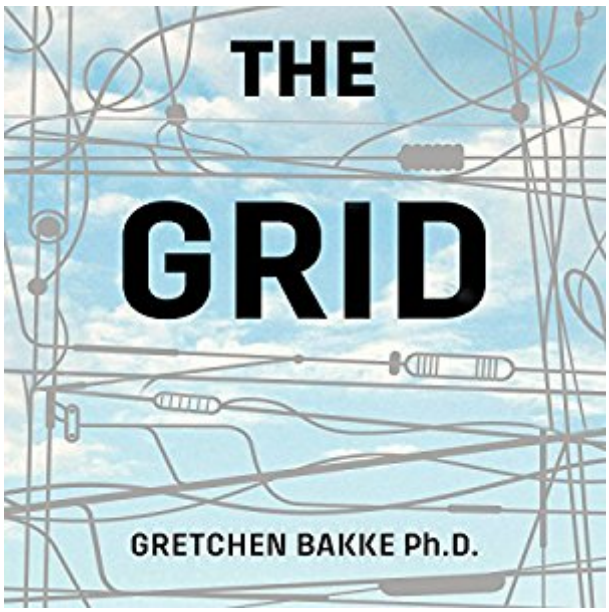
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The Grid: The Fraying Wires Between Americans And Our Energy Future



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Synopsis

The grid is an accident of history and of culture, in no way intrinsic to how we produce, deliver and consume electrical power. Yet this is the system the United States ended up with, a jerry-built structure now so rickety and near collapse that a strong wind or a hot day can bring it to a grinding halt. The grid is now under threat from a new source: renewable and variable energy, which puts stress on its logics as much as its components. In an entertaining, perceptive and deeply researched fashion, cultural anthropologist Gretchen Bakke uses the history of an increasingly outdated infrastructure to show how the United States has gone from seemingly infinite technological prowess to a land of structural instability. She brings humor and a bright eye to contemporary solutions and to the often surprising ways in which these succeed or fail. And the consequences of failure are significant. Our national electrical grid grew during an era when monopoly, centralisation and standardisation meant strength. Yet as we've increasingly become a nation that caters to local needs, and as a plethora of new renewable energy sources comes online, our massive system is dangerously out of step. Charting the history of our electrical grid, Bakke helps us see what we all take for granted, shows it as central to our culture and identity as a people and reveals it to be the linchpin in our aspirations for a clean-energy future.

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Customer Reviews

The Grid: The Fraying Wires Between Americans and Our Energy Future by Gretchen BakkeÃƒÂ¢Ã â ¬Ã Å“The GridÃƒÂ¢Ã â ¬Ã Â• is an insightful yet verbose book on

AmericaÃƒÂ¢Ã â ¬Ã â„¢s grid technology; itÃƒÂ¢Ã â ¬Ã â„¢s history together with the laws, people and logic that brought it into existence. Author Gretchen Bakke holds a Ph.D. in cultural anthropology and is currently a professor at McGill University in Montreal, Quebec, Canada brings us this seldom told story of the evolution of an essential infrastructure. This interesting 364-page book includes the following nine chapters: 1. The Way of the Wind, 2. How the Grid Got Its Wires, 3. The Consolidation of Power, 4. The Cardigan Path, 5. Things Fall Apart, 6. Two Birds, One Stone, 7. A Tale of Two Storms, 8. In Search of the Holy Grail, and 9. American Zeitgeist.Positives:1. A well-researched, accessible book.2. The seldom-told story of our electrical-grid infrastructure.3. Does a good job of describing the grid and its problems. ÃƒÂ¢Ã â ¬Ã Å“America has the highest number of outage minutes of any developed nationÃƒÂ¢Ã â ¬Ã â •coming in at about six hours per year, not including blackouts caused by extreme weather or other ÃƒÂ¢Ã â ¬Ã Å“acts of God,ÃƒÂ¢Ã â ¬Ã Â• of which there were 679 between 2003 and 2012. Compare this with Korea at 16 outage minutes a year, Italy at 51 minutes, Germany at 15, and Japan at 11.ÃƒÂ¢Ã â ¬Ã Â• Bonus, ÃƒÂ¢Ã â ¬Ã Å“This is our grid in a nutshell: it is a complex just-in-time system for making, and almost instantaneously delivering, a standardized electrical current everywhere at once.ÃƒÂ¢Ã â ¬Ã Â•4. Explains the most common causes of power outages. ÃƒÂ¢Ã â ¬Ã Å“Overgrown foliage is the number one cause of power outages in America in the twenty-first century.ÃƒÂ¢Ã â ¬Ã Â•5. Shares interesting findings. ÃƒÂ¢Ã â ¬Ã Å“National security was threatened more by the ÃƒÂ¢Ã â ¬Ã Å“brittlenessÃƒÂ¢Ã â ¬Ã Â• of AmericaÃƒÂ¢Ã â ¬Ã â„¢s electrical grid than by possible future disruptions in the flow of imported oil.ÃƒÂ¢Ã â ¬Ã Â•6. One of the most interesting topics covered has to do with the problems of integrating renewables into the existing grid. This is a recurring topic in the book. ÃƒÂ¢Ã â ¬Ã Å“The problem is that renewable energy adds unprecedented levels of stress to a grid designed for the previous century.ÃƒÂ¢Ã â ¬Ã Â•7. Key discoveries behind the grid. ÃƒÂ¢Ã â ¬Ã Å“This subtle-seeming transition in the structure of circuitry, from serial to parallel, was the gridÃƒÂ¢Ã â ¬Ã â„¢s first revolution. Though we tend to give Thomas Alva Edison the credit for having invented the lightbulb (he did not), he did devise something just as remarkableÃƒÂ¢Ã â ¬Ã â •the parallel circuit, one of his greatest if least lauded contributions to technological underpinnings of our modern world.ÃƒÂ¢Ã â ¬Ã Â•8. The key steps to big grids. ÃƒÂ¢Ã â ¬Ã Å“The first step toward a big grid, one that would make it possible to universalize access to electric power, was the invention and successful manufacture of alternating current (AC) electrical systems in 1887.ÃƒÂ¢Ã â ¬Ã Â•9. Discusses the history of big electrical business. ÃƒÂ¢Ã â ¬Ã Å“By 1925 almost nobody in the electricity business could even imagine a system for

making, transmitting, distributing, or managing electric power other than as a monopoly enterprise.ÃƒÂ¢Ã â ¬Ã Â•10. An interesting look at electrical efficiency. ÃƒÂ¢Ã â ¬Ã Å“By the mid-1960s it had become clear to utility men that a plant run at just over 30 percent efficiency was both the most reliable and the most cost-effective way to make electricity.ÃƒÂ¢Ã â ¬Ã Â•11. A look at President CarterÃƒÂ¢Ã â ¬Ã â„¢s impact on energy. ÃƒÂ¢Ã â ¬Ã Å“This turn toward conservation and energy efficiency was the first crisis, of three, that would shock the electric utilities during the Carter era.ÃƒÂ¢Ã â ¬Ã Â•12. A look at the wind industry. ÃƒÂ¢Ã â ¬Ã Å“The combination of federal and California incentives and innovative state regulations launched the wind industry in the U.S.ÃƒÂ¢Ã â ¬Ã Â•13. Blackouts and their causes. ÃƒÂ¢Ã â ¬Ã Å“A case in point: On August 14, 2003, eighteen months after Davis-Besse was shut down for repair, the largest blackout in our nationÃƒÂ¢Ã â ¬Ã â„¢s history, and the third-largest ever in the world, swept across the eastern half of the United States and parts of Canada, blacking out eight states and 50 million people for two days. So thorough and so vast was this cascading blackout that it shows as a visible dip on AmericaÃƒÂ¢Ã â ¬Ã â„¢s GDP for that year. The blackout, which covered 93,000 square miles, accounted for $6 billion of lost business revenue. If ever it was in doubt, the 2003 blackout proved that at its core AmericaÃƒÂ¢Ã â ¬Ã â„¢s economy is inexorably, indubitably electric.ÃƒÂ¢Ã â ¬Ã Â• Bonus, ÃƒÂ¢Ã â ¬Ã Å“In the case of the 2003 blackout the error on the grid took the form of overgrown trees and the error on the computers took the form of a line of code that disallowed simultaneous incoming data reports.ÃƒÂ¢Ã â ¬Ã Â•14. Financial challenges of the electric industry. ÃƒÂ¢Ã â ¬Ã Å“Historically, utilities made money when people used electricity; the more we used the more money they made. Now they donÃƒÂ¢Ã â ¬Ã â„¢t.
TodayÃƒÂ¢Ã â ¬Ã â„¢s utilities make money by transporting power and by trading it as a commodity.ÃƒÂ¢Ã â ¬Ã Â•15. A look at ÃƒÂ¢Ã â ¬Ã Å“smart gridsÃƒÂ¢Ã â ¬Ã Â•. ÃƒÂ¢Ã â ¬Ã Å“The ÃƒÂ¢Ã â ¬Ã Å“smartÃƒÂ¢Ã â ¬Ã Â• grid uses computers to alleviate the abiding problem of peak load.ÃƒÂ¢Ã â ¬Ã Â•16. Find out the impact of climate change to the grid.17. A look at the impact of major storms to the grid. ÃƒÂ¢Ã â ¬Ã Å“After Superstorm Sandy, the Northeast began to witness the return of the tiny grid. These new constructions bear a lot in common with Edison-era private plants, which generated customized electricity for a single owner on-site. Unlike EdisonÃƒÂ¢Ã â ¬Ã â„¢s private plants, these modern microgrids can connect and unconnect as needed to the big grid (which is now increasingly known as the ÃƒÂ¢Ã â ¬Ã Å“macrogridÃƒÂ¢Ã â ¬Ã Â•). And, unlike any system since the consolidation of power in the early twentieth century, these microgrids work perfectly well in ÃƒÂ¢Ã â ¬Ã Å“islandÃƒÂ¢Ã â ¬Ã Â• mode.ÃƒÂ¢Ã â ¬Ã Â•18. Military applications.

ÃƒÂ¢Ã â ¬Ã Å“Anything that can be done to eliminate the necessity of diesel generators, and reduce the amount of oil necessary to feed them on the field of battle, strengthensÃƒÂ¢Ã â ¬Ã â •adds resiliency, flexibility, and mobility toÃƒÂ¢Ã â ¬Ã â •the war effort. Mobile, matte, lightweight, and diversified systems for keeping the lights on, the data safe, and the troops cool are critical to mission success. For while some of this fuel is poured into gas tanks, a lot of it is used to make electricity.ÃƒÂ¢Ã â ¬Ã Â• Bonus, ÃƒÂ¢Ã â ¬Ã Å“As a result, the DoD, which operates a fleet of 200,000 nontactical vehicles, is working to convert them all to electricity with vehicle-to-grid technologies designed in from the start.ÃƒÂ¢Ã â ¬Ã Â•19. The ÃƒÂ¢Ã â ¬Ã Å“holy grailÃƒÂ¢Ã â ¬Ã Â• of electricity, storage. ÃƒÂ¢Ã â ¬Ã Å“Today the grail is less a new way to make power than it is to find a really good way to store it.ÃƒÂ¢Ã â ¬Ã Â•20. The future of the grid. In the final chapter, the author discusses the consumersÃƒÂ¢Ã â ¬Ã â„¢ personal interactions with power that may shape the grid of the future.21. Plenty of links in the notes section.Negatives:1. Verbose. It could and probably should have been a hundred pages fewer.2. Lack of supplementary visual material that could have done wonders to complement the narrative. The general public knows very little about how electricity works and this kind of book begs for diagrams and visual material, yet there is very little here.3. Not only does the book lack visual material it lacks supplementary material that would of have been of interest to the public. As an example: maps of key grids, table of electrical consumption around the country, timelines, charts and diagrams showing the use of renewables versus non-renewable energy sources, etc.4. Not only verbose but at times even tedious to read.5. Missed opportunities to ÃƒÂ¢Ã â ¬Ã Å“shockÃƒÂ¢Ã â ¬Ã Â• the reader with interesting tidbits or curiosities.6. Lacks scientific rigor, the book is intended for the masses.7. No formal bibliography.In summary, this book should have been much better. The topic of the grid is personally interesting to an engineer like myself but IÃƒÂ¢Ã â ¬Ã â„¢m very disappointed on how verbose and poorly presented the material was. The lack of supplementary materials did the book no favors either. On the other hand, I agree with the findings and conclusions of the author and I did learn a lot about the electric grid as en essential and pervasive infrastructure. More like a 3.5-star quality book, if you are interested in the grid by all means read this book but you just need to be patient with it. A mild recommendation.Further recommendations: ÃƒÂ¢Ã â ¬Ã Å“Living on the GridÃƒÂ¢Ã â ¬Ã Â• by William L, Thompson, ÃƒÂ¢Ã â ¬Ã Å“Empires of Light: Edison, Tesla, Westinghouse, and the Race to Electrify the WorldÃƒÂ¢Ã â ¬Ã Â• by Jill Jonnes, ÃƒÂ¢Ã â ¬Ã Å“AC/DC: The Savage Tale of the First Standards WarÃƒÂ¢Ã â ¬Ã Â• by Tom McNichol, ÃƒÂ¢Ã â ¬Ã Å“Faraday, Maxwell, and the Electromagnetic Field: How Two Men Revolutionized PhysicsÃƒÂ¢Ã â ¬Ã Â• by

Nancy Forbes and Basil Mahon, ÃƒÂ¢Ã â ¬Ã Å“The Man Who Changed Everything: The Life of James Clerk MaxwellÃƒÂ¢Ã â ¬Ã Â• by Basil Mahon, ÃƒÂ¢Ã â ¬Ã Å“The Electric Life of Michael FaradayÃƒÂ¢Ã â ¬Ã Â• by Alan Hirshfeld, and ÃƒÂ¢Ã â ¬Ã Å“TeslaÃƒÂ¢Ã â ¬Ã Â• by W. Bernard Carlson.

Author presented historical events to describe how our existing GRID came to pass (and occasionally fail). The current Grid needs to concern us all with Utilities desperately trying to make their business model work. Author discusses legislative influence at both state and federal levels. Discussed new technology impact (wind, solar, and electric-cars with battery potential - no pun intended). Several 'green' projects in the US are discussed. What worked what failed - the author presented an insightful analysis. In the end, the book's message foreshadows what we all know to be true - that change is heading our way in how we use and pay for electricity. Our existing centralized utility GRID must become a platform of interconnected systems (home, industrial, wireless) that, hopefully, will provide a stable and cost-effective source of electricity. I enjoyed the read and recommend. (Only 4 stars because sometimes the author kept going on after her point was made - and I can be impatient.) :)

Review of BakkeÃƒÂ¢Ã â ¬Ã â„¢s "The grid" by Paul F. Ross Gretchen Bakke presents a very interesting, very readable look at the history of electric power in the United States from Thomas Edison until now in order to assist us, the readers, in understanding and helping shape the still uncertain details affecting the future of electric power. The ubiquity of electric power in human affairs is certain. Just how that power will be provided, its fuel sources, and its_____ _____Bakke, Gretchen "The grid: The fraying wires between Americans and our energy future" 2016, Bloomsbury, New York NY, xxx + 353 pages_____ _____distribution methods are far from certain although they have been finding their unguided way to the present throughout the last century. The stunning contribution of Bakke, not an electrical engineer, is that she has the freedom to see what history, new technology, new uses, social expectations, and legal and economic structures have done to shape what we have and determine what we will have in the future. The 22 July 2016 issue of Science arrived in my US mailbox, I saw Cymene HoweÃƒÂ¢Ã â ¬Ã â„¢s review of BakkeÃƒÂ¢Ã â ¬Ã â„¢s book (p 355), and I went to my computer immediately to order the book from .com. Edison, in the closing decades

of the nineteenth century, invented and put in place direct current generators of electric power and distributed that power over local grids (to customers less than a mile from the generator) to produce light in electric light bulbs, also his invention. This method for lighting became a competitor to lamps that were being fueled by whale oil ("Moby Dick") and kerosene (John D. Rockefeller). By 1910, electricity and electric light became available to the urban and the rich. But line losses at low voltage (100v or less) and high current are large (watts = current-in-amps-squared times volts ÃƒÂ¢Ã â ¬Ã Â| notice that term showing the current is squared), power being given up as heat as the current pushes through the lineÃƒÂ¢Ã â ¬Ã â„¢s resistance, so electric power of this kind cannot be shipped very far (thus the early proliferation of power generating plants in an urban area like New York or Chicago). Then George Westinghouse and Nikola Tesla invented alternating current and its generation. Instead of flowing just one direction as with direct current, alternating current flows back and forth in an electric line (conductor). That changing direction, and the growth and collapse of magnetic fields around the changing current, make transformers possible ÃƒÂ¢Ã â ¬Ã Â| two coils of wire, a primary and a secondary. Feed current from the generator into the primary winding and, although the primary is insulated from the secondary, electrical current flows (back and forth) in the secondary and in the loads (light bulbs, electric motors) the secondary is feeding. The magic feature of transformers is that by feeding 100v into a primary with 100 turns in its coil, one can get 400v or even 50,000v from the secondary winding if you put enough turns into the coil of the secondary. The power transfer from primary to secondary is very efficient. The important new circumstance is that lots of power, measured in watts, can be moved along the 50,000v lines as alternating current using very little current ÃƒÂ¢Ã â ¬Ã Â| and thus experiencing very little line loss to heat. When the power gets to its destination, perhaps 200 miles or even 1,000 miles from its generating plant, another transformer can be used to step the voltage back down from 50,000v to much lower voltage (110v for use in our house lighting circuits) and electricity becomes relatively safe to use when untrained-in-the-ways-of-electricity human beings are nearby. This technological flip-flop was so quick that alternating current was in widespread use by the 1920s. Shipping alternating-current electric power over long distances made it possible for one power plant to serve a very large area and so society began to think of electric power as a ÃƒÂ¢Ã â ¬Ã Å“natural monopoly,ÃƒÂ¢Ã â ¬Ã Â• power companies as serving a large area, and the leaders of power companies as needing government oversight so they did not take advantage of their monopoly power. Electricity has another characteristic that is important. It must be used as soon as it is produced. So far, there are no easy and available methods for storing it for later use. Therefore demand and production must always be equal. Power plants have the characteristics of

machinery ÃƒÂ¢Ã â ¬Ã Â| they work most of the time but sometimes must be shut down for maintenance or simply break down. Demand from people and businesses has its own ups and downs ÃƒÂ¢Ã â ¬Ã Â| we all like to sleep at night and work in the daytime ÃƒÂ¢Ã â ¬Ã Â| we go to work and return home at approximately the same times for five days out of seven ÃƒÂ¢Ã â ¬Ã Â| we call for air conditioning in the summertime and heat in the winter. Thus power production must vary with demand. The electric utilities have the task of ÃƒÂ¢Ã â ¬Ã Å“balancingÃƒÂ¢Ã â ¬Ã Â• their production and distribution to meet demands that go up and down during every 24-hour cycle and sometimes take unexpected leaps or collapses. In recent decades the desire to minimize atmospheric pollution has caused us to try to downsize on coal and oil use, accept new supplies of natural gas with appreciation, continue to use hydro power where it is available, escape nuclear power generation when we can, and add power generation from solar energy and from wind. Suddenly (as measured by social and economic timelines) power is being generated in variable ways and in varying amounts (clouds go by, night arrives, the wind stops) in many different places. With these dispersed power producers in place (my neighborÃƒÂ¢Ã â ¬Ã â„¢s homeÃƒÂ¢Ã â ¬Ã â„¢s rooftop), weÃƒÂ¢Ã â ¬Ã â„¢ve asked, through governments, that the power companies accept all these power inputs and keep the grid balanced. Can it be done? Bakke sees the history, explains it to us so that we can understand it, includes the economic and societal and government and technological change elements in ÃƒÂ¢Ã â ¬Ã Å“the system,ÃƒÂ¢Ã â ¬Ã Â• and presents us with the challenge. She lets us know why our actions and our attitudes influence the solutions. ÃƒÂ¢Ã â ¬Ã Å“The gridÃƒÂ¢Ã â ¬Ã Â• is not ÃƒÂ¢Ã â ¬Ã Å“something in an out-of-sight place to which we need pay no attention until the lights are out at our house.ÃƒÂ¢Ã â ¬Ã Â• She lets us see how reliability of the supply chain for coal or diesel oil is just as important to the reliability of ÃƒÂ¢Ã â ¬Ã Å“the gridÃƒÂ¢Ã â ¬Ã Â• as is the risk that a tree will fall across a power line and interrupt power to our house. She helps us understand that it takes almost as much diesel fuel to deliver a gallon of diesel oil for use in an electric generator at an isolated military location in Afghanistan as the delivered-fuel itself. She lets us understand that our attitudes, our political actions, the operation of our governments are as important to delivering least-costly, uninterrupted electrical power to our future homes and offices as are the technological steps toward shipping electric power without wires and balancing the grid using smart metering, controllable loads (we may have to give the grid the power to turn down our air conditioning in order to balance production capacity and demand), and batteries of unimaginable properties to our electrical futures. Through her eyes we can glimpse some of the future that may emerge, but the important lesson she teaches is that we have to be a part of the planning in the

same way that we are a part of the systemÃƒÂ¢Ã â ¬Ã â„¢s performance. I glanced at a review of her book posted on .com and the reviewer was wondering how a cultural anthropologist (and a woman, to boot) is qualified to write about the electric power grid. We need BakkeÃƒÂ¢Ã â ¬Ã â„¢s insights very much since her behavioral science perspective brings a vital viewpoint to the task of shaping the future ÃƒÂ¢Ã â ¬Ã Â¦ a viewpoint that the reviewer I was reading is not able to bring to the work.Copyright Ãƒâ Ã Â© 2016 by Paul F. Ross All rights reserved.Bellevue, Washington28 August 2016

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