benefiting women and addressing their priorities. Lastly, experiences and emotions play a role in how women make decisions to use and manage water.

The authors of the chapter on “How Gender Equality Principles Are Integrated in National Energy Policies and Frameworks” do a deep dive into 192 energy frameworks from 137 countries, revealing that nearly one-third of these documents take gender considerations into account. Also, comparing these frameworks with other studies, e.g., 67 SEforALL country action documents, confirms the findings of energizing equality. While a lot of progress is being made in incorporating gender considerations, the authors do caution on important gaps that need to be addressed, particularly when bringing policy into implementation.

In the chapter on “A View from the North: Gender and Energy Poverty in the European Union,” the authors point out that one in seven European households struggle to pay their monthly energy bill, thereby highlighting the fact that energy poverty is a concrete issue and a growing concern for policymakers even in developed countries. Within this, the unfamiliarity with the gender dimension of energy poverty is partly caused by the lack of sex-disaggregated

data, which is only the first step into understanding the issue. Moreover, policy measures aiming at elevating vulnerable consumers out of energy poverty are too generic and do not reflect the gendered differences. Therefore, a more holistic understanding about energy consumers, moving beyond a model-based approach is needed to design effective policy interventions.

In conclusion, the book is a great read for those who want to get a quick understanding on the role of gender in the energy transition, especially as it brings forward learning from many different dimensions and outlooks globally—highlighting the fact that it's not simplistic in nature and context matters. The book will help stimulate readers to think beyond their own research or practice domains and promote crossovers. This being the very aim that the authors set out to do themselves reflects well on the outcome of the book.

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Survival Governance: Energy and Climate in the Chinese Century, by Peter Drahos (Oxford University Press, 2021), 264 pages, ISBN: 9780197534755.

This book is on one of the hottest topics of the day—energy and climate change. The author, Peter Drahos, an emeritus professor at the Australian National University and professor of law and governance at the European University Institute, offers a provocative argument that China, with its Communist Party-based political system and top-down policy implementation mechanisms, might be the plausible leader in the global energy transition of the 21st century. This book is written from the author's special perspective on the global intellectual property rights regime. The central argument is that, as the military and fossil fuel industries are behind America's global military and energy domination, no US president can ignore their interests and address the urgent climate change crisis. By contrast, China has the opportunity, capacity, and incentives to drive the world in a new non-fossil fuel direction. At a time when all that China does is seen as a threat, it is a bold venture deserving careful consideration.

Chapter 1 and 2 establish this argument. Chapter 3, 4 and 5 examines how the military and security concerns behind public funding in research and development favour fossil fuels at the expense of technologies that may be the saving grace for tackling climate change.

Chapter 6, 7 and 8 describe how China's rapid economic growth in the past four decades brought the country to the brink of ecological collapse and the government's recent efforts to save the country from this brink by building a circular economy. Technology is the key, with Chinese cities offering experimental sites for low-carbon technologies to address the climate change crisis.

Chapter 9 examines the daunting challenges India faces. While India is good at technology innovation and has a great potential to fulfill its "ambition to be a global solar power" (p. 186), its energy security depends on fossil fuels and its political system does not lead to quick policy shifts.

Chapter 10 reemphasises the role of the state and technology innovation in the global energy transition, both of which are directly affected by broader geostrategic competition among major powers in the world. Here again is the challenge: can state and technology save the world?

A short review like this is not able to cover all points presented in the book. Only a few will be discussed in what follows.

First, a caveat: the book does not address any specific energy source, its production, consumption, or impact on climate change. It argues that energy is not all about natural resources; it is about technology. Innovation is the key. To forestall the worst effects of climate change, energy systems based on fossil fuels need to be replaced by low-carbon technologies that for the most part are known technologies but are not yet cost effective. There is little incentive for the private sector to invest in scaling up these highly risky technologies. Public investment in low-carbon energy technologies, the book argues, will allow a country to take a lead in the global energy transition (see the Chinese effort to upgrade and scale up renewable energy technologies).

The discussion on energy and innovation is the strong point of the book. Yet, we are not given detailed information about what kind of energy technology the author has in mind. More detailed information would help readers understand the current contentious issue of global competition over technology innovation. In some areas, such as wind and solar power, China is competing more for market shares than to lead in technologies. In other areas, such as electricity vehicles, competition is more about critical raw materials than technologies *per se*. Finally, in other cases, such as advanced nuclear technologies or high-voltage transmission networks, China competes already today at the same level with traditional powers. The author bundles energy innovation as the “the bio-digital energy paradigm” without explaining what the bio-digital energy is, what innovation government funds, or how these “bio-digital energy technologies” contribute to the low-carbon energy transition. Unpacking this might help explain how China would be able to “guide the development of a paradigm of innovation” (p. 201) when facing the contentious competition with the US and others, as briefly discussed in Chapter 10.

Second, a concept: as the title of the book indicates, “survival governance”—i.e., prioritising climate change over energy security and economic development (p. 199)—is the key concept. While emphasising that no country “is currently fully in survival governance mode,” the author argues that those with “a strong state” might lead in survival governance. Most would agree that the state (I prefer to use “government”) plays a key role and its capacity to govern is critical to achieving national objectives. Government “is vested with sovereign power” to allocate resources (e.g., human, material, or financial). With this authority, government can shape the national narratives when facing the threat of climate change, or what the author calls “organising the exogenous shock needed to change” (p. 6). There is no shortage of climate-related exogenous shocks—from wild brush fires in Australia and California, severe droughts in much of the western part of the US and the African continent, record floods, heatwaves, to ice storms. Whether they are framed as “natural” disasters or consequences of climate change, severe climate-related exogenous shocks are used by governments to shape policies and allocate resources. However, it is not clear why a “strong state is necessary for a rapid transition out of the era of fossil fuel energy” (p. 6), especially when it is referred to the Chinese government.

The book argues that the US cannot lead the global energy future because its government has been captured by the military and fossil fuel industries and the EU is dogged with internal divisions. By contrast, it is argued that China, with its coercive and top-down exercise of authoritative power, could avoid being captured by special interests and therefore is the “best” candidate for leading the global energy transition. This begs the following question: what is a strong state? The term “a strong state” is a nebulous concept. If a strong state refers to “a

non-transparent, often corrupt, and lack[ing] public participation, with coercive top-down exercise of the authoritative power” (Chapter 2), is this ever an effective way to govern? If the strong state refers to its “pressure-driving mechanism,” it provides a weak foundation to build an all-encompassing argument that China has the capacity to “organise the exogenous shock” for the energy transition. After all, the concept of “the pressure-driving mechanism” is used to explain how China’s top levels of government exert pressure on the lower levels to deliver the target, not on how government can shape the dominant narratives and frame policies. As a mechanism for policy implementation, evidence suggests the process is problematic and is prone to frequent failures. In 2021, for example, the pressure on local levels of government to achieve the assigned targets for electricity consumption and carbon emissions backfired and caused extensive power shortages and blackouts.

Third, the trilemma of energy security, economic growth, and sustainable climate discussed in the book presents difficult challenges, indeed. No government can forgo any of these three objectives while all face resistance from incumbent fossil fuel industries. In China and India, “dethroning old king coal” is not necessarily easier than curbing the production and consumption of oil and natural gas in the US. Resistance to change by the incumbent industries (coal, petroleum, or natural gas) is a universal phenomenon even though the politics involved varies across countries. What makes king coal in China different from oil and gas in the US? If the EU cannot lead because of its “perpetual negotiations among its members” (p. 37), why would the similar “centrifugal forces” in China not have the same effects? Without examining the policymaking structures, actors, processes, and policy implementation in China to show why it would be the leader, as several studies have done, the book has been left only with “the opportunity and the potentials,” rather than actual policies and actions.

Finally, like other studies, this book is looking for a systemic leadership needed “to shift us from a terrible global public bad to one less bad” (p. 29). What does it take for a country to be a leader in the global energy transition? In addition to the state’s capacity, however defined, what other factors are important for a state to be a global leader in a systemic transition—the size of markets, financial capital, technological or manufacturing capacities? If these factors are taken into account, would they undermine or strengthen the proposition that China can indeed take on a leadership role?

In sum, the strength of this book is that it provokes. It starts from an unfashionable position: that China’s leadership in climate change could be crucial, a position that even the author is uncomfortable with. It covers a range of issues that are hotly debated: energy and climate change, the standing of China and the United States, technology innovation and its global competition, democratic versus authoritarian policymaking and implementation. It provides a potential future from which many would recoil. The author deserves our appreciation for raising these issues. Perhaps, more empirical evidence would have helped ground the main argument and settle some of these controversies. However, his broad case will make readers stop and think, re-evaluating the challenges governments of different political systems face. Even if in the end we cannot agree, we should be grateful for the journey the book made us take.

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