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Reimagining Energy

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RESPONSE

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INTRODUCTION

Wildfires blaze across the arid western country and winter storms wreak havoc in southern states.[1] These environmental crises are

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1. Cheri Mossburg & Kelly McCleary, *More Than 42,000 Californians Evacuate as State Battles Out-of-Control Wildfires*, CNN (Aug. 23, 2021, 8:40 PM), https://www.cnn.com/2021/08/23/weather/us-western-wildfires-monday/index.html [https://perma.cc/5PHD-7QYF]; Dustin Jones, *Western Wildfires May Take Weeks to Months to Contain*, NPR (Aug. 1, 2021, 12:13 AM), https://www.npr.org/2021/08/01/1023274008/western-wildfires-oregon-california-drought [https://perma.cc/ZG6H-BTRB]; Andrew Freedman, Jason Samenow, Paulina Firozi, Matthew Cappucci & Reis Thebault, *Deaths Mount, Millions Still Without Power Amid New Winter Storm*, WASH. POST (Feb. 17, 2021, 6:30 PM), https://www.washingtonpost.com/weather/2021/02/17/winter-storm-weather-texas-live/ [https://perma.cc/4ZXL-QH3B]; WEATHER CHANNEL, *Winter Storm Viola Smashed Records in the South and Brought Snow, Ice Into Northeast* (Feb. 20, 2021), https://weather.com/safety/winter/news/2021-02-14-cross-country-winter-storm-northwest-south-midwest-east [https://perma.cc/5JBJ-YF4D].

representative of the disastrous and deadly effects of the climate emergency in the United States.[2] They also underscore the momentous challenge of energy generation and transmission in the twenty-first century: providing affordable and reliable electricity, while simultaneously mitigating climate change by advancing renewable energy projects. Meeting this challenge—during "a code red for humanity"[3]—requires a complete rethinking of our energy system. Professor Joshua Macey's article, *Zombie Energy Laws*, begins this introspection.[4] In his article, Macey identifies three energy laws that have outlived their original purposes.[5] These "zombies" haunt the present landscape, infecting prospective renewable energy projects and unduly prolonging the carbon-intensive original inhabitants.[6]

This Response suggests that energy laws should support the advancement of carbon-neutral technologies and other infrastructure to reduce greenhouse gas emissions. This support requires a reimagining of our energy system, involving the entire energy lifecycle—from production to consumption, through abandonment and reuse. This reimagination should also occur in the forms of technological and legal innovation. As Macey keenly observes, zombie energy laws "distort electric power markets and impede the development of renewable energy sources."[7] But the zombies' affect reaches further than markets and the lucrative promise of a renewable future—the zombies stifle innovation.

This Response addresses the above issues in three Parts. Part I describes two recent examples of climate catastrophes that illustrate energy's central challenge—the California wildfires and the Texas winter storm. Part II reviews Macey's zombie laws, while suggesting how their application may affect grid evolution. Finally, Part III broadly describes the importance of reimagining energy.

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2. Rebecca Miller, Katharine Mach & Chris Field, *Climate Change Is Central to California's Wildfires*, SCI. AM. (Oct. 29, 2020), https://www.scientificamerican.com/article/climate-change-is-central-to-californias-wildfires/ [https://perma.cc/4P8C-LYTZ]; Melissa Gaskill, *Winter, Summer Weather Extremes are Taking a Toll on Texas Plants, Wildlife*, TEX. CLIMATE NEWS (Jul. 28, 2021), https://texasclimatenews.org/2021/07/28/winter-summer-weather-extremes-are-taking-a-toll-on-texas-plants-wildlife/ [https://perma.cc/2FHA-4RSY].

3. Press Release, Secretary-General, Secretary-General Calls Latest IPCC Climate Report 'Code Red for Humanity', Stressing 'Irrefutable' Evidence of Human Influence, U.N. Press Release SG/SM/20847 (Aug. 9, 2021).

4. Joshua C. Macey, *Zombie Energy Laws*, 73 VAND. L. REV. 1077 (2020).

5. *Id.* at 1080–81.

6. *Id.* at 1079–80.

7. *Id.* at 1105–06.

I. WILDFIRES AND WINTER STORMS: TWO BRIEF EXAMPLES OF THE CHALLENGES FACING ENERGY

A. California Wildfires

The damage from the California wildfires is devasting—loss of human life, destruction of natural resources and personal property, and injurious health outcomes due to air pollution, such as cardiac and respiratory distress.[8] California has been struggling to provide climate-friendlier power to its citizens, even as it faces its own Pyrocene age.[9] The wildfires exacerbate this challenge; the smoke and ash generated by the fires have created conditions similar to a solar eclipse, blocking sunlight and preventing solar power generation.[10] Although renewable energy provides California with thirty percent of its power supply, these renewable sources are mostly *intermittent* in nature and do not provide steady or reliable source supplies for power generation.[11] Affected solar power plants are offline during fires, leaving thousands without power;[12] but an aging electric grid only contributes to the power void.

In concerted efforts to prevent fires and reduce liability during the 2020 fires, Pacific Gas & Electric ("PG&E"), California's largest electric utility, cut power to 172,000 customers in Northern California.[13] Despite the profound consequences of leaving populations without power, PG&E elected this proactive response to curb the rampant spread of fire. After all, in 2019, the utility incurred astronomical damages due to its power lines causing past deadly wildfires, including the 2018 Camp Fire and the 2017 Tubbs Fire. The reported settlement reached with those wildfire victims was roughly $13.5 billion.[14] Those fire investigations revealed that PG&E's aging electric equipment, including power lines, caused those fires. As dry, hot summers become more frequent, the utility accordingly takes

8. Jill Cowan, *When Will the Air Quality Get Better?*, N.Y. TIMES (Sep. 14, 2020), https://www.nytimes.com/2020/09/14/us/california-fires-air-quality.html [https://perma.cc/RW5W-98XE].

9. Stephen J. Pyne, *From Pleistocene to Pyrocene: Fire Replaces Ice*, 8 EARTH'S FUTURE (Nov. 2020) (using the term "Pyrocene" as a literary description of the prevalence of anthropogenic fire in the Holocene).

10. Opinion, *California's Wildfire Power Eclipse,* WALL ST. J. (Sep. 11, 2020), https://www.wsj.com/articles/californias-wildfire-power-eclipse-11599864717 [https://perma.cc/SK5J-5KTN].

11. *Id.*

12. *Id.*

13. *Id.*

14. Derek Hawkins, *PG&E Reaches $13.5 Billion Settlement with California Wildfire Victims*, WASH. POST (Dec. 6, 2019), https://www.washingtonpost.com/nation/2019/12/06/pge-reaches-billion-settlement-with-california-wildfire-victims/ [https://perma.cc/8LCA-H7BS].

preemptive action by cutting power to customers during such dangerous conditions, which "infuriate[es] customers and lead[s] politicians to propose a public takeover"[15] of the twice-bankrupt entity.[16]

Yet scientists fear that wildfires and other catastrophic weather will only increase in number and intensity as the effects of climate change become more prevalent. The need to address those anthropogenic causes of climate change includes an examination of reliance on fossil fuels and a movement to increase renewable energy supply. But this balance is a delicate one, as revealed by the California fires.

B. Texas Winter Storm

In Texas, a brutal, winter storm in February 2021 resulted in at least 210 deaths and over four million people without power during a historic freeze.[17] The catastrophic event revealed the cascading failures of energy production, generation, transmission, and regulation. In the immediate aftermath, legislators and citizens demanded transformation of the Public Utility Commission of Texas ("PUC") and the Electric Reliability Council of Texas ("ERCOT").[18] But there were few substantive reforms in the regular legislative session and at present, there are no proposed grid reforms in the upcoming special sessions.[19]

Winter Storm Uri brought frigid Arctic air to southern states unprepared for the catastrophic cold and resulted in snow, ice, and freezing conditions for days.[20] The irony was as staggering as the

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15. *Id.*

16. Iulia Gheorghiu, *A PG&E Bankruptcy Timeline: The Road to Chapter 11 and Beyond*, UTILITY DIVE (June 18, 2020), https://www.utilitydive.com/news/a-pge-bankruptcy-timeline-the-road-to-chapter-11-and-beyond/547154/ [https://perma.cc/3GZP-E4FZ].

17. Andrew Weber, *Texas Winter Storm Death Toll Goes Up To 210, Including 43 Deaths In Harris County*, HOUS. PUB. MEDIA (Jul. 14, 2021, 2:07 PM), https://www.houstonpublicmedia.org/articles/news/energy-environment/2021/07/14/403191/texas-winter-storm-death-toll-goes-up-to-210-including-43-deaths-in-harris-county/ [https://perma.cc/QF4T-9A5A].

18. *See* Isabella Zou, *Texas Power Generation Companies Will Have To Better Prepare For Extreme Weather Under Bills Gov. Greg Abbott Signed Into Law*, TEX. TRIBUNE (Jun. 8, 2021), https://www.texastribune.org/2021/06/08/greg-abbott-texas-power-grid-ercot/ [https://perma.cc/KGT4-2F63] (summarizing Senate Bill 2, which primarily addresses ERCOT board governance, and Senate Bill 3, which calls for facility weatherization upgrades, but "is more lenient toward natural gas fuel companies" and lacks a mechanism to pay for such upgrades).

19. *Id.*

20. Theresa Machemer, *How Winter Storm Uri Impacted the United States*, SMITHSONIAN MAG. (Feb. 19, 2021), https://www.smithsonianmag.com/smart-news/how-winter-storm-uri-has-impacted-us-180977055/ [https://perma.cc/F6GF-98SU].

storm's impact—in this energy-rich state,[21] nearly seventy percent of Texans lost power.[22] And with the loss of electricity, the interwoven energy nexus of power, heat, water, and food quickly unraveled.[23] The lack of power directly impacted residential heating (no electricity to power furnaces) and electric cooking. Water treatment stations without power resulted in boil water advisory notices.[24] The lucky struggled through—the unlucky lost lives or those they loved. But everything could have been much worse. The Texas power grid had been close to collapse.[25]

ERCOT operates the Texas power grid. During the storm, as power generators tripped offline due to the cold temperatures, the demand far outstripped the failing supply.[26] The system frequency (generators operating at sixty hertz) began to fall. If the frequency had fallen below sixty hertz for nine minutes, it would have been "enough to damage power generators and other equipment, resulting in uncontrolled outages that could have caused the whole grid to fail."[27] ERCOT had been minutes away from this collapse.[28]

Following the storm, criticism was hurled at ERCOT, the PUC, and at Texas's lack of grid integrity and resilience. In this age of climate emergency, storms like Winter Storm Uri may occur more frequently

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21. *Texas*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/state/?sid=TX [https://perma.cc/6UAR-6VLG] (last updated Apr. 15, 2021) (reporting that Texas is the nation's top oil and gas producing state, leads the nation in wind-powered generation and produces almost one-third of all U.S. wind power, and "produces more electricity than any other state").

22. *Winter Storm 2021 and the Lifting of COVID-19 Restrictions in Texas*, U. HOUS. HOBBY SCH. OF PUB. AFFAIRS, https://uh.edu/hobby/winter2021/ [https://perma.cc/TJ2J-9ZGS] (last visited Sept. 3, 2021).

23. Machemer, *supra* note 20; *see also* Kara Norton, *Why Texas Was Not Prepared for Winter Storm Uri*, NOVA (Mar. 25, 2021), https://www.pbs.org/wgbh/nova/article/texas-winter-storm-uri/ [https://perma.cc/K3QP-2JJB] (statement of University of Texas at Austin Professor Michael Webber) ("So we have a water problem—freezing water, become[s] a gas problem, become[s] a power problem, become[s] a bigger gas problem, become[s] a bigger power problem, become[s] a water problem and a humanitarian crisis").

24. Brian Dakss, April Siese, Alex Sundby & Justin Carissimo, *Texans Face Drinking Water Shortage as Power Grid Returns to Normal*, CBS NEWS (May 6, 2021, 4:33 PM), https://www.cbsnews.com/live-updates/texas-drinking-water-power-grid/ [https://perma.cc/E52Q-ZWA2]; Norton, *supra* note 23.

25. Matt Largey, *Texas' Power Grid Was 4 Minutes and 37 Seconds Away from Collapsing. Here's How It Happened*, TEX. STANDARD (Mar. 1, 2021, 9:45 AM), https://www.texasstandard.org/stories/texas-power-grid-was-4-minutes-and-37-seconds-away-from-collapsing-heres-how-it-happened/ [https://perma.cc/9AMM-EABS].

26. Katherine Blunt & Russell Gold, *Texas Power Grid Was Minutes from Collapse During Freeze, Operator Says*, WALL ST. J. (Feb. 24, 2021, 4:27 PM), https://www.wsj.com/articles/texas-power-grid-was-minutes-from-collapse-during-freeze-operator-says-11614202063 [https://perma.cc/6EUS-CXQH].

27. *Id.*

28. *Id.*

and the grid will continue to be tested.[29] A decade earlier, during another winter event, there were calls for the Texas grid to winterize its power generation and upstream production assets (e.g., natural gas wellheads may freeze during winter events, preventing supply to natural gas fired power plants and wind turbines may be unable to operate during freezing weather).[30] That winterization/weatherization did not occur.[31] Others pointed to Texas's intentional disconnect from the greater (inter)national power grid, arguing that its oft-claimed cry of independence and removal from federal oversight is no longer possible or prudent in an era of climate change events and increased demand for power on aging infrastructure.[32] There were additional complaints of the deregulation of the power generation side, where misaligned market incentives caused human catastrophe.[33] Hoping to increase power generation to meet supply, regulators increased power prices at the maximum rate of $9,000 per megawatt-hour.[34] But generation could not occur with most of the natural gas supply offline due to freezing conditions.[35] And though wind and other renewables constitute a large component of energy for electricity generation, Texas

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29. Machemer, *supra* note 20:

> There is controversy among climate researchers about whether extreme cold events like Winter Storm Uri will become more common or not as climate change continues. In one camp, scientists expect that warming temperatures will make the events less common. Others say that as warming weakens the jet stream, the polar vortex will become unstable more often, causing more of these cold spells at least in the short term, per Vox. Per the *Washington Post*, anomalies of warm weather outpace unusual cases of extreme cold at a rate of two- or three-to-one.

30. *See generally* Mose Buchele, *Texas Lawmakers Passed Changes to Prevent Blackouts. Experts Say They're Not Enough*, NPR (Jun. 2, 2021, 5:00 AM), https://www.npr.org/2021/06/02/1002277720/texas-lawmakers-passed-changes-to-prevent-more-blackouts-experts-say-its-not-eno [https://perma.cc/7ZLJ-CGQG].

31. *Id.*

32. Kate Galbraith, *Texplainer: Why Does Texas Have Its Own Power Grid?*, TEX. TRIBUNE (updated Feb. 15, 2021), https://www.texastribune.org/2011/02/08/texplainer-why-does-texas-have-its-own-power-grid/ [https://perma.cc/CZT8-W7XZ] (explaining the history behind the Texas power grid); Matt Simon, *Texas' Icy Disaster Makes the Case for Uniting the US Grid*, WIRED (Feb. 25, 2021, 11:00 AM), https://www.wired.com/story/texas-disaster-makes-the-case-for-uniting-the-grid/ [https://perma.cc/5TCC-GSHV].

33. Christopher Hooks, *Who's Responsible for the Texas Blackouts?*, TEX. MONTHLY (Apr. 2021), https://www.texasmonthly.com/news-politics/responsible-texas-blackouts/ [https://perma.cc/F57R-DL8G]; *see generally* Will Englund, *The Texas Grid Got Crushed Because Its Operators Didn't See the Need to Prepare for Cold Weather*, WASH. POST (Feb. 16, 2021, 5:40 PM), https://www.washingtonpost.com/business/2021/02/16/ercot-texas-electric-grid-failure/ [https://perma.cc/6PLR-DHE5].

34. Erin Douglas & Mirchell Ferman, *Texas Legislature Close to Approving Billions to Pay for Winter Storm Financial Fallout*, TEX. TRIBUNE (May 25, 2021, 4:00 AM), https://www.texastribune.org/2021/05/25/electricity-market-financing-winter-storm/ [https://perma.cc/QST6-4J7F].

35. *Id.*

still relies heavily on natural gas for power generation.[36] This complex interconnection of production and generation requires addressing resiliency and climate adaptation efforts in a multipronged effort. However, there is also great interconnection between the Texas energy and power industries and the legislature—regulatory capture serves as the largest barrier to reform.[37]

What is the proper composition of a power generation portfolio that provides reliability to served populations, while also reducing greenhouse gases and noxious emissions to address climate change? Are supplies of natural gas and nuclear energy necessary as baseload or back up supplies to intermittent energy supplies? Is our power grid prepared for such catastrophic events? There are a multitude of paths forward, many of them interwoven—a veritable operations research enigma. But one path begins with the reexamination of energy laws and the reimagination of energy.

II. A REVIEW AND ANALYSIS OF MACEY'S ZOMBIE ENERGY LAWS

In *Zombie Energy Laws*, Professor Joshua Macey offers a critical analysis of three foundational energy laws, questioning their continued applicability during this transitional time in energy generation and distribution.[38] These three legal rules are:

1. Cost recovery for vertically integrated utilities.
2. The requirement that regulators assess the financial viability of energy projects before issuing a certificate of public convenience and necessity.
3. The filed rate doctrine, which emerged out of the view that electric power companies should be shielded from market forces.[39]

After a necessary review of the history that resulted in their creation, Macey argues that the natural monopoly, real or perceived, that existed at the time of those rules' adoption no longer applies—and that these zombie energy laws have outlived their original purpose.[40] Moreover, he argues that their continued use, due to an absence of legislative and regulatory address, has only prevented the proliferation of renewable energy generators, maintaining vertically integrated utility dominance.[41] Macey thoughtfully proposes abandoning these

36. *See generally* Buchele, *supra* note 30.
37. *Id.*
38. Macey, *supra* note 4.
39. *Id.*
40. *Id.* at 1080–83.
41. *Id.* at 1082–83.

three laws using sensible, not wildly ambitious, platforms, such as address by Federal Energy Regulatory Commission ("FERC");[42] application of existing legislation, namely the Federal Power Act ("FPA");[43] and judicial denouncement as means to mitigate and even eliminate the zombie laws' harmful effects and impacts.[44] However, he disfavors complete abandonment of rate regulation and the certificate of public convenience and necessity—proposing only that those doctrines evolve "to reflect the needs of competitive markets."[45]

Macey studies these zombie laws using persuasive logic and careful analysis, concluding that amendment or abandonment of these outdated laws would result in a more robust and competitive energy system.[46] On rate recovery, he proposes that the FERC could exert influence to end the utility's practice of recouping generation asset losses via the ratemaking process by prohibiting those integrated utilities from participating in wholesale auctions.[47] With respect to the restrictive certificates of public convenience and necessity, Macey suggests Congress amend the FPA to provide FERC with authority to site transmission facilities.[48] Finally, he proposes that the filed rate doctrine could be abandoned easily by the judiciary, as it is a judicial doctrine.[49]

Macey provides an insightful and necessary examination of these principles that shaped public utility law and informed the development of utility-scale generation and transmission assets.[50] He is correct that historical bases forced the evolution of public utility law to support monopolistic enterprise and that reliance on these doctrines hinders renewable growth.[51] But he does not discuss the larger problematic issues if we continue to apply these archaic doctrines blindly. Not only does an unwarranted application slow the growth of renewable energy generation sources, as Macey asserts,[52] but it prevents a greater reimagination and modernization of the energy

42. *Id.* at 1124–25.
43. *Id.* at 1084, 1123–24.
44. *Id.* at 1125–26.
45. *Id.* at 1084.
46. *Id.* at 1082–83.
47. *Id.* at 1121–22.
48. *Id.* at 1123.
49. *Id.* at 1125–26.
50. *Id.* at 1086–89.
51. *Id.* at 1087–89.
52. *Id.* at 1105–06.

grid,[53] which is crucial to national welfare and prosperity. And while this reimagination includes the escalation of renewable generation,

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53. Grid modernization is also known by other terms, such as "smart grid," "grid of the future," and "utility of the future." Julio Romero Agüeroa, Erik Takayesub, Damir Novosela & Ralph Masielloa, *Grid Modernization: Challenges and Opportunities*, 30 ELEC. J. 1, 1–6 (2017).

> The electric power systems around the world are undergoing an unprecedented transformation. In the US, this evolution has been clustered and described under various terms, including smart grid, grid of the future, grid modernization, and utility of the future. These terms emphasize the need to build an intelligent grid that can be monitored and controlled in real-time to provide a reliable, safe, and secure service and empower customers to actively participate and benefit from greater and more diverse market opportunities and services. Building this intelligent grid is a monumental task (particularly on the distribution and grid-edge sides which are vast and heterogeneous) that has led to the emergence of new concepts, technologies, and paradigms.

Id. at 1. This modern grid includes a variety of components, such as:

1. "Infrastructure and engineering aspects such as system wide real-time monitoring, protection, automation and control of power delivery systems with Distributed Energy Resources (DER), and enhanced grid resiliency, reliability and power quality";
2. "Processes and organizational aspects such as updated planning, operations and engineering practices and standards, trained workforce and suitable stakeholder organizational structures";
3. "Business aspects such as asset ownership of new technologies and concepts (DER, microgrids, etc.), and service diversification"; and
4. "Regulatory and policy aspects, such as rate and market design and business models for power delivery systems with DER, etc."

Id. at 1. The issue of grid modernization has been taken up in Congress, but has not resulted in passage. Grid Modernization Act of 2019, S. 2332, 116th Cong. (2019); *see also* S. REP. NO. 116-149 (2019). The Committee states:

> The United States' electric grid is comprised of a vast network of transmission and distribution systems that deliver electricity from producers to consumer homes and businesses. Many sectors of our economy, including healthcare and manufacturing, simply can- not operate without a reliable supply of electricity.
>
> Large, centralized fossil fuel-fired resources have historically provided the majority of electricity generation in the United States. Recently, however, the generation fuel mix has moved toward an increased use of intermittent renewable resources and decentralized, behind-the-meter sources of power. For example, in 1998 coal accounted for approximately [fifty-five] percent of electricity generation, and non-hydropower renewables accounted for just over one percent. In 2018, coal declined to only 27.4 percent of generation, and non-hydropower renewables increased to slightly over [ten] percent.
>
> Such a dramatic shift in the power supply mix has required utilities to spend a significant amount on upgrades and additions to transmission infrastructure. In 2016 and 2017 alone, utilities regulated by the Federal Energy Regulatory Commission [ ]—which represent about [seventy] percent of all electricity demand in the country—spent over $40 billion on capital additions for trans- mission infrastructure. Utilities have also invested significantly in energy storage, which helps to balance the output of renewable resources. According to Wood Mackenzie Power & Renewable's recent report, "Global Energy Storage Outlook 2019: 2018 Year in Review and Outlook to 2024," U.S. energy storage deployments will grow thirteen fold over the next six years, with $71 billion in investment.
>
> S. 2332 would provide the Department of Energy (DOE) with the tools it needs to facilitate this grid transition and support industry and states as they adapt to the energy needs of the future. Specifically, the bill authorizes research, development, and

introduction of competing generation sources remains only one component of the larger system. Grid modernization requires technological innovation, in addition to supportive (de)regulation and legislation and evolution or removal of regulatory and other inefficiencies, such as Macey's identified zombie laws.

Accordingly, we wonder whether the amendment or elimination of these three laws only encourages renewable energy generation, as Macey offers,[54] or if amendment or elimination leads to the transformation of the energy grid itself. Consider Macey's arguments in favor of modifying or terminating these three doctrines.

A. The Cost Recovery Doctrine

The cost recovery doctrine allows utility recovery of reasonably incurred costs along with a reasonable rate of return.[55] Macey provides doctrinal background for its adoption, revisiting economic theory and state desire for monopoly control.[56] But he cogently observes that FERC and its predecessors chose not to subject the utilities to strict antitrust scrutiny, which likely would have entailed the divestiture of generation assets from transmission assets by vertically integrated utilities.[57] The failure to divest or "break up" these assets results in utilities with both generation and transmission assets.[58] This integration allows utilities

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> demonstration programs at DOE for energy storage, distribution infrastructure, and microgrids. It also requires DOE to develop model grid architecture and model policy pathways to modernize the electric grid.

Agüeroa et al., *supra* note 53, at 1–2. There is additional legislation, which has been recently introduced, and failed to pass. *See e.g.,* Grid Modernization and Research and Development Act of 2020, H.R. 5428, 116th Cong. (2020); 21st Century Power Grid Act, H.R. 5527, 116th Cong. (2019); Clean Energy Grid Act of 2019, S. 2422, 116th Cong. (2019).

54. Macey, *supra* note 4, at 1105–06.

55. *Id.* at 1098.

56. *Id.*

57. *Id.*

58. In 2011, FERC issued Order No. 1000, which sought to open new transmission line buildout to competition. In Order No. 1000-A, FERC affirmed Order 1000's transmission planning reforms that:

> (1) require that each public utility transmission provider participate in a regional transmission planning process that produces a regional transmission plan; (2) provide that local and regional transmission planning processes must provide an opportunity to identify and evaluate transmission needs driven by public policy requirements established by state or federal laws or regulations; (3) improve coordination between neighboring transmission planning regions for new interregional transmission facilities; and (4) remove from Commission-approved tariffs and agreements a federal right of first refusal.

FERC Order 1000-A, 18 C.F.R. Part 35 (2012), https://www.ferc.gov/sites/default/files/2020-04/E-1_28.pdf [https://perma.cc/SA2W-KGNC]. Following the Order's issuance, many states passed right-of-first refusal laws, affirming the utilities' right to build in-state lines. For example, Texas enacted SB 1938, "which granted existing transmission and distribution utilities the exclusive

to game the cost recovery doctrine by selling generation at a loss, while being able to use their associated transmission assets to recoup the losses and earn a profit.[59] The doctrine thus benefits those utilities with the combined generation and transmission assets, primarily traditional and older coal-fired power plants, while blocking new entrants—renewable energy generators—from accessing power markets via the auction process.[60]

While there are other possible options aside from the elimination of the cost recovery doctrine such as (1) application of antitrust laws to divest generation assets from vertically integrated utilities, or (2) elimination of merit order dispatch and replacement with a legislative mandate requiring certain fuel compositions,[61] both options require legislative action, which may not be immediately feasible.

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right to build lines that interconnect to their infrastructure." Bridget Reed Morawski, *Judge Dismisses NextEra Challenge to Texas Right-of-First-Refusal Law*, S&P GLOB. MKT INTEL. (Mar. 4, 2020), https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/judge-dismisses-nextera-challenge-to-texas-right-of-first-refusal-law-57375641 [https://perma.cc/Q7NK-RKDJ]. Litigation also ensued, challenging those right-of-first-refusal laws. *See, e.g.*, NextEra Energy Capital Holdings, Inc. v. Walker, No. 1:19-CV-626-LY, 2020 WL 3580149 (W.D. Tex. Feb. 26, 2020) (dismissing lawsuit seeking overturning of Texas statute [SB 1938] that gives local utilities first right to build transmission lines that connect to their facilities). The federal judge in *NextEra* stated:

> Additionally, SB 1938 does not single out Texas transmission-line providers as the sole beneficiaries of the right of first refusal over out-of-state providers such as NextEra Midwest. The existing regulated transmission-line providers with a right of first refusal are not similarly situated with unregulated providers such as NextEra Midwest. Neither does SB 1938 overtly discriminate by granting incumbent transmission-line providers the right of first refusal because that preference does not discriminate against out-of-state providers. Indeed, most incumbent providers in Texas are owned by out-of-state companies, and SB 1938 allows out-of-state providers a means to enter the Texas market for transmission services by buying a Texas utility. Incumbent providers may "sell, assign, or lease a certificate or a right obtained under a certificate" with PUCT approval, if the transaction will not diminish the retail-rate jurisdiction of Texas.

Id. at *6 (citations omitted); TEX. UTIL. CODE § 37.154(a); *see also* LSP Transmission Holdings, LLC v. Lange, 329 F. Supp. 3d 695 (D. Minn. 2018), *aff'd sub nom.* LSP Transmission Holdings, LLC v. Sieben, 954 F.3d 1018 (8th Cir. 2020) (finding that state's right-of-first-refusal law did not violate the Dormant Commerce Clause and affirmed on appeal).

59. Macey, *supra* note 4, at 1108–09.

60. The hopeful purpose of the competitive bid auction is discussed in KENNETH ROSE, ROBERT E. BURNS & MARK EIFERT, NAT'L REGUL. RSCH. INST., IMPLEMENTING A COMPETITIVE BIDDING PROGRAM FOR ELECTRIC POWER SUPPLY (1991), https://ipu.msu.edu/wp-content/uploads/2016/12/Rose-Burns-Eifert-Competitive-Bidding-90-15-Jan-91.pdf [https://perma.cc/Q9YJ-XHB8] (footnote omitted):

> Competitive bidding is seen by some as a means to choose among potential power suppliers and to insert into the procurement of power supply competitive forces where previously there had been none. This is based on the belief that the electric utility is given little or no incentive to minimize its cost of production by the traditional regulatory process. The competitive pressure of the marketplace, it is believed, will result in lower production cost, either from alternative suppliers or the utility.

61. *See, e.g.*, Macey, *supra* note 4, at 1085 (discussing California's incentive to attract wind power to generation portfolio).

Macey's proposal to amend the cost recovery doctrine such that generation losses are not recoverable in the transmission ratemaking proceeding is a softer, more precise solution.[62] Undoubtedly, the affected vertically integrated utilities are likely to lobby the state PUC to avoid such action. But embracing the broader, beneficial goal of grid modernization may incentivize agencies to reevaluate these recovery mechanisms to promote generation diversity and just and reasonable customer pricing. The grid of the future includes transmission infrastructure such as microgrids, distributed generation, and proliferation of technology such as Blockchain.[63] If customers are able to generate their own power and enter into direct exchanges with customer-consumers, there may be mass defections from utility grids, which would lead to challenges recouping investments.[64] Adopting Macey's amendments allows the utility to begin its own adaptation to a rapidly changing environment. Instead of transferring losses to captive ratepayers, who may one day alienate their utilities when modern grid opportunities arise, utilities could look to adding customer-focused services "such as electric-vehicle charging and peer-to-peer trading platforms."[65]

Amending this recovery, which includes pass-through of generation losses via the fuel adjustment clause, addresses the perverse incentive of awarding bids to generators who purposely lose money in energy markets because they are able to recover those costs from their captive ratepayers.

B. The Certificate of Public Convenience and Necessity

Macey argues that the Certificate of Public Convenience and Necessity is another outdated doctrine that has no place in the modern utility where the regulated entity partially operates in the free market.[66] This hybrid utility can exploit the regulatory framework that

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62. *Id.*

63. *See* Magín Yáñez et al., *The Power Grid of the Future*, BOS. CONSULTING GRP. (Jul. 12, 2018), https://www.bcg.com/en-us/publications/2018/power-grid-future [https://perma.cc/NL9B-D2AJ] (Blockchain "acts as an encrypted, immutable ledger—[that] will enable companies to develop peer-to-peer online platforms, offering reliable, secure, and traceable transactions for localized producers and buyers of energy."); Ikechukwu Dimobi, Manisa Pipattanasomporn & Saifur Rahman, *A Transactive Grid with Microgrids Using Blockchain for the Energy Internet*, *in* 2020 IEEE POWER & ENERGY SOCIETY INNOVATIVE SMART GRID TECHNOLOGIES CONFERENCE 1 (Feb. 2020) ("The increased proliferation of economically viable renewable energy sources coupled with technological advancements at customer premises has led the ongoing transformation of the energy grid.").

64. Yáñez et al., *supra* note 63.

65. *Id.*

66. Macey, *supra* note 4, at 1112–13.

was constructed to fence the monopoly's potential abuses. As the modern—not future—utility progresses toward a private firm model, it retains the benefits of the traditional utility regulations, while also adopting the benefits of unobstructed competition and private contracting.

Macey's historical review provides the background for the Certificate of Public Convenience and Necessity.[67] Although it is used in many facets, this Response primarily discusses its usage in transmission. The Certificate of Public Convenience and Necessity ("the Certificate") is necessary prior to the commencement of any energy infrastructure buildout.[68] In appreciable irony, the Certificate is essentially an anticompetitive veto held by the monopolistic entity to exclude potential competitive entrants.[69] Although the Certificate is awarded by the regulator, it is ultimately exercised on behalf of the ensconced utility and protects the utility, rather than consumer interests, which may best be served by competitor entry. As with the other zombie energy laws, Macey observes that the Certificate originated with moralistic ideals: the utility could invest in infrastructure to serve all community members, no matter their relative profitability, and be protected from non-infrastructure paying competitors (nonintegrated generators), who threatened to steal those profitable consumers.[70] The historical perspective Macey provides supports the original good intent for the Certificate's use. But its use no longer promotes growth and public service; rather, it serves as a barrier to competitor entry.[71]

Since the heady days of Thomas Edison and Nikola Tesla, we have developed only one method of power transmission—the electric power grid.[72] This cacophonous web of wires, transformers, and substations is a massive invention of the twentieth century and arguably, one of humankind's greatest engineering feats.[73] Larger than Eisenhower's Interstate Highway System and more ambitious than lunar exploration,[74] the engineering infrastructure, capital costs, and

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67. *Id.* at 1099–1102.

68. *Id.* at 1099.

69. *See e.g., id.* at 1113–17.

70. *Id.* at 1099–1102.

71. *Id.* at 1116.

72. For an excellent overview on the electric grid, refer to GRETCHEN A. BAKKE, THE GRID: THE FRAYING WIRES BETWEEN AMERICANS AND OUR ENERGY FUTURE (Bloomsbury 2016).

73. Alan T. Crane, Editor's Note, *Modernizing and Protecting the Electricity Grid*, 40 BRIDGE: LINKING ENG'G & SOC'Y 3, 3 (Spring 2010).

74. Jenny Gold, *A Modern Electric Grid: The New Highway System?*, NPR (Apr. 27, 2009, 12:00 AM), https://www.npr.org/templates/story/story.php?storyId=103349614 [https://perma.cc/VQ32-7UYP].

land requirements are almost unimaginable. Admittedly then, there should be protections for those utilities that own, operate, and invest in this infrastructure. Macey proposes that FERC invokes its existing authority over site transmission lines, in place of the states.[75] Federalism conflicts aside, Macey's reformation of the Certificate as a means to encourage renewable growth may be overly optimistic. This overoptimism relates to the Certificate acting as a restraint on innovation.

There is no question that there is a regulatory capture problem within agencies—Macey correctly identifies this issue[76]—and his examples of state agencies barring wind generation and solar power are not unique.[77] But there is a second problem with the Certificate—it bars innovation. Since the 1880s, we have devised methods to transmit power through streets and over states. But the electric delivery mechanism remains relatively unchanged since those early days and essentially since the 1960s, with the build out of high-voltage transmission lines. Conversely, generation technology has evolved from the early days of coal-fired power plants. Natural gas, nuclear, hydro, solar, and wind generation are examples of this technological evolution and were born out of economic competition and favorable environments created with tax incentives, subsidies, and legislation mandating use. Absent a competitive transmission market, our grid remains firmly trapped in the mid-twentieth century.

The Certificate effectively acts as a barrier against competitive entry: there is no need for the established firm to improve upon its technology because there are no competitors threatening to usurp its position. To address this inefficiency without removing the Certificate, regulators could modify use of the Certificate so that it acts as a utilitarian incentive to innovate and not a deterrent to the same. Modeling the Certificate after the patent is one such modification. The Certificate is provided for a certain period of time to protect the heavy initial investment of the infrastructure. That period of time could be tied to the rate of return and recovery. After expiration of the term, the Certificate expires, allowing entrants to propose transmission bids to the regulator without fear of the established utility's veto.

In addition to Macey's proposal, another less feasible solution is to nationalize transmission lines.[78] Composed of several separate

75. Macey, *supra* note 4, at 1123.

76. Macey, *supra* note 4, at 1089–1190.

77. *Id.* at 1113–15.

78. Vauhini Vara, *The Energy Interstate*, ATLANTIC (June 2016), https://www.theatlantic.com/magazine/archive/2016/06/the-energy-interstate/480756/ [https://perma.cc/8C6X-2U53].

regional grids—and Texas,[79] there is actually very little exchange of electricity between regions.[80]

Regional grid amalgamation results in several benefits: (1) increased cost-efficiencies, which could be passed on to the consumer; (2) increased engineering efficiencies, such as decreased line loss and prevention of regional or local brownouts and blackouts; and (3) increased grid resiliency and allowance for rigorous cybersecurity protections.[81] The National Renewable Energy Laboratory has come to similar conclusions, where such integration and seamless study would allow the entry of competitive generators and ensure greater fuel flexibility and efficient development of resources for fuel.[82]

C. Filed Rate Doctrine

Of the three zombie energy laws Macey proposes eliminating, the filed rate doctrine is most easily abandonable with arguably the least detrimental impact and the greatest benefit.[83] Like its zombie energy brethren, it served a once-noble goal: preventing judicial enforcement of federal and state laws "from forcing rate-regulated utilities to modify rates that they had already filed with the state and federal regulators."[84] But as Macey discusses, the filed rate doctrine developed during the era of regulator-controlled ratemaking proceedings.[85] In those proceedings, regulators "carefully scrutinize utility rates to make sure that rates are just and reasonable."[86] Utilities are therefore protected from external demands (e.g., complaining

79. *See* Galbraith, *supra* note 32 (providing a history of Texas's separate power grid (ERCOT), which therefore makes it exempt from FERC oversight); *see also* Richard D. Cudahy, *The Second Battle of the Alamo: The Midnight Connection*, 10 NAT. RES. & ENV. 56 (1995) (which details an accidental interstate transmission of power by Texas and the legal battle that ensued).

80. Although our forays across the country show those gargantuan steel towers and lines appear interconnected, they are not. Rather, they are composed of several separate regional grids: WECC, MRO, SPP, NPCC, RFC, SERC, FRCC, and TRE. The regions that connect the United States and Canada are largely composed of the Western Interconnection, Eastern Interconnection, ERCOT Interconnection, and Quebec Interconnection. David Roberts, *A National US Power Grid Would Make Electricity Cheaper and Cleaner*, VOX (June 20, 2020), https://www.vox.com/energy-and-environment/2020/6/20/21293952/renewable-energy-power-national-grid-transmission-microgrids [https://perma.cc/Z2CP-CH4F].

81. *Id.*

82. *Interconnections Seam Study*, NAT'L RENEWABLE ENERGY LAB., https://www.nrel.gov/analysis/seams.html [https://perma.cc/ADW5-YAJM]; *see* Peter Fairley, *Building an Interstate Highway System for Energy*, DISCOVER MAG. (Jun. 10, 2009), https://www.discovermagazine.com/environment/building-an-interstate-highway-system-for-energy [https://perma.cc/UXS3-KH9M].

83. Macey, *supra* note 4, at 1125–26.

84. *Id.* at 1102–03.

85. *Id.* at 1103.

86. *Id.*

consumers) to modify rates that were already filed with the regulatory agency.[87]

Macey correctly observes that since the deregulation of energy markets, generators increasingly enter into competitive procurements and "no longer actually file rates with public service commissioners."[88] Thus the filed rate doctrine serves as a protective mechanism for private contracting without the transparency and accountability afforded by the ratemaking process.[89]

Public utility ratemaking ensures the fairness of rates between customers by ensuring that the monopolistic power of the utility does not create unaffordable rates, allows utilities a certain rate of return on their assets so as to pursue investment capital for further development, creates a transparent and open process to promote fairness and access, and promotes energy efficiency and reduction of use by altering supply and demand fundamentals.[90] While private contracting also serves to mitigate risk and fulfill efficiency and capital access goals, the inherent risk of a quasi-public entity utilizing private contract can increase the risk of market manipulation and abuse of power. Macey illustrates these risks with his depiction of the 2000–2001 California energy crisis, the Enron debacle, and similar abuses in various other states.[91]

But the question remains: why do courts continue the application of the filed rate doctrine if the rate in question formed out of private contract and not public ratemaking? One answer lies in the judicial principle of stare decisis, as well as regulatory capture issues. But a greater step back provides an observation that courts are falling into the *Chevron* trap:[92] they give great deference to regulatory blessing and by doing so fail to exercise the authority and position of the

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87. *Id.* at 1103–05.

88. *Id.* at 1117.

89. *Id.* at 1118, 1121.

90. *How Utilities Determine Generation and Distribution Rates*, ELEC. CHOICE, https://www.electricchoice.com/blog/how-utilities-determine-generation-and-distribution-rates-ratemaking/ [https://perma.cc/BFC2-WRN2]; *see generally* Macey, *supra* note 4, at 1101–05.

91. Macey, *supra* note 4, at 1118.

92. Chevron, U.S.A., Inc. v. Nat'l Res. Def. Council, Inc., 467 U.S. 837, 842–43 (1984). Nicholas Bednar explains:

> *Chevron* deference is a two-step standard of review for determining whether a court should defer to an agency interpretation of a statute. At step one, the court asks whether the statute is clear or unambiguous. If so, "the intent of Congress is clear, [and] that is the end of the matter; for the court, as well as the agency, must give effect to the unambiguously expressed intent of Congress." If not, the court asks at step two whether the agency's interpretation is "reasonable" or "based on a permissible construction of the statute."

Nicholas Bednar, *What to do About* Chevron*—Nothing*, 72 VAND. L. REV. 151, 151 n.1 (2019) (citation omitted).

judiciary to act as a check on the administrative agency. Professors Jonathan Siegel and Philip Hamburger discuss these issues in their respective *Chevron* works, questioning the role of the judiciary if abdicating review in deference to administrative agencies.[93] In other words, *quis custodiet ipsos custodes*?[94] Judicial deference to the rate setting authority may be logical when that authority originates from the public ratemaking process; however, it is an improper deference when that rate setting authority defers to the private contracting process of a biased party.

Macey does an admirable job of analyzing why FERC has largely "replaced monopoly cost-of-service ratemaking with a market-based approach to setting wholesale rates in most of the country."[95] The siren lure of competitive and open markets is beguiling to all voyagers whose most noble goal is the disintegration of "regulatory and economic barriers that hinder a free market."[96] There is heavy irony when an agency whose name is eponymous with regulation espouses such goals of destroying regulatory barriers and chasing the free market. Surely FERC and state regulatory agencies are aware that the only way to dismantle the aforementioned barriers would be to eliminate their oversight and perhaps very existence. The free market, replete with its invisible hands, could then joyfully embrace market forces and thrill to competitive wholesale power provision. But as Macey's historical review supports, there is not a true free market for a quasi-public entity.[97] The heavy power of the quasi monopoly is not easily reigned in without legislative or regulatory oversight. That leads to two options: enforce public ratemaking proceedings and reject the use of market-based approaches; or adopt the private contracting mechanisms that allow parties to operate fairly and in good faith. A movement away from the open access market orders issued by FERC is not likely, which leads to our examination of the latter option. Under private contract, typically via the Power Purchase Agreement, a generator agrees to sell power to a purchaser, typically a trader or a consumer, for a certain term and price. These contracts are usually long-term in nature and may take the form of a physical or financial contract. These contracts are bilateral agreements that contain standard contractual terms, such as quantity, price, delivery location, accounting, remedies for breach, and risk

93. Philip Hamburger, Chevron *on Stilts: A Response to Jonathan Siegel*,72 VAND. L. REV. EN BANC 77 (2018); Jonathan Siegel, *The Constitutional Case for* Chevron *Deference*, 71 VAND. L. REV. 937 (2018).

94. In other words, "Who will watch the watchmen?"

95. Macey, *supra* note 4, at 1120.

96. *Id.*

97. *Id.* at 1102–05.

mitigation (insurance and indemnification). If regulatory agencies, and the judiciary by extension, wish to retain the filed rate doctrine, then the applicable regulatory agency should avail itself of private contract remedies in order to adopt the market-based rate. Such rights could include:

1. Agency right to audit—Under private contracts, the right to audit allows a party to investigate the documents or conduct due diligence at agreed-upon schedules or frequency. FERC or the state agency could mandate an agency right of audit to private contracts in order to establish the veracity and fairness of the "private ratemaking" procedure. During these audits, any found malfeasance or bad faith could result in revocation of the filed rate doctrine or other penalties.
2. Third-party indemnification—The indemnification right is a powerful contractual remedy that allows the breached party remedy from the breaching party, usually in the form of monetary damages. The regulator could request indemnification on behalf of the public consumer in the event of any found wrongdoing or breach by the contracting party. The private contractors could mitigate this risk using insurance or cross-indemnification provisions.

By use of these provisions, in addition to others, the regulator does not become a party to the private contracting process, which interferes in the market approach. Rather, it retains its identity as the overseeing agency to ensure the promotion of public good and the protection of consumer rights.

Macey makes a good argument for the elimination of the filed rate doctrine.[98] It does not have a place in a market-based rate approach and should be eliminated by judicial declaration or else modified by affording the federal or state regulator certain protective contractual rights that the private parties would themselves obtain.[99]

III. THE REIMAGINATION OF ENERGY SYSTEMS

Macey's article serves as a solid basis to support the transformation of the energy system. Remnants of legislation and regulation from the era of ferries-as-public-utilities, while critical as historical exemplars, should not ground these systems and prevent their evolution. What we need is a paradigm shift from thinking of electric power generation as a static, linear model to one that is dynamic

98. Macey, *supra* note 4, at 1125–26.
99. *Id.*

and resilient, adaptive and reactive—a living system. In order to move to that dynamic and resilient model, we cannot hold on to notions of energy law that only impede its transformation.

This reimagination is necessary for several reasons:

1. Smart devices, technological electrification (e.g., cars, package-delivery drones, etc.), and general digitalization are increasing energy demand. Access to the Internet, in addition to the Internet of Things—everyday objects that are connected to communications networks—are placing high demands on the grid, which will only increase over time.[100] Moreover, the relationship between these electrified devices and energy systems is an active, participatory one—which is disruptive to the existing centralized control model.[101]
2. The centralized grid model, similar to a hub-and-spoke model, is increasingly outdated. The electric future includes distributed generation with connected microgrids and open source technology. This technological disruption is similar to the introduction of cloud computing, which has displaced physical storage.[102] Grid security underlies this movement and advances

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100. *Digitalisation and Energy*, INT'L ENERGY AGENCY (Nov. 2017), https://www.iea.org/reports/digitalisation-and-energy [https://perma.cc/Z9QG-VJTV].

101. *How Our Current Power Grid is Failing Us*, POWER MAG. (May 31, 2020), https://www.powermag.com/how-our-current-power-grid-is-failing-us/ [https://perma.cc/P3UL-BL3F]; Lisa Wood et al., *Recovery of Utility Fixed Costs: Utility, Consumer, Environmental and Economist Perspectives*, FUTURE ELEC. UTIL. REGUL. (June 2016), https://emp.lbl.gov/sites/all/files/lbnl-1005742.pdf [https://perma.cc/SF4C-X867]. The authors identify key trends in electric utility industry transformation, including:

> In the United States, the movement toward a more digital and distributed power grid is well underway. The need for more reliable and resilient grid operations, for greater efficiency and control, and for the connection and interaction with the "Internet of Things"[ ]—every device with an IP address—creates new challenges, roles and opportunities. The deployment of more than [sixty] million digital smart meters to U.S. households is one key building block. The integration of ever more distributed energy resources is another. Utilities are playing a central role as the integrators and enablers of the evolving Grid of Things.
>
> Given recent trends, the utility industry's current $20 billion annual investment in the distribution grid is expected to continue over the next several years. But for the grid to continue to evolve to provide the services that customers want, and to integrate an increasing number of "things," all customers who use the grid will need to continue to share in the cost of maintaining and operating it. This will entail moving toward a services model rather than a throughput model, which requires regulatory change.

Id. at 4.

102. *See* Eric Griffith, *What is Cloud Computing?*, PC MAG. (Jun. 29, 2020), https://www.pcmag.com/news/what-is-cloud-computing [https://perma.cc/F7UF-PB9B]:

> In the simplest terms, cloud computing means storing and accessing data and programs over the internet instead of your computer's hard drive. (The PCMag Encyclopedia defines it succinctly as "hardware and software services from a provider on the internet.") Ultimately, the "cloud" is just a metaphor for the internet. It goes back to the days of flowcharts and presentations that would represent the gigantic server-farm

in encryption, such as quantum encryption, could ensure the grid is protected from cyberattacks and other malicious actions.[103]

3. Energy poverty is a little-addressed problem in the United States, but it has the potential to increase as electrification increases. Generally, energy poverty is defined as a household's inability to meet needs.[104] Because energy poverty does not fall within federal poverty recognition, the lack of heat and power is typically addressed at the state or local level.[105] Often, this energy provision to low-income households is subsidized by the utility or local distribution company. A movement away from this traditional utility model would require further introspection as to how to provide for those in energy poverty.[106]

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infrastructure of the internet as nothing but a puffy cloud, accepting connections and doling out information as it floats.

103. Wood et al., *supra* note 101. The authors identify key trends in electric utility industry transformation, including:

> The power grid itself is changing, becoming "smarter" by virtue of a digital communication overlay with millions of sensors that will make the grid more controllable and potentially self- healing. The electric utility industry is investing more than $20 billion per year in the distribution grid alone, which will enable the connection of distributed energy resources, as well as new devices in our homes and businesses. Many of these resources and devices will interact with the grid, resulting in more reliable, resilient and efficient grid operations. The digital grid is evolving into a multi-path network of power and information flows that will use data analytics for grid management and optimization from end to end.

Id. at 3. The authors also advise that "[w]hile the digital power grid offers many benefits, it also raises cyber security risks which the utilities are addressing through a variety of measures, often with government cooperation, and which will add to the costs of maintaining the grid." *Id.* at 3, n. 8.

104. Dominic J. Bednar & Tony G. Reames, *Recognition of and Response to Energy Poverty in the United States*, 5 NAT. ENERGY 432, 432 (2020) (proposing to define American energy poverty as: "a state where households are challenged by everyday situations in meeting basic energy needs because of an assemblage of socio-economic, technical and environmental–political factors . . . includ[ing] gender, age, housing age, tenure type, energy inefficiency, education, employment, geography, socioeconomic status and race/ethnicity") (citations omitted).

105. *Id.*

106. *See generally* Shelley Welton, *Grid Modernization and Energy Poverty*, 18 N.C.J.L. & TECH. 565 (2017) (arguing that energy poverty contributes to the gap between the potential of grid modernization and the reality of a traditionally-regulated system). Welton states:

> For those who care about justice, current electricity governance also leaves much to be desired. In 2015, fourteen million U.S. households had unpaid utility bills, and 2.2 million had service disconnected. That means around [fourteen percent] of US households are either actively without energy services, or in danger of losing them imminently. Many of these families, and many others who manage to pay their bills on time but sacrifice other basic necessities to do so, spend an exorbitant and unsustainable portion of their monthly earnings on obtaining energy supplies, causing them to experience "energy poverty." To add insult to injury, many of these same families are likely to be more severely harmed than wealthier Americans by the effects

4. Renewable energy is intermittent, which necessitates energy infrastructure that is fluid and adaptable in its generation intake.[107]

This reimagination will require a greater vision than that which created the grid. It will require an informed questioning of every facet of our energy laws, regulations, and frameworks. Not only will the technology to generate and deliver power transform, so, too, will the investment and pricing mechanisms that allow this access. The century-old utility model of pricing will change—morphing into one that rewards efficiency, access, diversity, and equity.[108]

CONCLUSION

It is not coincidental that in science, power is defined as the ability to do work. Electric power will be the advantage of this century, as we develop a society based on technological wonder—drones, smart devices, electric vehicles, cloud and quantum computing. But with those advances, the problems of delivering secure and safe quantities of electric power remain. Energy poverty is rampant nationally, with many underserved populations lacking access or reliable connectivity to power. The COVID-19 pandemic has only exacerbated those issues with school-aged children unable to connect to the Internet to attend school

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of climate change—another inconvenient byproduct of our current energy infrastructure.

> Descriptions of Americans opening their ovens to stay warm in the winter appear a far cry from the cornucopia of technological wonders described in the first paragraph of this Article. Perhaps in part for this reason, grid modernization and energy poverty are rarely discussed in the same conversation, much less in the same sentence. Yet grid modernization—for all its anticipated substantial long-term benefits—requires substantial short-term spending, and carries both short- and long-term distributional consequences. Most decisions on how to modernize both infrastructure and regulatory frameworks are made by state electricity regulators, "nearly all [of whom] feel pressure or the desire to address the issue of affordability. For this reason, as the project of grid modernization substantially advances in many states, regulators no longer feel able to ignore its intersections with energy poverty.

Id. at 567–68 (footnotes omitted); *see also* Lakshman Guruswamy, *Global Energy Poverty: The Relevance of Faith and Reason*, 7 BELMONT L. REV. 199 (2020) (for discussion on global energy poverty).

107. Wood et al., *supra* note 101, at 3. The authors identify key trends in electric utility industry transformation, including:

> The portfolio of energy resources we use to meet our electricity needs is changing. As a nation, we are investing increasingly in renewable energy, transitioning from coal to natural gas, continuing to generate electricity using nuclear energy and pursuing energy efficiency. At the same time, modernization and digitization of the grid enable the integration of more carbon-free renewable resources, both large-scale and distributed. In fact, we expect continued growth . . . of utility solar—the dominant market segment—followed by private residential solar and nonresidential solar.

108. *See* Magín Yáñez et al., *supra* note 63.

from home or families unable to access information about health and social welfare.

In California, the fires continue to burn. The skies herald the mariner's ancient warning of red skies at dawn. Ending or changing Macey's zombie energy laws will not on their own address climate change, resiliency, and energy poverty. But they are a much-needed start.