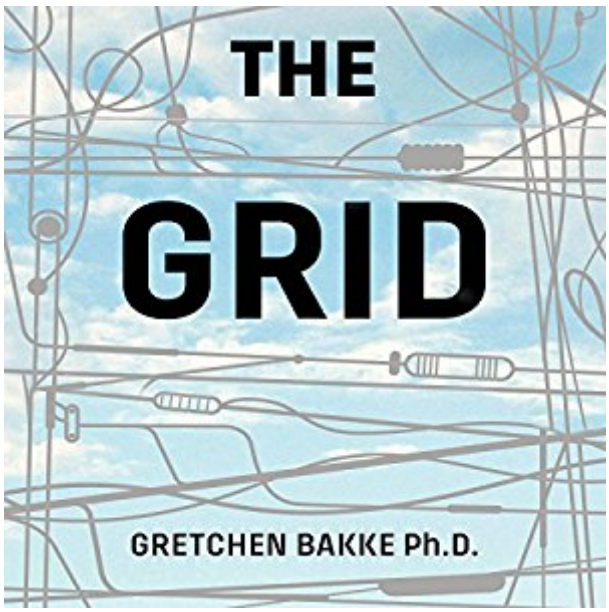
The Grid: The Fraying Wires Between Americans And Our Energy Future



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perceptive and deeply researched fashion, cultural anthropologist Gretchen Bakke uses the history of an increasingly outdated infrastructure to show how the United States has gone from seemingly infinite technological prowess to a land of structural instability.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 BakkeÃ¢Â ÂœThe GridÃ¢Â Â• is an insightful yet verbose book on AmericaÃ¢Â Â™s grid

technology; itÃ¢Â 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. Ã¢Â ÂœAmerica has the highest number of outage minutes of any developed nationÃ¢Â Â”coming in at about six hours per year, not including blackouts caused by extreme weather or other Ã¢Â Âœacts of God,Ã¢Â 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.Ã¢Â Â• Bonus, Ã¢Â ÂœThis 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.Ã¢Â Â•4. Explains the most common causes of power outages. Ã¢Â ÂœOvergrown foliage is the number one cause of power outages in America in the twenty-first century.Ã¢Â Â•5. Shares interesting findings. Ã¢Â ÂœNational security was threatened more by the Ã¢Â ÂœbrittlenessÃ¢Â Â• of AmericaÃ¢Â Â™s electrical grid than by possible future disruptions in the flow of imported oil.Ã¢Â 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. Ã¢Â ÂœThe problem is that renewable energy adds unprecedented levels of stress to a grid designed for the previous century.Ã¢Â Â•7. Key discoveries behind the grid. Ã¢Â ÂœThis subtle-seeming transition in the structure of circuitry, from serial to parallel, was the gridÃ¢Â 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 remarkableÃ¢Â Â”the parallel circuit, one of his greatest if least lauded contributions to technological underpinnings of our modern world.Ã¢Â Â•8. The key steps to big grids. Ã¢Â ÂœThe 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.Ã¢Â Â•9. Discusses the history of big electrical business. Ã¢Â ÂœBy 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.Ã¢Â Â•10. An interesting look at electrical efficiency. Ã¢Â ÂœBy 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.Ã¢Â Â•11. A look at President CarterÃ¢Â Â™s impact on energy. Ã¢Â Âœ This turn toward conservation and energy efficiency was the first crisis, of three, that would shock the electric utilities during the Carter era.Ã¢Â Â•12. A look at the wind industry. Ã¢Â Âœ The combination of federal and California incentives and innovative state regulations launched the wind industry in the U.S.Ã¢Â Â•13. Blackouts and their causes. Ã¢Â Âœ A case in point: On August 14, 2003, eighteen months after Davis-Besse was shut down for repair, the largest blackout in our nationÃ¢Â 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 AmericaÃ¢Â 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 AmericaÃ¢Â Â™s economy is inexorably, indubitably electric.Ã¢Â Â• Bonus, Ã¢Â Âœ 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.Ã¢Â Â•14. Financial challenges of the electric industry. Ã¢Â Âœ Historically, utilities made money when people used electricity; the more we used the more money they made. Now they donÃ¢Â Â™t. TodayÃ¢Â Â™s utilities make money by transporting power and by trading it as a commodity.Ã¢Â Â•15. A look at Ã¢Â Âœsmart gridsÃ¢Â Â•. Ã¢Â Âœ The Ã¢Â Âœsmart Ã¢Â Â• grid uses computers to alleviate the abiding problem of peak load.Ã¢Â Â•16. Find out the impact of climate change to the grid.17. A look at the impact of major storms to the grid. Ã¢Â Âœ 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 EdisonÃ¢Â Â™s private plants, these modern microgrids can connect and unconnect as needed to the big grid (which is now increasingly known as the Ã¢Â Âœmacrogrid Ã¢Â Â•). And, unlike any system since the consolidation of power in the early twentieth century, these microgrids work perfectly well in Ã¢Â Âœisland Ã¢Â Â• mode.Ã¢Â Â•18. Military applications. Ã¢Â Âœ 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, strengthensÃ¢Â Â”adds resiliency, flexibility, and mobility toÃ¢Â 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.Ã¢Â Â• Bonus, Ã¢Â Âœ 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.Ã¢Â Â•19. The Ã¢Â Âœholy grailÃ¢Â Â• of electricity, storage. Ã¢Â ÂœToday the grail is less a new way to make power than it is to find a really good way to store it.Ã¢Â Â•20. The future of the grid. In the final chapter, the author discusses the consumersÃ¢Â 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 Ã¢Â ÂœshockÃ¢Â 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 IÃ¢Â 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: Ã¢Â ÂœLiving on the GridÃ¢Â Â• by William L, Thompson, Ã¢Â ÂœEmpires of Light: Edison, Tesla, Westinghouse, and the Race to Electrify the WorldÃ¢Â Â• by Jill Jonnes, Ã¢Â ÂœAC/DC: The Savage Tale of the First Standards WarÃ¢Â Â• by Tom McNichol, Ã¢Â ÂœFaraday, Maxwell, and the Electromagnetic Field: How Two Men Revolutionized PhysicsÃ¢Â Â• by Nancy Forbes and Basil Mahon, Ã¢Â ÂœThe Man Who Changed Everything: The Life of James Clerk MaxwellÃ¢Â Â• by Basil Mahon, Ã¢Â ÂœThe Electric Life of Michael FaradayÃ¢Â Â• by Alan Hirshfeld, and Ã¢Â ÂœTeslaÃ¢Â 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 BakkeÃ¢Â 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
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_____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 HoweÃ¢Â Â™s review of BakkeÃ¢Â 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 Ã¢Â Â| notice that term showing the current is squared), power being given up as heat as the current pushes through the lineÃ¢Â 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 Ã¢Â 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 Ã¢Â 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 Ã¢Â Âœnatural monopoly,Ã¢Â 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 Ã¢Â 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 Ã¢Â Â| we all like to sleep at night and work in the daytime Ã¢Â Â| we go to work and return home at approximately the same times for five days out of seven Ã¢Â 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 Ã¢Â ÂœbalancingÃ¢Â 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 neighborÃ¢Â Â™s homeÃ¢Â Â™s rooftop), weÃ¢Â 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 Ã¢Â Âœthe system,Ã¢Â Â• and presents us with the challenge. She lets us know why our actions and our attitudes influence the solutions. Ã¢Â ÂœThe gridÃ¢Â Â• is not Ã¢Â Âœsomething in an out-of-sight place to which we need pay no attention until the lights are out at our house.Ã¢Â Â• She lets us see how reliability of the supply chain for coal or diesel oil is just as important to the reliability of Ã¢Â Âœthe gridÃ¢Â 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 systemÃ¢Â 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 BakkeÃ¢Â Â™s insights very much since her behavioral science perspective brings a vital viewpoint to the task of shaping the future Ã¢Â Â| a viewpoint that the reviewer I was reading is not able to bring to the work.Bellevue, Washington28 August 2016

Power System) (Living Off Grid, Wind And Solar Power Systems) Fraying at the Edge: A Novel (The Amish of Summer Grove) Reiki: The Healing Energy of Reiki - Beginnerâ ™s Guide for Reiki Energy and Spiritual Healing: Reiki: Easy and Simple Energy Healing Techniques Using the ... Energy Healing for Beginners Book 1) Cape Wind: Money, Celebrity, Energy, Class, Politics, and the Battle for Our Energy Future The Renewable Energy Handbook: A Guide to Rural Energy Independence, Off-Grid and Sustainable Living Dance Bullet Grid Journal: A Perfect Gift for Dancers and Teachers, 150 Dot Grid and Inspiration Pages, 8x10, Professionally Designed (Journals, Notebooks and Diaries) Shit to Do: Unicorn Dot Grid Journal, Over 150 Pages, 8" by 10" Notebook, Planner, and Sketch Book Diary for Bullet Grid Journaling, Calligraphy, and Hand Lettering Cute Piglet: Sketchbook for Kids : Dot Grid Journal : Notebook Composition:Girls: dot grid journal and sketchbook for boys and girls 8x10 inch,99 Pages Dot Grid Journal: Bullet Grid Journal, Floral, Over 150 Pages, 8" by 10" Notebook, Planner, and Sketch Book Diary for Journaling, Calligraphy, and Hand Lettering A Teacher’s Bullet Grid Journal: A Perfect Gift, 150 Dot Grid and Inspiration Pages, 8x10, Professionally Designed (Journals, Notebooks and Diaries) Optics of Quantum Dots and Wires (Artech House Solid-State Technology Library) Superconductivity and Superconducting Wires (Horizons in World Physics) Wires and Nerve: Volume 1 Wires and Nerve, Volume 2: Gone Rogue Modified: GMOs and the Threat to Our Food, Our Land, Our Future Dot Grid Paper Notebook: Watercolor Circles: 7.5 x 9.5 Dot Grid Journal, 170 Pages (Dot Notebooks) Bullet Blue Journal: Bullet Grid Journal Blue Polka Dots, Large (8 x 10), 150 Dotted Pages, Medium Spaced, Soft Cover (Vintage Dot Grid Journal Large) (Volume 6)