

The Natural Gas Paradox: Shutting Down a System Designed to Operate Forever

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THE NATURAL GAS PARADOX: SHUTTING DOWN A SYSTEM DESIGNED TO OPERATE FOREVER

HEATHER PAYNE*

ABSTRACT

The scientific consensus is clear: the earth's climate is changing, and mankind must take collective bold action. While the pace of decarbonization is being debated as a political question, it is already impacting business decisions and regulators need to address it. From a decarbonization perspective, most challenging is what happens inside the home: addressing natural gas used for heating, cooking, clothes drying, and hot water. Eliminating natural gas usage for these activities will require societal change at a massive scale, with significant economic and regulatory implications.

As states move toward full decarbonization, the natural gas distribution system will need to become a central focus. Pipes put into the ground today have a lifespan of up to eighty years—far past the point where the scientific community has indicated we will need to be fully transitioned away from all fossil fuel use. Compounding this problem from a financial and regulatory perspective, natural gas distribution systems are monopoly regulated utilities, with their costs paid for by captive ratepayers.

The transition raises three interrelated questions, one political and two regulatory: (1) what policies are necessary to electrify household energy uses; (2) how should regulators shut down the natural gas distribution system; and (3) how should regulators compensate regulated monopoly utilities for the assets that have become stranded in the transition? The answer to the first question will have a direct impact on the other two.

To address these questions, this Article starts with a description of the natural gas distribution system, including a quantification of value. The Article discusses options that exist for regulators as they plan to shut off, and subsequently decommission, natural gas infrastructure. Assuming some assets will become stranded, this Article reviews learnings from other stranded asset challenges, examines potential regulatory treatments, and

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demonstrates what regulators could do to lessen future challenges as they are approving projects now. How to both incent and pay for the transition of all residential uses away from natural gas will be the most difficult challenge of decarbonization.

I. INTRODUCTION	696
II. THE NATURAL GAS DISTRIBUTION SYSTEM.....	708
A. Current Ownership and Value of Natural Gas System	708
B. Aging Infrastructure and Stranded Costs	710
C. Options To Shut Down the Natural Gas Distribution System ...	712
1. Option One: All At Once.....	713
2. Option Two: Piecemeal	715
3. Option Three: Restrictions Based on Use or Application ...	716
4. Option Four: Restrictions Based on Source	725
III. REGULATORY OPTIONS TO ADDRESS THE CHALLENGE	728
A. Potential Regulatory Strategies and Options	729
1. Recovery Including Profit	730
2. Capital Recovery Not Including Profit.....	731
3. Disallowing Recovery/Finding Investments Imprudent.....	731
4. Accelerated Depreciation	732
5. Securitization	732
6. Committed Decommissioning	734
7. Abandonment Proceedings.....	735
8. Market Responses.....	736
9. Cross-subsidization.....	737
B. Assets Already In the Ground	738
C. Investment Starting Now.....	740
D. Utility Responses	743
E. Other Considerations	752
IV. CONCLUSION.....	753

Greenhouse gases are emitted by all sectors of the economy, including electric power (28% of total), transportation (29%), industry (22%), residential and commercial (12%), and agriculture (9%).¹

The residential sector uses natural gas to heat buildings and water, to cook, and to dry clothes. About half of the homes in the United States use natural gas for these purposes.²

1. *U.S. Emissions*, CTR. FOR CLIMATE & ENERGY SOLUTIONS, <https://www.c2es.org/content/u-s-emissions/> (last visited Jan. 12, 2020).

2. *Natural Gas Explained*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/energyexplained/index.php?page=natural_gas_use (last updated Nov. 30, 2020). For a detailed breakdown of energy use by individual uses, see generally *Quadrennial Technology Review: An Assessment of Energy Technologies and Research Opportunities*, U.S. DEP'T OF ENERGY Ch. 5 (Sept. 2015), <https://www.energy.gov/sites/prod/files/2017/03/f34/qr-2015-chapter5.pdf>.

I. INTRODUCTION

Berkeley.³ Menlo Park.⁴ Seattle.⁵ Brookline.⁶ Santa Rosa.⁷ As cities are increasingly focused on actions to reduce their contributions to climate change and the impact from it, policy actions around natural gas are coming to the fore, even for cities as large as San Jose, the nation's tenth largest.⁸ But why now?

3. Elena Shao, *Bay Area Cities Poised to Follow Berkeley's Natural Gas Ban*, S.F. CHRON. (Aug. 19, 2019), <https://www.sfchronicle.com/business/article/Bay-Area-cities-poised-to-follow-Berkeley-s-14342117.php>. The California Restaurant Association, representing the restaurant industry, has challenged Berkeley's ordinance, asserting that both the federal Energy Policy and Conservation Act and state law—both the California Building Standards Code and the California Energy Code—preempted the ordinance. Complaint at 10–15, *California Rest. Ass'n v. City of Berkeley*, No. 3:19-cv-07668 (N.D. Cal. Nov. 21, 2019). Berkeley has moved to dismiss. Defendant's Motion to Dismiss at 1, *California Rest. Ass'n v. City of Berkeley*, No. 4:19-cv-07668 (N.D. Cal. Jan. 13, 2020). The federal court granted in part the City of Berkeley's motion to dismiss on ripeness and standing grounds, but granted the California Restaurant Association leave to file an amended complaint. The court denied Berkeley's motion to dismiss on the remaining grounds but said Berkeley could raise them again in response to the amended complaint. *California Rest. Ass'n v. City of Berkeley*, No. 4:19-cv-07668 (N.D. Cal. July 22, 2020).

4. Sara Tabin, *Palo Alto Will Consider Limits on Natural Gas This Fall*, PALO ALTO DAILY POST (Sep. 19, 2019), <https://padailypost.com/2019/09/19/palo-alto-will-consider-limits-on-natural-gas-this-fall/>. For a summary of municipal bans, authority under state law, and challenges, see Amy Turner, *Municipal Natural Gas Bans: Round 1*, SABIN CTR. FOR CLIMATE CHANGE L. (Jan. 9, 2020), <http://blogs.law.columbia.edu/climatechange/2020/01/09/municipal-natural-gas-bans-round-1/>.

5. Daniel Beekman, *Seattle City Council to Consider Ban on Natural Gas for New Homes, Buildings*, SEATTLE TIMES (Sept. 5, 2019), <https://www.seattletimes.com/seattle-news/politics/seattle-city-council-to-consider-ban-on-natural-gas-for-new-buildings/> (“The Seattle City Council will consider a ban on natural gas for newly constructed homes and buildings, favoring the use of electricity for heating and cooking. . . . The ban would take effect for permitting on July 1, 2020 Fifty-five percent of Seattle's existing single-family houses were heated by natural gas in 2018, while 28% used oil and 16% used electricity.”). Seattle is looking to potentially pay for the transition to electric heat through a tax on heating oil providers. Jason Plautz, *Seattle mayor proposes heating oil tax to push electrification*, SMART CITIES DIVE (Aug. 9, 2019), <https://www.smartcitiesdive.com/news/seattle-mayor-proposes-heating-oil-tax-to-push-electrification/560564/>.

6. *Brookline Adopts Ban on New Gas and Oil Infrastructure in Major Construction*, WICKED LOCAL BROOKLINE (Nov. 22, 2019), <https://brookline.wickedlocal.com/news/20191122/brookline-adopts-ban-on-new-gas-and-oil-infrastructure-in-major-construction> (noting the Brookline ban is the first one east of the Sierra Nevadas and the only one to include renovation projects); Benjamin Storrow, *Gas Bans, Once a Calif. Specialty, Arrive in New England*, E&E NEWS (Nov. 25, 2019), <https://www.eenews.net/stories/1061638023> (noting the frequency of fuel oil use in New England and that while what will replace the fleet of old oil furnaces—natural gas or electric heat pumps—is a matter of much debate, there could be benefits by avoiding gas infrastructure installation costs).

7. Santa Rosa's ban requiring appliances in new homes of three stories or less to use electricity rather than natural gas has also been challenged, this time by a developer. Complaint, *Gallaher v. City of Santa Rosa*, No. SCV265711 (Cal. Super. Ct. Dec. 17, 2019), <http://climatecasechart.com/case/gallaher-v-city-of-santa-rosa>.

8. Pierre Delforge, *San Jose Adopts Strongest Building Code Among Large Cities*, ENERGY CENTRAL (Sept. 18, 2019), <https://www.energycentral.com/c/ec/san-jose-adopts-strongest-building-code-among-large-cities> (describing the effect of San Jose's zero-emission building

Because the scientific consensus is clear. The earth's climate is changing. To stave off the most dramatic effects, mankind must take collective bold action toward decarbonization in order to stay below 1.5 degrees Celsius above pre-industrial levels.⁹ Currently on a pathway to 3 degrees Celsius or more,¹⁰ the scientific warnings about climate change have become more dire as the trajectory of carbon dioxide levels in the atmosphere continue to rise.¹¹ The takeaway from the Intergovernmental Panel on Climate Change ("IPCC") report is that "[h]umanity has a dozen years to hold off the accelerated risks of extreme heat waves, wildfires, flooding, drought, sea level rise, and extensive poverty."¹²

ordinance) ("San Jose's reach code aims to make zero-emission buildings—where all equipment such as heaters and water heaters are powered by clean renewable electricity—the default in San Jose. Following adoption . . . , greenhouse gas emissions of San Jose's new buildings will be cut by 90 percent. The companion ordinance in October will require all new municipal buildings to be all-electric, as well as requiring this of all new single-family and low-rise multi-family housing. For high-rise and commercial buildings, San Jose's new code encourages electric construction, while still leaving flexibility to build with gas. That said, buildings heated by gas will need to meet higher energy efficiency requirements. They will also need to provide the necessary electric infrastructure to easily switch to electric appliances later, to protect consumers from higher gas bills and retrofit costs in future years."). See also Robert Walton, *San Jose Becomes Largest City Requiring All-Electric Buildings, As Local Climate Actions Rise*, UTIL. DIVE (Sept. 19, 2019), <https://www.utilitydive.com/news/san-jose-becomes-largest-city-requiring-all-electric-buildings-as-local-cl/563249/>; Nichola Groom, *San Jose Moves to Ban Natural Gas in New Residential Buildings*, REUTERS (Sep. 17, 2019), <https://www.reuters.com/article/us-usa-naturalgas-sanjose/san-jose-moves-to-ban-natural-gas-in-new-residential-buildings-idUSKBN1W302J> ("San Jose, the 10th most populous U.S. city and political center of Silicon Valley, on Tuesday moved to ban natural gas in most new residential buildings San Jose's measure falls short of an outright ban on natural gas in new buildings such as the one passed by nearby Berkeley, California, earlier this year because it would not include high-rise buildings").

9. SPECIAL REPORT: GLOBAL WARMING OF 1.5° C, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (2018), <https://www.ipcc.ch/sr15/> (listing the climate impacts at 1.5 degrees C).

10. David Brown & Prakash Sharma, *What Would an Accelerated Global Energy Transition Look Like?*, GREENTECH MEDIA (Jan. 23, 2020), <https://www.greentechmedia.com/articles/read/what-would-an-accelerated-global-energy-transition-look-like>.

11. *Carbon Dioxide Concentrations at Mauna Loa Observatory*, SCRIPPS INST. OF OCEANOGRAPHY (Jan. 10, 2020), https://scripps.ucsd.edu/programs/keelingcurve/wp-content/plugins/sio-blueluemoon/graphs/mlo_full_record.png.

12. Mitchell Beer, *1.5°C is Doable, But Just a Dozen Years Left to Get on a Low-Carbon Pathway*, THE ENERGY MIX (Oct. 8, 2018), <https://theenergymix.com/2018/10/08/1-5c-is-doable-but-just-a-dozen-years-left-to-get-on-a-low-carbon-pathway/>. And this is not the most dire prediction. Australia's Breakthrough – National Centre for Climate Restoration looked at a 3 degrees Celsius scenario in 2050, which is where the world might be without stronger climate action by world governments. The scenario "provides a glimpse into a world of 'outright chaos' on a path to the end of human civilisation [sic] and modern society as we have known it, in which the challenges to global security are simply overwhelming and political panic becomes the norm." David Spratt & Ian Dunlop, *Existential Climate-Related Security Risk: A Scenario Approach*, NAT'L CTR. FOR CLIMATE RESTORATION 8–10 (May 2019), https://docs.wixstatic.com/ugd/148cb0_90dc2a2637f348edae45943a88da04d4.pdf.

One of the things we must address to combat climate change is our use of natural gas.¹³ The focus on ending the use of natural gas is due to new scientific information around climate change, and comes as more information is also being reported about the impact on climate change from the production and transportation of natural gas.¹⁴ “[R]ather than being an environment-friendly product that can help solve our climate problems, gas is the new coal. . . . [G]as is also a bigger contributor to climate change than was understood.”¹⁵ Or as one headline succinctly put it: “As Coal Fades in the U.S., Natural Gas Becomes the Climate Battleground.”¹⁶

By taking action, cities are looking to change how their jurisdictions utilize energy, and some are recognizing that banning new natural gas lines in construction is necessary.¹⁷ While the pace of accelerated decarbonization is still being debated as a political question, it is already impacting business decisions.¹⁸ In response to the increasing impact of natural gas on the climate, Beyond Coal—the Sierra Club campaign originally formed to combat reliance on coal—has become Beyond Carbon.¹⁹

13. Steven Mufson, *The Battle over Climate Change is Boiling over on the Home Front*, WASH. POST (Feb. 23, 2021), <https://www.washingtonpost.com/climate-environment/2021/02/23/climate-change-natural-gas/> (“But long term, if cities are serious about their climate goals, electric buildings are inevitable.”).

14. *New Analysis Reveals ‘Clean’ Natural Gas as ‘The New Coal.’* THE ENERGY MIX (July 2, 2019), <https://theenergymix.com/2019/07/02/new-analysis-reveals-clean-natural-gas-as-the-new-coal/> (“Methane leaks from liquified natural gas (LNG) and other parts of the gas production chain are making the supposedly ‘clean fuel’ a climate pollutant on par with coal . . .”).

15. *Id.* In the words of one scientist, “[n]atural gas may produce fewer carbon emissions than coal, but that just means you cook the planet a bit more slowly.” Brad Plumer, *Carbon Dioxide Emissions Hit a Record in 2019, Even as Coal Fades*, N.Y. TIMES (Dec. 3, 2019), <https://www.nytimes.com/2019/12/03/climate/carbon-dioxide-emissions.html>.

16. Brad Plumer, *As Coal Fades in the U.S., Natural Gas Becomes the Climate Battleground*, N.Y. TIMES (June 26, 2019), <https://www.nytimes.com/2019/06/26/climate/natural-gas-renewables-fight.html>.

17. There are three approaches that cities looking to decrease natural gas usage can take: (1) require homes to be ready for electric uses, even if the home currently uses natural gas; (2) adopt higher efficiency standards for homes that use a combination of natural gas and electric appliances than for all-electric homes; and (3) require all construction to be all electric. Shao, *supra* note 3.

18. While this Article will primarily deal with business decisions in the energy sector, other businesses and sectors are also determining that climate change is a source of risk and needs to be addressed in the normal course of business. *See, e.g., A Call for Action: Climate Change as a Source of Financial Risk*, NETWORK FOR GREENING THE FINANCIAL SYSTEM 19–33 (April 2019), https://www.banque-france.fr/sites/default/files/media/2019/04/17/ngfs_first_comprehensive_report_-_17042019_0.pdf (discussing changes central banks and policymakers need to make to address climate change as a source of economic and financial risk within the financial sector).

19. Robert Walton, *Bloomberg Commits \$500M to Phasing Out Coal, Halting New Gas Plants*, UTIL. DIVE (June 7, 2019), <https://www.utilitydive.com/news/bloomberg-commits-500m-to-phasing-out-coal-halting-new-gas-plants/556430/> (“Simultaneously and starting now, Beyond Carbon will extend the successful strategies utilized in the Beyond Coal campaign to other fossil fuels, by working to prevent new construction of gas plants.”). The money will be used for “lobbying efforts in state legislatures, city councils and public utility commissions” and the expected

Meanwhile, in California, there are additional signs that the natural gas business is vulnerable. Currently, there are calls for Pacific Gas & Electric, which is currently in the midst of bankruptcy proceedings, to be broken up into two parts—“splitting the natural gas and electric delivery businesses into separate companies.”²⁰ At first glance, the gas business looks like it would fetch a nice price—the system has 4.3 million customers and generates more than \$4 billion in annual revenue.²¹ However, the potential pool of interested buyers may be limited because of the state’s ambitious environmental goals and “stringent regulatory climate,” which could lead to the natural gas infrastructure becoming obsolete by 2045.²² It would become obsolete because the state would have mandated full-building electrification—replacing the household and commercial uses of natural gas and shutting down the natural gas system. Business leaders, too, recognize that support for using natural gas is fading.²³ Mass electrification is needed.²⁴

Given the urgency needed to solve this ambition gap and lack of action at the federal level in the United States,²⁵ some states have attempted to take

expenditures are “\$500 million in the next three years.” Jeff St. John, *Bloomberg Commits \$500M to Close All US Coal Plants by 2030, Halt New Natural Gas Plants*, GREENTECH MEDIA (June 7, 2019), <https://www.greentechmedia.com/articles/read/bloomberg-commits-500m-to-close-all-us-coal-plants-by-2030-halt-natural-gas>.

20. Robert Walton, *As California Considers Breaking Up PG&E, Utility ‘Open to a Range of Solutions,’* UTIL. DIVE (Dec. 28, 2018), <https://www.utilitydive.com/news/as-california-considers-breaking-up-pge-utility-open-to-a-range-of-solut/545011/>. The main driver behind potentially splitting up the company into its constituent parts is to drive safety improvements. Robert Walton, *Split Apart PG&E? The Utility is Open to it, but Warns Rates Would Likely Rise*, UTIL. DIVE (Feb. 21, 2019), <https://www.utilitydive.com/news/split-apart-pge-the-utility-is-open-to-it-but-warns-rates-would-likely-r/548869/>.

21. David R. Baker, *PG&E May Sell California Assets Nobody Will Want in 20 Years*, BLOOMBERG (January 24, 2019), <https://www.bloomberg.com/news/articles/2019-01-24/pg-e-may-be-selling-california-assets-nobody-wants-in-20-years>.

22. *Id.* (“And California’s goals to phase out greenhouse gas emissions by 2045 could render a fossil fuel network worthless.”).

23. The executive direction or industry trade group Center for Liquefied Natural Gas stated at a conference: “‘If natural gas becomes the next coal, that’s going to be a real challenge.’” Corey Paul, *Political Challenges Send Chill Through US Gathering of LNG Interests*, S&P GLOB. (Oct. 15 2019), <https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/101519-political-challenges-send-chill-through-us-gathering-of-lng-interests>. Equipment manufacturers are also starting to focus on promoting “renewable” natural gas as a way to maintain market share and stop pressure on their businesses. GTM Creative Strategies, *Why Flexible Gas Generation Must Be Part of Deep Decarbonization*, GREENTECH MEDIA (Dec. 9, 2019), https://www.greentechmedia.com/articles/read/why-flexible-gas-must-be-part-of-the-path-to-100-percent-decarbonization?utm_medium=email&utm_source=Daily&utm_campaign=GTMDaily.

24. Brown & Sharma, *supra* note 10 (noting that electrification is core to meeting a two degree Celsius target).

25. Ann Pramaggiore, senior vice president of Exelon, summed it up nicely when talking about climate change at a recent conference: “The challenge is a lack of national policy . . . where there are 50 different states . . . with different models . . . It’s happening, but it’s not cohesive.” Rod Walton, *Accenture IUEC: Beware (And Embrace) the Steep Cliffs of Disruption*, POWER ENG’G

action to start the decarbonization process, through legislation, executive orders, or regulatory decisions.²⁶ However, when decarbonization is mentioned, the discussion is typically focused on electricity generation, and how electricity can be decarbonized.²⁷ This made sense for multiple reasons—until recently, electricity was the economic sector with the highest emissions—followed by transportation, industry, residential and commercial, and agriculture—and, given the limited number of sources, it was relatively easy to regulate.²⁸ Some states have enacted renewable portfolio standards to start the transition to clean or carbon-free electricity.²⁹ States have also taken other actions around electricity generation, often with regard to natural gas peaker plants, to continue to decarbonize their grid.³⁰

After electricity generation, probably because it is now the largest source of greenhouse gas emissions in the United States, policymakers tend to focus on transportation,³¹ and what requirements or incentives are needed

(Apr. 5, 2019), <https://www.power-eng.com/renewables/accenture-iuec-beware-the-steep-cliffs-of-disruption/>. See also Victor Flatt & Heather Payne, *Not One Without The Other: The Challenge of Integrating U.S. Environment, Energy, Climate, and Economic Policy*, 44 ENV'T. L. 1079 (2014) (noting skepticism that we will be able to come together to limit warming to two degrees Celsius based on what would need to happen).

26. Many actions target the electricity system, but some are economy-wide. Cf. Robert Walton, *Clean Energy Advocates Want New York to Move Quickly on 70% Renewables Goal*, UTIL. DIVE (Dec. 19, 2019), <https://www.utilitydive.com/news/clean-energy-advocates-new-york-quickly-70-renewables-goal-climate-target/569377/> (electricity-specific goal); Kavya Balaraman, *Nevada governor orders plans for economy-wide carbon reductions*, UTIL. DIVE (Nov. 25, 2019), <https://www.utilitydive.com/news/nevada-governor-orders-plans-for-economy-wide-carbon-reductions/567946/> (economy-wide goal).

27. See, e.g., Lori Bird & Tyler Clevenger, *2019 Was a Watershed Year for Clean Energy Commitments from U.S. States and Utilities*, WORLD RES. INST. (Dec. 20, 2019), <https://www.wri.org/blog/2019/12/2019-was-watershed-year-clean-energy-commitments-us-states-and-utilities>; Amanda Sorell, *States Set Clean Energy Goals*, MOTHER EARTH NEWS (Dec. 2019), <https://www.motherearthnews.com/nature-and-environment/states-clean-energy-goals-zm0z19djzols>.

28. Not to say that scientists are not also focused on these areas. Scientists want peak meat by 2030 as well. *Scientists Urge 'Peak Meat' by 2030, But Farm Rep Sees More Complex Picture*, THE ENERGY MIX (Dec. 15, 2019), <https://theenergymix.com/2019/12/15/scientists-urge-peak-meat-by-2030-but-farm-rep-sees-more-complex-picture/>.

29. *State Renewable Portfolio Standards and Goals*, NAT'L CONF. OF STATE LEGISLATURES, <http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx> (last updated Jan. 4, 2021).

30. See Heather Payne, *Pulling in Both Directions: How States Are Moving Toward Decarbonization While Continuing to Support Fossil Fuels*, 45 COLUM. J. ENV'T. L. 285, 292–302 (2020).

31. *Sources of Greenhouse Gas Emissions*, EPA, <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions> (last visited Jan. 12, 2020) (Overview tab). California had adopted regulations which would require that manufacturers sell an increasing percentage of medium- and heavy-duty zero-emissions vehicles (“ZEVs”), although those regulations have been challenged by the California Natural Gas Vehicle Coalition. Complaint at 1, *California Nat. Gas Vehicle Coal. v. California Air Res. Bd.* (Cal. Super. Ct. July 30, 2020), http://blogs2.law.columbia.edu/climate-change-litigation/wp-content/uploads/sites/16/case-documents/2020/20200730_docket-

to decarbonize transportation.³² There is no doubt that the transition of transportation away from fossil fuels will be a significant societal challenge,³³ but there are federal incentives for electrification,³⁴ the Volkswagen (“VW”) settlement is bringing both awareness and money to the states for emissions reductions,³⁵ and an electric car is within the top ten sales by volume.³⁶ With the addition of proper incentives, a significant impact on transportation could happen relatively quickly: the average life expectancy of a new vehicle in the United States is around eight years.³⁷

While the industrial sector is the third largest producer of greenhouse gas emissions,³⁸ most of these direct emissions come from the consumption

na_petition-for-review.pdf?mc_cid=c559235420&mc_eid=0a6d4e7891. At the more local level, for example, Los Angeles has committed to moving to 100% electric garbage trucks by 2035. E.A. Crunden, *Los Angeles Commits to 100% Electric Sanitation Fleet By 2035. Other Cities Aren't Ready to Follow*, WASTEDIVE (Jan. 29, 2020), <https://www.wastedive.com/news/los-angeles-sanitation-truck-fleet-100-percent-electric/571166/>.

32. See generally Andrea Hudson Campbell, Avi Zevin & Keturah Brown, *Heavy-Duty Vehicles and Freight*, in LEGAL PATHWAYS TO DEEP DECARBONIZATION IN THE UNITED STATES 384–423 (ELI, Michael B. Gerrard & John C. Dernbach, eds., 2019) (discussing how heavy duty vehicles and rail can help achieve the goal of decarbonizing transportation 75–100% from a 2014 baseline); *Transportation and Climate Initiative (TCI)*, GEORGETOWN CLIMATE CTR., <https://www.georgetownclimate.org/transportation/transportation-landing.html> (regional collaboration among eleven northeast and mid-Atlantic states plus DC); *REV West*, NAT'L ASS'N OF STATE ENERGY OFFS., <https://www.naseo.org/issues/transportation/rev-west> (framework for creating electric vehicle corridor for western US including eight states).

33. See, e.g., Mark K. Matthews, *Cutting Carbon in Homes: 'It is a Head Change for People'*, CLIMATEWIRE (Nov. 15, 2019), <https://www.eenews.net/climatewire/stories/1061551849> (describing the arguments over a new parking garage, which opponents say “runs counter to the city’s quest of becoming carbon neutral”).

34. See *Search Federal and State Laws and Incentives*, OFFICE OF ENERGY EFFICIENCY & RENEWABLE ENERGY, <https://www.energy.gov/eere/electricvehicles/electric-vehicles-tax-credits-and-other-incentives> (last visited Jan. 12, 2020).

35. *About the Settlement*, VW SETTLEMENT CLEARINGHOUSE, <https://vwclearinghouse.org/about-the-settlement/> (last visited Jan. 12, 2020).

36. The Tesla Model 3, YTD numbers as of Jan. 3, 2020. *2019 U.S. Passenger Car Sales Analysis*, “US Best Selling Passenger Cars Last Month,” GOOD CAR BAD CAR, <http://www.goodcarbadcar.net/us-passenger-car-sales-figures-by-model/>.

37. Herb Weisbaum, *What's the Life Expectancy of My Car?*, NBC NEWS (Mar. 28, 2006), http://www.nbcnews.com/id/12040753/ns/business-consumer_news/t/whats-life-expectancy-my-car/#.XT4ShuhKjZs. Although the author admits to having a 1985 Mercedes 300 TD station wagon with 376,000 miles in addition to a Tesla Model 3, she recognizes that there are certainly outliers from that average. Indeed, there is some indication that electric vehicles are replacing cars that have not yet come to the end of their useful life—owners are switching out even when they do not have to. However, current models of adoption of electric vehicles (“EVs”) tend to assume that replacements will happen only when needed—so the transition from internal combustion engines (“ICEs”) to EVs may happen more quickly than is currently being predicted. Unfortunately, buses are another matter—the average equipment lifetime of a bus is twenty-three years. Amanda Myers, *The Capital Stock Turnover Problem for 100% Clean Energy Targets*, GREENTECH MEDIA (Nov. 18, 2019), <https://www.greentechmedia.com/articles/read/the-capital-stock-turnover-problem-for-100-clean-energy-targets>.

38. EPA, *supra* note 31 (Overview tab).

of fossil fuels for energy,³⁹ which is being addressed through efficiency, fuel switching, and additional electrification.⁴⁰ In aggregate, the amount of greenhouse gas emissions from the industrial sector is trending down over time.⁴¹ While existing industrial infrastructure will need to be addressed for decarbonization to be successful,⁴² research is also continuing on sector-specific replacements for fossil-fuel use in industry.⁴³ Should limited continued use of fossil fuels be necessary in some industrial applications for a longer period of time,⁴⁴ those facilities can both pay the necessary price for

39. *Id.* (Industry tab). “Most direct emissions come from the consumption of fossil fuels for energy.” Direct emissions, rather than indirect, account for approximately seventy-five percent of the total emissions from the industrial sector. Indirect emissions from the generation of electricity accounts for the vast majority of the indirect emissions.

40. *Id.*; see also Manfred Fischedick et al., *Industry in CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE. CONTRIBUTION OF WORKING GROUP III TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE* 754–55, 758–60, 762, 774–75, 782 (O. Edenhofer et al. ed., 2018), https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter10.pdf; Justin Gerdes, *Using Solar to Displace Fossil Fuels for Process Heat in Industrial Facilities*, GREENTECH MEDIA (Sep. 27, 2019), <https://www.greentechmedia.com/articles/read/using-solar-to-displace-fossil-fuels-for-process-heat-in-industrial-facilit> (noting that “[a]t many of these facilities, fossil fuels, and especially natural gas, are the energy feedstock used for process heating applications” and discussing how solar can meet some of these needs); Julian Spector, *CSP Startup Heliogen Cranks Up Solar Thermal to 1,000 Degrees*, GREENTECH MEDIA (Nov. 19, 2019), <https://www.greentechmedia.com/articles/read/heliogen-cranks-solar-thermal-up-to-1000-degrees-cel> (discussing use of solar power for industrial heat).

41. EPA, *supra* note 31 (Industry tab).

42. John Parnell, *WoodMac: Energy Sector Faces ‘Darwinian Challenge’ to Tame Climate Change*, GREENTECH MEDIA (Sept. 24, 2020), <https://www.greentechmedia.com/articles/read/wood-mac-energy-sector-faces-darwinian-challenge-to-tame-climate-change>.

43. A steel plant is being developed that will run on wind energy. Jeffrey Tomich, *U.S. Readies First Wind-Powered Steel Plant*, E&E NEWS (Nov. 15, 2019), <https://www.eenews.net/stories/1061552453> (“For decades, access to cheap coal-fired electricity fueled industrial expansion across the Midwest, from auto plants to steel mills. These days, a cleaner and cheaper energy source—winds blowing across the central Plains—is enabling new manufacturing investments, key sources of jobs and taxes for states hungry to grow their economies. The latest example? A \$250 million Nucor Corp. ‘micro’ mill taking shape in Sedalia, Mo., that will be the first U.S. steel production plant that will run on wind energy.”). The plant will use high-efficiency electric arc furnaces. *Id.* See also David Roberts, *A New Solar Heat Technology Could Help Solve One of the Trickiest Climate Problems*, VOX (Nov 20, 2019), <https://www.vox.com/science-and-health/2019/11/19/20970252/climate-change-solar-heat-heliogen-csp> (discussing the ability make high-temperature industrial heat from sunlight); Suzanne Hunt & Jigar Shah, *The Best Option for Airlines to Shrink Their Carbon Footprint*, GREENTECH MEDIA (Oct. 22, 2019), https://www.greentechmedia.com/articles/read/the-best-option-for-airlines-to-shrink-their-carbon-footprint?utm_medium=email&utm_source=Daily&utm_campaign=GTMDaily (noting that, for airlines, offsets might be the best option, at least near-term).

44. There are some industries that will need additional R&D to understand how to fully decarbonize. David Roberts, *This Climate Problem is Bigger than Cars and Much Harder to Solve*, VOX, <https://www.vox.com/energy-and-environment/2019/10/10/20904213/climate-change-steel-cement-industrial-heat-hydrogen-ccs> (last updated Jan 31, 2020) (“[A]ctually, there are some sectors, some uses of fossil fuels, that we do not yet know how to decarbonize. Take, for instance, industrial heat: the extremely high-temperature heat used to make steel and cement. It’s not sexy,

maintaining the infrastructure supplying them (which will increase per unit as other uses are decreased but is much more limited than for residential uses) and for whatever carbon offsetting mechanisms are required by regulators for the continued use of emitting fuels.⁴⁵

While policymakers have a clear path forward, then, on the top three sectors for greenhouse gas emissions, the path forward for the commercial and residential sector is far less clear.⁴⁶ It is perhaps unsurprising then that local actors have been among the first to take action to reduce natural gas in buildings. Electricity generation and transportation are both generally regulated at the federal and state levels.⁴⁷ But much of what happens in our buildings—especially around enforcement of building codes—happens at the local level. Given that 92% of the end users of the natural gas distribution system are residential, we must focus on them to succeed in decarbonization.⁴⁸ Indeed, recent research indicates that households do not “receive sufficiently high priority in current climate policy strategies.”⁴⁹

The need to focus on households is strengthened by the simple fact that home appliances have a longer life expectancy than that of vehicles, which have a relatively short life expectancy (even given their comparatively high initial cost). “[S]low capital stock turnover – the process whereby old

but it matters.”). This will also be important because, like electricity and natural gas infrastructure, some of these pieces of equipment are designed for exceedingly long lives. *Id.* Most “equipment [is] meant to last between 20 and 50 years. Blast furnaces sometimes make it to 60. These are large, long-term capital investments, with relatively low stock turnover.” *Id.*

45. Indeed, charging these costs to the specific industries will prompt those products to be more expensive, which will hasten either their disuse or research into alternatives that do not use fossil fuels. Southern California Edison expects what little natural gas will still be in use by 2045 will mostly go to industry. Justin Gerdes, *Southern California Edison’s Vision for How the State Achieves Carbon Neutrality*, GREENTECH MEDIA (Feb. 20, 2020) [hereinafter Gerdes, *Southern California*], <https://www.greentechmedia.com/articles/read/southern-california-edisons-vision-for-how-the-state-achieves-carbon-neutrality>.

46. The same challenges will exist, however, around heating, cooking, drying and hot water for businesses, especially small businesses. While the EPA puts commercial and residential together for classification purposes, this Article will focus on standard residential uses. Of the end users of the natural gas distribution system, residential units constitute 92% of the customers, with 7% being commercial businesses and 1% large generation or electricity generators. U.S. ENERGY INFO. ADMIN., DISTRIBUTION OF NATURAL GAS: THE FINAL STEP IN THE TRANSMISSION PROCESS 1 (2008).

47. Electricity generation is primarily a state issue. Natural gas pipelines are federally regulated. Electricity transmission and distribution implicate both state and federal regulations. Motor vehicle engine fuel economy and emissions are mainly federally regulated, although California is allowed to establish its own vehicle standards which other states can choose to follow.

48. See U.S. ENERGY INFO. ADMIN., *supra* note 46.

49. Ghislain Dubois et al., *It Starts at Home? Climate Policies Targeting Household Consumption and Behavioral Decisions are Key to Low-Carbon Futures*, 15 ENERGY RSCH. & SOC. SCI. 144, 144 (2019); see also *id.* at 147 (stating researchers found heating as one of the most dominant components of household greenhouse gas footprints: “Mobility, food, and heating dominate household consumption footprints.”).

equipment, such as vehicles and appliances, is replaced with new equipment,” thus presents a challenge for decarbonization.⁵⁰ The life expectancy of a furnace is between sixteen and twenty years;⁵¹ a stove is thirteen to fifteen years;⁵² a dryer is ten to thirteen years;⁵³ and a water heater is eight to twelve years.⁵⁴ Therefore, if we are going to address decarbonization from this sector, we have already almost ensured that it will not happen by 2030.⁵⁵ Even reaching net-zero goals by 2050 may be at risk unless there is an immediate acceleration in the number of all-electric buildings.⁵⁶

What these cities—and, perhaps, all of us—are not acknowledging is that decarbonization will be hard.⁵⁷ In the natural gas context, the most

50. Amanda Myers, *The Capital Stock Turnover Problem for 100% Clean Energy Targets*, GREENTECH MEDIA (Nov. 18, 2019), <https://www.greentechmedia.com/articles/read/the-capital-stock-turnover-problem-for-100-clean-energy-targets> (last visited Jan. 23, 2021).

51. *When is it time to replace your oil or natural gas furnace?*, PETRO, <https://www.petro.com/heating/is-it-time-for-a-new-furnace> (last visited Jan. 23, 2021); see also Robert Gross & Richard Hanna, *Path Dependency in Provision of Domestic Heating*, 4 NATURE ENERGY 358 (2019) (stating research in Europe has also demonstrated that lock-in of natural gas for heating can occur through path dependency, and that “policymakers aiming to decarbonise [sic] heating in gas dependent countries should seek to encourage increasing returns to adoption of low carbon heating technologies over an extended period of policy implementation” as “network infrastructure, technologies, markets and institutions *coevolve*” but that other EU countries have been successful in decarbonizing their heating sector); see also Claire McKenna et al., *It’s Time to Incentivize Residential Heat Pumps*, ROCKY MOUNTAIN INST. (June 8, 2020), <https://rmi.org/its-time-to-incentivize-residential-heat-pumps>, (Additionally, “5 to 8 million US buildings will add or replace heating equipment each year. Each one of these decisions may lock in fossil fuel use in buildings for decades”).

52. Taryn Fiol, *The Life Expectancy of 7 Major Appliances*, H&R BLOCK (Oct 21, 2013), <https://www.hrblock.com/tax-center/lifestyle/how-long-do-appliances-last/>.

53. *Id.*

54. Brian G., *How to Decide Between Water Heater Repair or Replacement*, LOWES, (Oct. 9, 2020), <https://www.lowes.com/n/how-to/when-to-replace-a-water-heater>.

55. Myers, *supra* note 50 (“Capital stock turnover makes net-zero emissions harder to reach with every year we wait to start electrifying our vehicles and buildings . . . This creates significant lag time between setting all-electric sales targets and achieving the goal of all-electric fleets.”); see also Jason Deign, *UK Electrification Strategy Should Emphasize Heating Over EVs, Researcher Says*, GREENTECH MEDIA (July 5, 2019), https://www.greentechmedia.com/articles/read/uk-electrification-strategy-should-emphasize-heating-over-evs?utm_medium=email&utm_source=Daily&utm_campaign=GTMDaily#gs.qnka2m (last visited Jan. 23, 2021) (“[T]he share of heat pumps in new homes has risen from less than 1 percent in 2000 to 23 percent in 2016, thanks to a range of policies including a market incentive program for renewable heat and a federal renewable energies heat law. Admittedly, the German market has also shown that retrofitting heat pumps to existing homes could be a challenge. Despite all incentives, only 1.7 percent of old homes in Germany had heat pumps in 2015, up from 0.2 percent in 2005”).

56. Myers, *supra* note 50.

57. See Matthews, *supra* note 33 (detailing that one activist noted, “it is a head change for people” and explaining that “[u]nlike the energy and transportation sectors — where the solutions are difficult but relatively straightforward — cutting carbon emissions at home and work is a complex equation.”).

challenging switch—more than electricity generation, transportation, or the industrial sector—will be what happens inside the home and addressing natural gas used for heating, cooking, clothes drying, and hot water. Eliminating natural gas usage for these activities will require societal change at a massive scale, with significant economic and regulatory implications.⁵⁸ But that we do so is critical. As Joshua Rhodes, an expert in energy, explains, “‘To fully decarbonize, we must eventually eliminate carbon emissions from our homes.’”⁵⁹

Therefore, as states look to move toward full decarbonization, the natural gas distribution system must become a central focus.⁶⁰ Natural gas systems being put into the ground today have a lifespan of up to 80 years—far past the point where the scientific community has indicated we will need to be fully transitioned away from all fossil fuel use.⁶¹ This challenge is compounded by the fact that most natural gas distribution systems—unlike major natural gas pipelines—are monopoly regulated utilities, with their costs paid for by captive ratepayers.⁶²

58. Dubois, *supra* note 49 at 145 (“[C]limate change mitigation will increasingly affect households and their lifestyles.”).

59. Robert Walton, *ERCOT Weathers Steamy August, but Could Texas Become a Winter-Peaking System?*, UTIL. DIVE (Oct. 3, 2019), <https://www.utilitydive.com/news/ercot-weather-steam-august-but-could-texas-become-a-winter-peaking-syste/564218/> (last visited Jan. 23, 2021) (describing that at least one study shows that Texas could electrify household uses of natural gas using existing technology).

60. Sam Kalen, *A Bridge to Nowhere? Our Energy Transition and the Natural Gas Pipeline Wars*, 9 MICH. J. ENV'T. & ADMIN. L. 319, 323 (2020) (noting that a deeply decarbonized future will either require removing natural gas as a fuel source by 2030 or carbon capture and storage (CCS) technology to decrease emissions and that CCS has not proven economically viable for wide scale adoption).

61. Kavya Balaraman, ‘A Critical Milestone’: PG&E First Gas-Electric IOU to Publicly Support California’s All-Electric Construction, UTIL. DIVE (June 26, 2020), <https://www.utilitydive.com/news/a-critical-milestone-pge-first-gas-electric-iou-to-publicly-support-cal/580598/> (noting that gas assets have lifespans up to 80 years).

62. The stranded asset concerns around non-monopoly parts of the natural gas system—extraction and production, gathering, processing, interstate pipelines and those intrastate pipelines which are not part of a monopoly-regulated local distribution company—are not addressed in this Article. The reason is because the stranded assets of those businesses will not be borne by captive ratepayers, but rather by the investors in those businesses. Sam Kalen et al., *Natural Gas Infrastructure: Locking in Emissions?*, ABA NAT. RES. & ENV'T (Apr. 1, 2020); *see also* JOEL EISEN ET AL., *ENERGY, ECONOMICS & THE ENVIRONMENT* 478 (4th ed. 2015) (utility investors have no guarantee of a profit, and are not shielded from poor business decisions (like investing in natural gas) or regulatory change); *see also* Federal Power Commission v. Natural Gas Pipeline Co., 315 U.S. 575, 590 (1942) (“[R]egulation does not insure that the business shall produce net revenues.”). Non-monopoly gas companies’ recompense, if any, must be at the political level, rather than the regulatory one. This is not without precedent: the federal government incented development of coal in response to the oil crises and embargoes of the 1970s. As the country has moved away from coal as a fuel source, previous governmental support has not kept coal companies from bankruptcy or coal-heavily merchant generators from financial hardship. However, the financial pain of those pipeline investors may be shared with captive natural gas consumers as, in

The transition to a carbon-constrained world and the use of natural gas for household purposes raises three interrelated questions, one political and two regulatory: (1) what policies are necessary and will be implemented to electrify heating, cooking, clothes drying and hot water; (2) how should regulators shut down the natural gas distribution system; and (3) how should regulators compensate—or not compensate—regulated monopoly utilities for the assets that have been stranded in the transition? The answer to the first question—and how quickly it happens—will have a direct impact on the other two.

The policies around electrification are essentially legislative: in order to make the transition, political bodies need the will to (1) pass laws restricting use of natural gas, (2) allocate funds to aid in the transition to electrification, and (3) take other actions necessary to drive societal change. The answer to the two regulatory questions will be, in part, based on how quickly the mandates and incentives passed by legislatures create that societal change.⁶³

When thinking about the how regulators should shut down the natural gas distribution system, there are multiple options, but, again, these will be driven by the policies adopted by legislatures. One option is for the natural gas distribution system to be fully maintained up until the point that it is all shut down—across the entire system—at once. Another option would be to shut the system down piecemeal, based on various factors, such as where significant capital investment would be necessary to maintain the integrity and safety of the system. A third regulatory option is restricting the use of natural gas based on application—i.e., allowing uses that may be harder (or more expensive to electrify) to continue longer, and switching uses for which electric alternatives exist more quickly.

Regardless of which option regulators choose for shutting down the system, it will have serious financial implications for captive ratepayers of regulated monopoly utilities. Whatever value is left in the system when the full transition away from natural gas occurs will leave behind stranded assets—assets that have become obsolete ahead of the end of their useful

the short term, interstate pipelines attempt to recoup costs on lower volumes of gas; *see also* ROCKY MOUNTAIN INST., A BRIDGE BACKWARDS? THE FINANCIAL RISKS OF THE “RUSH TO GAS” IN THE US POWER SECTOR 2 (According to RMI, “throughput on new gas pipelines will fall 20%–60% below presumed levels by 2035” which “will lead to rising unit costs for delivered gas”).

63. Legislative, rather than regulatory, action is necessary for the decision to decarbonize because it is what people expect based on our form of government. *See* Jasmin Melvin, *FERC Authority Over Carbon Pricing in Power Markets May Soon Be Put to Test*, S&P GLOB. (Oct. 16, 2019), <https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/101619-ferc-authority-over-carbon-pricing-in-power-markets-may-soon-be-put-to-test> (last visited Jan. 23, 2021) (“Most people’s normal expectation is that fees, taxes, charges on something like carbon are going to come from the legislature, either the federal legislature or the state legislature”).

life.⁶⁴ Unlike the other situations where utility assets have become stranded, regulators are in the unique position with natural gas distribution systems to know *as the initial capital investment is happening* that those assets will become stranded in the future. Regulators will then need to confront how the regulatory scheme should treat the assets that are already in the system up until this point—the investments that were made without the knowledge that they would become stranded. Regulators will also need to determine how projects and capital investment should be assessed in the natural gas system going forward, since there must be a recognition that they will, eventually, become stranded assets.

Of course, regulators could choose not to address these questions, and let the regulatory system take the path of least resistance based on precedent. Doing that, however, will make the transition both more costly and of longer duration. By not addressing our build-out of natural gas infrastructure, in the words of Professor Sam Kalen, “[i]f we fail to avoid yet another folly, our new natural gas infrastructure could become either a shackle, impeding a zero-carbon energy future, or a bridge to nowhere.”⁶⁵ Unfortunately, we may not have until even 2050 to make the transition.

* * *

To address these questions, this Article will begin with a description of the natural gas distribution system, including a quantification of current installed asset valuation. Next, I will discuss options which exist for

64. Jim Rossi & Emily Hammond, *Stranded Costs and Grid Decarbonization*, 82 BROOK. L. REV. 645, 647 (2017) (stating that a stranded asset is something that has become obsolete or non-performing well ahead of its useful life, and must be recorded on a company’s balance sheet as a loss of profit. Another, more energy-centric definition is “[e]xisting energy infrastructure that retains some useful life, but that can no longer generate initially expected revenue due to regulatory shifts, market forces, or innovation.”); see Patrick Jenkins, *Energy’s Stranded Assets are a Cause of Financial Stability Concern*, FIN. TIMES (Mar. 2, 2020), <https://www.ft.com/content/17b54f60-5ba5-11ea-8033-fa40a0d65a98> (last visited Jan. 23, 2021) (explaining that stranded assets are not new: “Goose herds, rendered redundant by the 19th century switch from quills to metal-nibbed pens, were an early example. So were the whaling ships no longer needed when electric light replaced oil lamps.”); see also J. Gregory Sidak & Daniel F. Spulber, *Deregulatory Takings and Breach of the Regulatory Contract*, 71 N.Y.U. L. REV. 851, 869 (1996) (explaining that by [f]ocusing on recovery for utilities, stranded assets have also been defined as the “inability of utility shareholders to secure return of, and a competitive rate of return on, their investment”); Timothy J. Brennan & James Boyd, *Stranded Costs, Takings, and the Law and Economics of Implicit Contracts*, 11 J. REG. ECON. 41, 45 (1997) (stating that previously, four basic types of stranded costs for electric utilities had been identified: “(1) Undepreciated investments in power plants that are more expensive than generators available today. (2) Long-term contracts— most if not all mandated by PURPA . . . (3) Generators built but not used, primarily nuclear. (4) Expenses related to ‘demand-side management’ (DSM) and other conservation programs that, as substitutes for new plant construction, were charged to the generation side of the business.”).

65. Kalen, *supra* note 60, at 324; see also Jason A. Delborne et al., *Dueling Metaphors, Fueling Futures: “Bridge Fuel” Visions of Coal and Natural Gas in the United States*, 61 ENERGY RSCH. & SOC. SCI. 101350 (2020) (discussing how the bridge metaphor “reveals a set of contested assumptions, implications, and meanings.”).

regulators as they plan to shut off natural gas infrastructure. With the assumption that some assets in the regulated monopoly natural gas distribution system will become stranded, the Article will then address multiple areas to aid regulators considering these challenges, including what we can learn from other stranded asset challenges and what regulators could do to lessen future challenges as they are approving projects now. How to both incent and pay for the transition of all residential uses away from natural gas will be the hardest challenge of decarbonization.

II. THE NATURAL GAS DISTRIBUTION SYSTEM

There are more than 2.2 million miles of natural gas distribution pipelines in the United States.⁶⁶ As shown below, the value of the installed natural gas distribution system is likely more than \$160 billion. This equates to more than \$500 for each person currently living in the United States. While this may not seem like a lot, “[f]ifty-seven percent of Americans don’t have enough cash to cover a \$500 unexpected expense,”⁶⁷ which may give regulators pause as they consider whether to have ratepayers pay—in part or in full—for these assets as we transition to a decarbonized society.

A. Current Ownership and Value of Natural Gas System

Investor-owned distribution companies account for approximately 55% of all natural gas deliveries to end users, as opposed to municipal-owned distribution companies.⁶⁸ For residential customers, however, investor-owned distribution companies are more important than that statistic would indicate, as investor-owned distribution companies supply 88% of residential customers.⁶⁹ There are currently a total of 204 investor-owned natural gas

66. PIPELINE 101, <https://pipeline101.org/topic/where-are-gas-pipelines-located/> (last visited May 10, 2021). This includes “approximately 1,276,900 miles of mains and 913,773 miles of service lines in the U.S.” U.S. DEP’T OF ENERGY, NATURAL GAS INFRASTRUCTURE MODERNIZATION PROGRAMS AT LOCAL DISTRIBUTION COMPANIES 8 (2017). For reference, that is enough pipe to go between the earth and the moon almost nine times (8.79 to be exact, based on a distance of 238,855 miles between the earth and the moon. *How Far Away is the Moon?*, NASA SPACE PLACE, <https://spaceplace.nasa.gov/moon-distance/en/> (last visited Jan 23, 2021). The natural gas distribution system consists of mains, typically of between 2” and 24”, which are kept at a regulated pressure. Generally, smaller pipes and lower pressures exist closest to the end customer. *How Does the Natural Gas Delivery System Work?*, AM. GAS ASS’N, <https://www.aga.org/natural-gas/delivery/how-does-the-natural-gas-delivery-system-work/> (last visited Jan. 23, 2021).

67. Aimee Picchi, *A \$500 Surprise Expense Would Put Most Americans into Debt*, CBS NEWS, (Jan. 12, 2017), <https://www.cbsnews.com/news/most-americans-cant-afford-a-500-emergency-expense/>.

68. U.S. Energy Info. Admin., *supra* note 46, at 10.

69. *Id.*

distribution companies in the United States.⁷⁰ Given the high volume of residential customers served by investor-owned distribution companies and the impact that investor ownership has on the stranded asset analysis—as those residential customers are the captive ratepayers who will be expected to potentially pay investors as we transition away from the natural gas distribution system—this Article will focus on that segment.⁷¹

Looking at the ten largest investor-owned natural gas distribution companies, the current value of their natural gas distribution systems—what they already have in the ground—is more than \$67 billion dollars.

Utility	Value
Pacific Gas and Electric Company	\$11,112,794,189 ⁷²
Southern California Gas Company	\$10,096,491,751 ⁷³
Atmos Energy Corporation	\$8,141,733,000 ⁷⁴
Public Service Electric and Gas Company	\$7,854,000,000 ⁷⁵
Consolidated Edison Company of New York, Inc.	\$7,223,220,281 ⁷⁶
Brooklyn Union Gas Company	\$4,876,812,892 ⁷⁷

70. See *infra* Appendix A (showing a complete list of investor-owned distribution companies). This list is derived using a method developed by the Energy Institute at University of Texas at Austin. See also Andrés Méndez et al., *Local Distribution Companies: Relationship between Pipeline Miles and Number of Customers, and Different Pipeline Diameter Sizes*, U. OF TEX. 3–4 (2019), https://energy.utexas.edu/sites/default/files/UTAustin_EIoF_Pipeline_Miles_and_Customers_2019-02-21.pdf (last visited Jan. 23, 2021). Mild consolidation has occurred in the sector; the EIA found a total of 257 investor-owned distribution companies in 2006. See U.S. ENERGY INFO. ADMIN., *supra* note 68, at 3.

71. The Article will not, therefore, address the potential impact on merchant pipelines, or deregulated parts of the natural gas system. This is not to say that disruption will not occur in these parts of the market. It will. But, that discussion is outside the scope of this Article.

72. ANNUAL REPORT OF PACIFIC GAS & ELECTRIC CO., FERC FORM NO. 2, at 208, https://www.pge.com/pge_global/common/pdfs/about-pge/company-information/regulation/FERCForm2.pdf (2018) (last visited Jan. 23, 2021).

73. APPLICATION OF SOUTHERN CALIFORNIA GAS COMPANY REGARDING YEAR 25 (2018–2019) OF ITS GAS COST INCENTIVE MECHANISM (A1906009), at D-2, https://www.socalgas.com/regulatory/documents/a-19-06-009/GCIM_Yr_25_Application_Final.pdf (last visited Jan. 23, 2021).

74. ANNUAL REPORT OF ATMOS ENERGY CORP., SEC FORM 10-K, at 73 (2018), http://www.atmosenergy.com/sites/default/files/10-k_18_0.pdf (last visited Jan. 23, 2021).

75. ANNUAL REPORT OF PUBLIC SERVICE ELECTRIC & GAS CO., SEC FORM 10-K, at 107 (2018), <http://d18m0p25nwr6d.cloudfront.net/CIK-0000788784/460bd33f-12d7-43ee-a9bb-f6dc91054ac2.pdf> (last visited Jan. 23, 2021).

76. ANNUAL REPORT OF CONSOLIDATED EDISON COMPANY OF NEW YORK, NYPS FORM 182-15, at 62 (2018), <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={DDF7CA82-E3D8-4D88-933D-1BEEEBB765A9}> (last visited Jan. 23, 2021).

77. ANNUAL REPORT OF THE BROOKLYN UNION GAS COMPANY, FORM 182-96, at 62 (2018), <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={1302D145-3D27-4EFF-A40E-B3968F8DF2AD}> (last visited Jan. 23, 2021).

Northern Illinois Gas Company	\$4,742,864,837 ⁷⁸
Consumers Energy Company	\$4,668,819,474 ⁷⁹
Washington Gas Light Company	\$4,246,823,385 ⁸⁰
Peoples Gas Light and Coke Company	\$4,178,157,773 ⁸¹

The top twenty combined have a current value of more than \$99.8 billion.⁸² Assuming the next 184 investor-owned natural gas distribution companies have a valuation equal to at least the top ten systems, the combined asset value in investor-owned natural gas distribution systems is more than \$160 billion.

Recognize how important household uses are to these companies. As recently noted about Southern California Gas Company (“SoCalGas”), the company with the second highest asset value, “[g]as deliveries to houses, apartments and smaller businesses are the heart of SoCalGas’s business—the vast majority of its revenue is tied to building and maintaining the expansive network of small distribution pipelines that feeds these customers.”⁸³ Electrification could leave the company with “more than 100,000 miles of underutilized pipes.”⁸⁴

B. Aging Infrastructure and Stranded Costs

It is also unlikely that overall value of the natural gas distribution system will go down significantly without explicit legislative and regulatory action.⁸⁵

78. ANNUAL REPORT OF NORTHERN ILLINOIS GAS CO., FORM 21 ILCC, at 209 (2018), <https://www.icc.illinois.gov/downloads/public/filing/2/2/2/185794.pdf> (last visited Jan. 23, 2021).

79. ANNUAL REPORT OF CONSUMERS ENERGY COMPANY, MPSC FORM P-522, at 210 (2018), https://www.michigan.gov/documents/mpsc/Consumers_Energy_Company_P522_655019_7.pdf (last visited Jan. 23, 2021).

80. ANNUAL REPORT OF WASHINGTON GAS LIGHT CO., FERC FORM 2, at 208 (2018), <https://edocket.dcpsec.org/apis/api/filing/download?attachId=83963&guidFileName=cc949285-3941-4e01-be62-fa40ce207820.pdf> (last visited Jan. 23, 2021).

81. ANNUAL REPORT OF THE PEOPLES GAS LIGHT AND COKE CO., FORM 21 ILCC, at 208 (2018), <https://www.icc.illinois.gov/downloads/public/filing/2/2/2/185726.pdf> (last visited Jan. 23, 2021).

82. *See infra* Appendix B.

83. Phil McKenna, *Fearing for Its Future, a Big Utility Pushes ‘Renewable Gas,’ Urges Cities to Reject Electrification*, INSIDE CLIMATE NEWS (Nov. 13, 2019), <https://insideclimatenews.org/news/13112019/biogas-climate-change-renewable-gas-marketing-socialgas-reject-electrification-california> (last visited Jan. 23, 2021).

84. *Id.*

85. For example, WEC Energy’s CEO noted “the very critical need to upgrade the natural gas distribution systems in our country are driving a fair amount of capital spend for us and capital investment opportunity for us in the natural gas distribution business . . . 42% of the \$11.8 billion in our capital plan over the next 5 years is dedicated to expanding and upgrading the quality for our natural gas distribution system.” Matt Kasper, *WEC Energy Files Application for LNG Peaking Facilities; Emails Show Company Discussed Project With PSC Before Filing*, ENERGY AND POL’Y

Instead, it is likely to increase.⁸⁶ Parts of the natural gas distribution system are more than 100 years old.⁸⁷ Replacements are increasing based on both age and material,⁸⁸ as cast iron and unprotected steel pipes are more prone to failure.⁸⁹ Accelerated main replacement programs have attempted to solve that problem and make the system safer, but have correspondingly increased the capital invested in the system. In addition to the safety and reliability concerns, which have historically driven repair and modification programs,⁹⁰ the increasing ability to detect natural gas leaks⁹¹ and the knowledge that natural gas leaks can have a significant climate impact is also spurring investment into the system.⁹² Therefore, utilities will continue “spending on gas infrastructure replacement that will cost billions in the coming years,”⁹³

INST. (Nov. 13, 2019), <https://www.energyandpolicy.org/wec-energy-files-application-for-Ing-peaking-facilities-as-it-increases-gas-investments/> (omission in original).

86. See Shant Shahrigan, *National Grid’s Plans Are ‘Onerously Expensive and Environmentally Detrimental.’ NYC Comptroller Scott Stringer*, N.Y. DAILY NEWS (Mar. 11, 2020), <https://www.nydailynews.com/news/politics/ny-scott-stringer-national-grid-20200311-siwgqbhvbrbmzgtthremgsw6ie-story.html> (“National Grid cites its infrastructure projects as justification for proposed rate hikes of \$16.50 per month over customers’ current bills.”).

87. U.S. DEP’T OF ENERGY, *supra* note 66, at 5.

88. Mike Hennen & Kiley Kroh, *A New Approach to America’s Rapidly Aging Gas Infrastructure*, ROCKY MOUNTAIN INST. (Jan. 6, 2020), <https://rmi.org/a-new-approach-to-americas-rapidly-aging-gas-infrastructure/> (“Across the United States, the utilities that provide natural gas to homes and businesses have rapidly increased total spending, tripling from roughly \$5 billion per year to \$15 billion between 2009 and 2017 Age is just one factor gas utilities consider when planning gas main replacement projects—other factors such as pipe material can be more critical—but the increased spending on an aging system does call into question the wisdom of doubling down on a fossil fuel delivery network that’s becoming more expensive at the same time the need for climate action is becoming more urgent.”).

89. U.S. DEP’T OF ENERGY, *supra* note 66. “Four States (New Jersey, New York, Massachusetts, and Pennsylvania) account for half of all the cast iron pipe in the U.S. Similarly, four States (Ohio, Pennsylvania, California, and New York) account for half of all the unprotected steel pipe in the U.S. While some States, such as New York, have relatively large inventories of both cast iron and unprotected steel, some States with large inventories of unprotected steel pipes do not have large inventories of cast iron pipe (California, for example) and vice versa.” *Id.* at 10.

90. *Id.* at 11.

91. Google is helping, including sensors on its cars as it updates Google Street View. Krutika Pathi, *Google Street View is Helping Scientists Spot Methane Leaks*, BLOOMBERG (Mar. 24, 2017) <https://www.citylab.com/solutions/2017/03/google-street-view-cars-methane-leaks/520719/>; see generally *Local Leaks Impact Global Climate*, <https://www.edf.org/climate/methanemaps> (last visited May 11, 2021) (displaying city maps (older cities with older systems tend to have more leaks)).

92. The natural gas distribution system is currently “responsible for about 6% of the methane emissions from the natural gas industry (approximately 2% of total U.S. methane emissions). Methane emissions from LDC service lines and mains account for nearly 50% of emissions from the natural gas distribution sector.” U.S. DEP’T OF ENERGY, *supra* note 66, at 11.

93. Andy Balaskovitz, *Michigan Utilities Target Aging Natural Gas Distribution Lines for Upgrades*, ENERGY NEWS NETWORK (Dec. 11, 2018), <https://energynews.us/2018/12/11/midwest/michigan-utilities-target-aging-natural-gas-distribution-lines-for-upgrades/> (last visited Jan. 23, 2021); see also FRACTRACKER ALLIANCE, <https://maps.fractracker.org/latest/?appid=bd367e14ba064a15a58013b8e99ddf1e> (last visited May

in the absence of legislative and regulatory action, even though doing so risks long-term shareholder value.⁹⁴ “Burning gas along with smaller amounts of oil and propane in buildings accounts for 10 percent of total US economy-wide emissions, and only 10 large states are responsible for 56 percent of those emissions.”⁹⁵ The large states include New York, California, Illinois, New Jersey, Texas and Michigan—those served by some of the utilities listed above with the largest asset valuations.⁹⁶ While there may have been good reasons to invest in the natural gas distribution system in the past, those no longer exist. “We have been talking about, for the last few years, gas as the bridge . . . There is an inevitability about bridges, which is that sooner or later you get to the end of the bridge.”⁹⁷ For ratepayers, for shareholders, and for the planet, the bridge must end.⁹⁸

C. Options To Shut Down the Natural Gas Distribution System

When thinking about how regulators should shut down the natural gas distribution system, there are multiple options, but, again, these will be driven by the policies adopted by legislatures.⁹⁹ One option is for the natural gas distribution system to be fully maintained up until the point that it is all shut down—across the entire system—at once. Another option would be to shut the system down piecemeal, based on various factors, such as where significant capital investment would be necessary to maintain the integrity and safety of the system. A third regulatory option would be to restrict the use of natural gas based on application—allowing for uses which may be

11, 2021); Matt Kelso, *Pipelines Continue to Catch Fire and Explode*, FRACTRACKER ALL. (Feb. 21, 2020), <https://www.fractracker.org/2020/02/pipelines-continue-to-catch-fire-and-explode/>.

94. Matthew Bandyk, *Report: Natural gas is a loser for long-term utility shareholder value*, UTIL. DIVE (Apr. 20, 2020), <https://www.utilitydive.com/news/report-natural-gas-is-a-loser-for-long-term-utility-shareholder-value/576245/>; see also John Parnell, *Gas Is Good but Not Good Enough, Says European Investment Bank*, GREENTECH MEDIA (Nov. 15, 2019), <https://www.greentechmedia.com/articles/read/gas-is-good-but-not-good-enough-says-european-investment-bank> (Similarly, the European Investment Bank is ceasing investment support for fossil fuel projects in 2021 “unless they negate their emissions through carbon capture or offsets.”).

95. Mark Silberg, *Fossil Gas Has No Future in Low-Carbon Buildings*, ROCKY MOUNTAIN INST. (Jan. 6, 2020), <https://rmi.org/fossil-gas-has-no-future-in-low-carbon-buildings/> (last visited Jan. 23, 2021); see also *The Impact of Fossil Fuels in Buildings*, ROCKY MOUNTAIN INST., <https://rmi.org/insight/the-impact-of-fossil-fuels-in-buildings/> (giving a state-by-state comparison).

96. Silberg, *supra* note 95.

97. Julia Pyper, *Where Does the Natural Gas ‘Bridge’ End?*, GREENTECH MEDIA (Jan. 27, 2020) <https://www.greentechmedia.com/articles/read/natural-gas-bridge-nearing-end>.

98. Michael Brune, *Building Our Own Bridge*, SIERRA CLUB (Feb. 28, 2020) <https://www.sierraclub.org/michael-brune/2020/02/regenerate-california-natural-gas>.

99. Transitioning to a fully renewable grid by 2030, for example, may not even be “achievable, because of more social political issues.” Julia Gheorghiu, *Transitioning US to 100% Renewables by 2030 Will Cost \$4.5 Trillion: Wood Mackenzie*, UTIL. DIVE (last updated July 1, 2019, 10:34 AM), <https://www.utilitydive.com/news/transitioning-us-to-100-renewables-by-2030-will-cost-rate-payers-45t-wo/557832/>.

harder or more expensive to electrify to continue longer, and switching uses for which electric alternatives exist more quickly. A fourth option would be to allow use to continue based on the source of the gas.

1. Option One: All At Once

The first option regulators could employ is maintaining the entire natural gas distribution system until a specific date, at which point the entire system is shut down all at once. This approach would have several advantages. First, unlike shutting down the system piecemeal, there would not be potential bias with some locations having natural gas service and other neighborhoods not being granted access. Second, it would be simpler from an administration perspective than either a piecemeal shutdown or restrictions based on the specific application or source of the gas.¹⁰⁰

The main drawback for this type of shut down would be that it would likely be the most expensive. Given that natural gas distribution systems must be maintained adequately—otherwise there is the potential for explosions and loss of life and property¹⁰¹—a good deal of the investment made to maintain the system over the next decade will become part of a stranded asset. The continued investment in the system would also continue to incent the use of the natural gas distribution system for a longer period of time, depending on which stranded asset regulatory solution is chosen by regulators.¹⁰² If regulated monopoly utilities will not receive their return on equity¹⁰³ when the system is shut down, then there will be considerable

100. From an administrative perspective, this option would include closing any valves which allow gas to flow into the system, bleeding the lines, followed by cutting and capping the lines where the system interconnects with any pipeline or supply point. Any contractual obligations of the distribution utility would also need to be addressed.

101. See, for example, the 2010 pipeline explosion that occurred in San Bruno, California. Richard Gonzalez, *PG&E Falsified Gas Pipeline Safety Records, Regulators Say*, NPR (Dec. 14, 2018, 11:55 PM), <https://www.npr.org/2018/12/14/677003961/pg-e-falsified-gas-pipeline-safety-records-regulators-say>. See also *Gas Pipeline Accidents*, NAT. GAS DASHBOARD, <https://climatenexus.shinyapps.io/GasExplorer/> (last visited May 11, 2021) (providing a visual representation of gas pipeline accidents and fatalities since Jan 1, 2010).

102. Catherine Morehouse, *2020 Outlook: Natural Gas Faces Regulatory, Environmental Scrutiny but Still Wants Role in Carbon-Free Future*, UTIL. DIVE (Jan. 15, 2020), <https://www.utilitydive.com/news/2020-outlook-natural-gas-faces-regulatory-environmental-scrutiny-but-stil/570332/>.

103. See Stephen G. Hill, WHAT IS “ROE,” AND WHY DOES IT MATTER IN SETTLING RATES FOR MOBILE GAS?, AARP 1, 9–11 (2013), <http://states.aarp.org/wp-content/uploads/2013/03/WHAT-IS-ROE-Steve-Hill.pdf> (“The [return on equity] is the allowed return on common equity—the profit allowed the utility. The [overall rate of return] is the weighted average cost of all forms of capital used to finance the utility. It includes the cost of debt as well as the cost of common equity.”).

pressure from them to continue operation of the system, which could make the transition away from natural gas longer than necessary.¹⁰⁴

This option could also have the greatest effect on residential users. Even with significant outreach and communication, there could be those who do not switch over their gas uses by the scheduled shut-off date. This could be due to a lack of planning, funds, or other reasons. Shutting off the entire system at once could create both supply shortages of the equipment that is necessary to electrify households, and a potential lack of contractors or manpower to install the new equipment, inspectors to inspect the installations, etc.¹⁰⁵ As many of these needs are considered basic and are required for units to be habitable, a lack of heat, hot water, or cooking could render units uninhabitable. If a significant number of units are rendered uninhabitable all at the same time, this could lead to housing shortages, especially if a large number of the units that did not convert appropriately before the cut-off date are rental properties. To counter this possibility, local governments or public utility commissions would want to assess the transition away from natural gas in the interim to ensure that large-scale disruptions in the housing sector would not occur on the shut-off date. Incentives—and communication—will be critical.

Compared to other shut down options, this option could be the easiest to communicate. Similar to when the government transitioned from analog to digital signals for television, there was ample, frequent communication that reached the vast majority of households, such that few people were left unprepared when analog television signals were no longer broadcasted.¹⁰⁶ A similar, single-date shut-off mechanism could therefore also be the easiest to communicate in this case.

104. This is especially a potential challenge if the issue of shutting down the natural gas distribution system does not become one of high salience to the general public. See Heather Payne, *Game Over: Regulatory Capture, Negotiation, and Utility Rate Cases in an Age of Disruption*, 52 U.S.F. L. REV. 75 (2017) (discussing regulatory capture).

105. See Jane Margolies, *'All Electric' Movement Picks Up Speed, Catching Some Off Guard*, N.Y. TIMES (Feb. 4, 2020), <https://www.nytimes.com/2020/02/04/business/all-electric-green-development.html> (describing how “real estate and construction industries are scrambling to keep up” with the “‘electrify everything’ movement” and bans on new natural gas hookups in cities).

106. Sam Sewall, *The Switch from Analog to Digital TV*, NIELSEN (Nov. 3, 2009), <https://www.nielsen.com/us/en/insights/article/2009/the-switch-from-analog-to-digital-tv/#:~:text=On%20June%2012%2C%202009%2C%20the%20FCC%20required%20all%20high%2D,to%20a%20digital%2Donly%20transmission> (noting that “the great majority” of households were prepared for the switch); Gary Shapiro & Gordon Smith, *What the Digital Transition Teaches Us, a Decade Later* <https://www.nexttv.com/blog/what-the-digital-transition-teaches-us-a-decade-later> (last visited May 11, 2021) (noting that, in hindsight, adequate preparation is one of the three key actions that made the transition successful).

2. Option Two: Piecemeal

The second option for regulators when shutting down the natural gas distribution system is to do it piecemeal. This option could be the most economical, as the most logical way to determine which parts of the system would be shut off would be based on the new capital investment needed to maintain the system adequately.¹⁰⁷ Therefore, when significant investment would need to be put into the system to keep it safe, all parts of the system downstream from that physical location that could not be served from another line that was still safe¹⁰⁸—would be shut down.¹⁰⁹ Typically, these are planned investments, with the regulated monopoly knowing which pipes and other parts need replacing.¹¹⁰ Therefore, there could be a two- or three-year notification period before the shutdown so that homeowners could electrify their residential appliances.¹¹¹

In the context of housing stability, this approach may also have fewer potential impacts across an entire metro area than an all at once option. Even if the same percentage of homeowners and landlords did not prepare for the

107. See Mike Henchen & Kiley Kroh, *A New Approach to America's Rapidly Aging Gas Infrastructure*, ROCKY MOUNTAIN INST. (Jan. 6, 2020), <https://rmi.org/a-new-approach-to-americas-rapidly-aging-gas-infrastructure/> (“Locations where significant gas system investments are to be made represent a good starting point for utilities, policymakers, and other stakeholders to target building electrification efforts. Any major gas investment could offer an opportunity to avoid unnecessary spending, and an electrification pathway can be more cost-effective, depending on local system and building factors.”).

108. There could be the situation where parts of a system could be shut off but some of the customers who have received their primary service through that part of the system could still receive service, albeit from a different part of the system. This would, of course, depend on the specific configuration of the shutoff valves that exist within each system. See *How Does the Natural Gas Delivery System Work?*, AM. GAS ASS'N, <https://www.aga.org/natural-gas/delivery/how-does-the-natural-gas-delivery-system-work/> (last visited May 11, 2021) (“Distribution mains are interconnected in multiple grid patterns with strategically located shut-off valves. These valves minimize the need for customer disruption to service during maintenance operations and emergencies.”)

109. Some regulators, at least, seem to already be considering this an option. In New York, regulators are asking local monopolies to “look for opportunities to avoid replacing leak-prone pipe and instead implement a non-pipeline alternative.” Tom DiChristopher, *With an Eye to Cutting Gas Use, NY Regulator Proposes Utility Planning Overhaul*, S&P GLOB. MARKET INTEL. (Feb. 16, 2021), <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/with-an-eye-to-cutting-gas-use-ny-regulator-proposes-utility-planning-overhaul-62655591>.

110. “Most pipeline and infrastructure replacement programs are more complex and expensive and are typically classified as capital investments. They require permitting from local authorities to close and excavate streets and may need to be coordinated with city paving or other operations. These are often multi-year projects requiring long lead times for planning and design.” See U.S. Dep’t of Energy, *supra* note 66, at 17. However, gas shutdowns are not always planned. See Philip Marcelo, *Months After Massachusetts Gas Explosions, Normalcy Far Off*, BOSTON (Dec. 14, 2018), <https://www.boston.com/news/local-news/2018/12/14/months-after-massachusetts-gas-explosions-normalcy-far-off>.

111. How that would occur will again depend on the political branches, and whether there will be sufficient funding and incentives allocated is a question for the legislative function.

shutdown, it would not impact that entire area, so the supply shortage issues may be somewhat mitigated. Of course, in areas of exceptionally tight housing markets (like New York City), there could still be displacement and other issues, but not at as large a scale. Again, communication, incentives, and verification—by either local governments, the public utility commission or both—will be critical.

One of the other benefits of this approach is that it has some analogs. Consider abandonment proceedings, for example. In an abandonment proceeding, a regulated monopoly utility that has determined part of its system has become uneconomic requests to be released from its duty to serve customers within that part of the system.¹¹² Given that state PUCs already handle abandonment cases, they could provide a model for a piecemeal shutdown. With abandonment cases, since the regulated monopoly utility is requesting to be released from its duty to serve, the utility often provides the necessary funds to transition residential uses away from natural gas.¹¹³ The difference between a traditional abandonment proceeding and what would happen when shutting down the natural gas distribution system in a piecemeal fashion, however, is that the regulated monopoly utility would most often be able to make a profit if it were allowed to invest in the infrastructure. Therefore, the incentive on the utility's part to provide economic help to those moving away from natural gas would not exist. But, from a regulatory standpoint, abandonment proceedings might still be a useful model to transition customers away from a specific utility service.

3. Option Three: Restrictions Based on Use or Application

A third way for regulators to manage the shutdown of the natural gas distribution system is to restrict use of natural gas based on application.¹¹⁴ As previously noted, the main household uses for natural gas are heating, cooking, clothes drying and hot water. Importantly, some of these could more easily be electrified than others.¹¹⁵

112. See, e.g., Docket No. A-2011-2239521 (PA abandonment case), <https://www.puc.pa.gov/docket/A-2011-2239521>. See generally Oliver P. Field, *The Withdrawal from Service of Public Utility Companies*, 35 YALE L.J. 169 (1925).

113. In a steam system abandonment case, the settlement provided that “NRG will make a contribution (“Conversion Contribution”) toward a Settling Customer’s cost of converting to an alternative heating system . . .”). Docket No. A-2011-2239521, Joint Settlement Non-confidential version, ¶ 19. For a natural gas abandonment, this could include providing for the installation of a propane tank, for example, and ensuring that existing gas appliances can either work on propane, or providing an incentive to electrify certain appliances that would need to be replaced.

114. A California utility, for example, expects more than 70% of “building heating and cooling and water heating and cooling coming from electricity by 2045.” See Gerdes, *Southern California*, *supra* note 45.

115. *Id.*

Tank hot water heaters, for example, are sold in both gas and electric models. It would be relatively easy to stop selling tank gas hot water heaters because an economic substitution with comparable performance is readily available.¹¹⁶ Heat pump hot water heaters are also becoming widely available and can easily be substituted for a more traditional tank gas-fired unit.¹¹⁷ An application-specific transition away from natural gas and toward electrification would be similar to the transition away from incandescent lightbulbs. After a specific date, certain inefficient lightbulbs were simply unavailable for purchase.¹¹⁸ A similar transition could occur, with the additional provision that no building permits for replacement gas units would be approved.¹¹⁹

Clothes drying is another situation where, in most cases, it would be relatively easy to electrify, and where the electric version is both economically and effectively similar.¹²⁰ Again, a statewide ban on sales of the gas version could be effective in transitioning, although replacing a dryer,

116. Electric hot water heaters are cheaper to purchase. *Gas vs Electric Water Heater*, Fixr (<https://www.fixr.com/comparisons/gas-vs-electric-water-heater#cQ> (last visited May 11, 2021) (noting that including purchase and installation, “the total cost for a 40-gallon electric hot water heater between \$1000 and \$1,700 with the total costs of a 40 gallon gas hot water heater between \$1,400 and \$2,800.”). Some regulations may still need to be changed, however. One experience of a homeowner in Oakland, CA, had this experience when he changed out all his gas appliances for electric: “‘The inspector didn’t actually sign off on our project, because on a check box, it said there needed to be a gas shut-off valve on our hot water heater,’ he says. Eventually, the city agreed to ignore the check box.” Lauren Sommer, *Give Up Your Gas Stove to Save The Planet? Banning Gas Is the Next Climate Push*, NPR (Aug. 4, 2019, 4:25PM), <https://www.npr.org/2019/08/05/745051104/give-up-your-gas-stove-to-save-the-planet-banning-gas-is-the-next-climate-push>. Additionally, heat pump hot water heaters can still be demand response assets for local utilities, and typically are 50% more efficient than the hot water heaters they are replacing. Jeff St. John, *Heat Pump Water Heaters Can be Demand Response Assets*, GREENTECH MEDIA (June 25, 2019), <https://www.greentechmedia.com/articles/read/energyhub-shows-that-heat-pump-water-heaters-can-be-demand-response-assets>.

117. Justin Gerdes, *California Moves to Tackle Another Big Emissions Source: Fossil Fuel Use in Buildings*, GREENTECH MEDIA (Feb. 4, 2020), <https://www.greentechmedia.com/articles/read/california-moves-to-tackle-another-big-emissions-source-fossil-fuel-use-in-buildings>.

118. Scott Anderson, *Is There an Incandescent Lightbulb Ban?*, REGENCY LIGHTING (Jan. 28, 2021 8:00 AM) <https://insights.regencylighting.com/was-there-actually-an-incandescent-lightbulb-ban>.

119. This would deal with the “stockpiling” problem that was seen with inefficient incandescent lightbulbs, where homeowners purchased many more lightbulbs than they would need rather than transition. Anna M. Tinsley, *Shoppers Stockpiling Old-Fashioned Incandescent Bulbs*, FORT WORTH STAR-TELEGRAM (last updated Jan. 2, 2014, 8:43 AM), <https://www.star-telegram.com/news/business/article3841446.html> (“Maria Statton was busy buying all the light bulbs she could find this week . . . She bypassed the newer options — halogen, compact fluorescent, LED and revamped incandescent bulbs — to buy dozens of the old-style bulbs and add to her stockpile of about 200 at her Benbrook home.”).

120. I recognize that clothes dryers may be harder to electrify as they are more often in a finished part of the home, and therefore getting the appropriate wiring to the location of a clothes dryer may be harder in many cases than the location of a hot water heater.

without more, rarely requires a permit, so enforcement of replacements from neighboring jurisdictions could be harder than with hot water heaters or furnaces.

When talking about space heating needs, “heat pumps are the most energy efficient.”¹²¹ Due to technological innovations, heat pumps are effective almost everywhere in the country for space heating¹²² as well as hot water.¹²³ However, due to the relatively new adoption of this technology in colder climates,¹²⁴ it may take more education, additional incentives, and a longer period of time for adoption to occur.¹²⁵ However, houses with heat

121. Fei Wang, *Electrifying Space Heating Will Require a Herculean Effort*, GREENTECH MEDIA (May 12, 2020), <https://www.greentechmedia.com/articles/read/electrifying-space-heating-will-require-a-herculean-effort>.

122. McKenna et al., *supra* note 51.’

123. See JACOB CORVIDAE, ET. AL., THE ECONOMICS OF ZERO-ENERGY HOMES, ROCKY MOUNTAIN INST. (2019) <https://rmi.org/insight/economics-of-zero-energy-homes/> Justin Gerdes, *Electrification Myth-Busting: Heat Pumps Are Ready for Cold Climates Today*, GREENTECH MEDIA (Apr. 15, 2019), <https://www.greentechmedia.com/articles/read/electrification-myth-busting-heat-pumps-are-ready-for-cold-climates-today> (“The report found that when air-source heat pumps or heat pump water heaters are installed in a new home also outfitted with a tight building envelope and rooftop solar PV panels, electrification is economical even in regions with the harshest winters. . . . The report notes that cold-climate heat pumps can heat homes even when outdoor temperatures dip to -12 degrees Fahrenheit and found that supplemental electric resistance heating was needed just 3 percent of the time in Bozeman and 10 percent of the time in Duluth.”); Justin Gerdes, *Maine Decides to Go Big on Heat Pumps*, GREENTECH MEDIA (June 27, 2019) [hereinafter Gerdes, *Maine*], <https://www.greentechmedia.com/articles/read/maine-wants-to-install-100000-heat-pumps-by-2025#gs.stiflh> (noting Maine’s primary reliance on heating oil and the major effect proposed legislation calling for heat pump installations would have in Maine’s decarbonization efforts).

124. “An ongoing challenge to growing the heat pump market in Maine and other northern jurisdictions is the lingering perception that heat pumps won’t work in extreme cold. New research . . . upends this conventional wisdom . . . [A] recent Vermont Public Service Department study confirms that high-performance cold-climate heat pumps will continue to produce heat down to outside temperatures of -10 or -15 degrees Fahrenheit.” See Gerdes, *Maine*, *supra* note 123.

125. TRIEU MAI ET AL., ELECTRIFICATION FUTURES STUDY: SCENARIOS OF ELECTRIC TECHNOLOGY ADOPTION AND POWER CONSUMPTION FOR THE UNITED STATES, NAT’L RENEWABLE ENERGY LAB’Y xii (2018) <https://www.nrel.gov/docs/fy18osti/71500.pdf> (“barriers to heat pump adoption, such as buildings retrofits and consumer familiarity, might limit growth in sales.”). New York has targeted \$454 million in incentives for heat pumps through 2025. *Summary from Advanced Energy Economy*, POWERSUITE (Aug. 7, 2020, 6:37 PM) <https://powersuite.aee.net/dockets/ny-18-00381-18-m-0084> (“On January 16, 2020, the Commission issued an order, implementing the “New Efficiency: New York” plan to bolster its energy efficiency and building decarbonization goals. The order will direct nearly \$2 billion in additional utility energy efficiency and electrification actions: \$893 million for electric energy efficiency; \$553 million for gas energy efficiency; and \$454 million for heat pumps through 2025. The programs implemented are expected to save more than 35 TBtu of energy through 2025.”). It has also been recognized in other parts of the world that gas heating will need to be banned—and potentially by 2025—for carbon goals to be met. Damian Carrington, *Ban New Gas Boilers in UK from 2025 or Risk Missing Net Zero Target, Says CBI*, GUARDIAN (July 22, 2020), <https://www.theguardian.com/environment/2020/jul/22/ban-new-gas-boilers-uk-net-zero-target-cbi-climate-goals-heating>.

pumps installed are already fetching a premium upon sale.¹²⁶ Installers will be key: “Whenever a homeowner’s making a decision, if their system goes out, they lean heavily on what the HVAC company suggests or tells them because the average homeowner doesn’t know much about their systems.”¹²⁷ Making sure installers are both familiar with the equipment and can talk to residential customers about something relatively new will be needed for mass adoption.¹²⁸

Natural gas and fuel oil satisfy about seventy-five percent of household heating needs in the United States.¹²⁹ Air source or ground source (geothermal) heat pumps could replace much of this demand¹³⁰ and the costs will come down as the technology is deployed more widely.¹³¹ Especially in parts of New England where fuel oil “remains the most common form of home heating,” mandated use of electric heat pumps rather than natural gas furnaces could stop the installation of natural gas infrastructure.¹³² Geothermal heat pumps have also been shown to be cost effective in comparison with natural gas.¹³³ Even with the current electricity mix,

126. Xingchi Shen et al., *Estimation of Change in House Sales Prices in the United States After Heat Pump Adoption*, 6 NATURE ENERGY 30 (2021).

127. Justin Gerdes, *Texas-Sized Gas-for-Electricity Swap*, GREENTECH MEDIA (Nov. 22, 2019), <https://www.greentechmedia.com/articles/read/a-texas-sized-gas-for-electricity-swap>.

128. AN ENERGY EFFICIENT STRATEGY FOR NEW JERSEY, NORTHEAST ENERGY EFFICIENCY P’S HIPS, INC. (2009), <https://www.state.nj.us/emp/docs/pdf/041609NEEP.pdf> (emphasizing the role of installers and contractors).

129. Fei Wang, *Electrifying Space Heating Will Require a Herculean Effort*, GREENTECH MEDIA (May 12, 2020), <https://www.greentechmedia.com/articles/read/electrifying-space-heating-will-require-a-herculean-effort>.

130. See TRIEU MAI ET AL., *supra* note 125, at xii (explaining how heat pumps are “key technologies” for building electrification which would replace fossil use for heating and that “[t]he high efficiency and multi-service potential of heat pumps can support their economic attractiveness”).

131. *Future Energy – Zero-Carbon Heating*, WOOD MACKENZIE (May 12, 2020), <https://www.woodmac.com/news/the-edge/future-energy—zero-carbon-heating/> (describing how heat pumps “could be part of the answer” in reducing carbon emissions). Geothermal pumps are already being used for large-scale projects internationally. See *Giant Canadian Construction Project Incorporates Low Carbon Heating and Cooling: Don Pittis*, CBC NEWS (Jan. 27, 2020, 4:00 AM), <https://www.cbc.ca/news/business/climate-heat-cooling-1.5437701> (describing project in Toronto, Canada).

132. See Storrow, *supra* note 6. In New York, it is estimated that, in order to achieve the state’s targets, 2.7 million housing units must be electrified by 2030, including all new housing stock, 2.1 million heating oil systems and 400,000 natural gas systems. Comments of Acadia Center, et. al, Case 17-G-0606 and Case 19-G-0080 Before the New York State Public Service Commission, Feb. 28, 2019, page 3.

133. Jigar Shah and Kathy Hannun, *The Case for Switching From Natural Gas Hookups to Heat Pumps*, GREENTECH MEDIA (Jul. 23, 2019), <https://www.greentechmedia.com/articles/read/the-case-for-switching-from-natural-gas-hookups-to-heat-pumps> (“In fact, switching from natural gas to a renewable alternative—namely, geothermal heat pumps—would prove *less* expensive for homeowners.”). See ASA S. HOPKINS, ET. AL. DECARBONIZING OF HEATING AND ENERGY USE IN CALIFORNIA BUILDINGS, SYNAPSE ENERGY ECONOMICS, INC. 6 (2018).

replacing gas furnaces with heat pumps would reduce carbon emissions in 99% of US households.¹³⁴ District heating¹³⁵—although rarely used in the United States¹³⁶—and geothermal loops are other options.¹³⁷

Removing natural gas from our buildings by focusing on heating may also be the first strategy adopted. For example, Bellingham, Washington, is considering banning natural gas heating not just in new homes, but in existing ones as well.¹³⁸ All homes would need to be converted by 2035 or 2040, and “[t]he measure under consideration would require electric heat conversions earlier than that when replacing heating systems.”¹³⁹

134. See McKenna et. al., *supra* note 51; see also Mike Henchen & Sherri Billimoria, *States Are Falling Short on Building Decarbonization – Here’s What Regulators Need to Do*, UTIL. DIVE (July 9, 2020), <https://www.utilitydive.com/news/states-are-falling-short-on-building-decarbonization-heres-what-regulato/581261/>.

135. Jason Deign, *Europe’s Plan for Districts That Produce Energy, Rather Than Using It*, GREENTECH MEDIA (Feb. 4, 2020), <https://www.greentechmedia.com/articles/read/europes-plan-for-districts-that-produce-energy-rather-than-using-it>; see also https://setis.ec.europa.eu/system/files/setplan_smartcities_implementationplan.pdf; see also *District Heating Would Save 9.38 Gigatons of Carbon by 2050*, THE ENERGY MIX (Dec. 15, 2019), <https://theenergymix.com/2019/12/15/district-heating-would-save-9-38-gigatons-of-carbon-by-2050/>.

136. The largest district heating system in the United States is ConEd’s steam service in New York City, “serving more than 3 million New Yorkers, from the southern tip of Manhattan to 96th Street.” *Steam Service*, CONEDISON, <https://www.coned.com/en/commercial-industrial/steam> (last visited May 11, 2021). The steam is used to heat and cool buildings and “also provides humidity to art museums, steam cleaning for restaurants to clean dishes, and other uses.” *New York City Steam System*, WIKIPEDIA, https://en.wikipedia.org/wiki/New_York_City_steam_system (last visited May 11, 2021). Other uses include sterilizing hospital equipment. Greg Moyer, *Miles of Steam Pipe Snake Beneath New York*, N.Y. TIMES (Oct. 9, 2014), <https://www.nytimes.com/2014/10/10/nyregion/miles-of-steam-pipes-snake-beneath-new-york.html> (including a detailed history and discussion of the operation of the NY city steam system).

137. Justin Gerdes, *Massachusetts Pilot Project Offers Gas Utilities a Possible Path to Survival*, GREENTECH MEDIA (Aug. 6, 2020) [hereinafter Gerdes, *Massachusetts Pilot Project*], <https://www.greentechmedia.com/articles/read/can-gas-companies-evolve-to-protect-the-climate-and-save-their-workers>; Sarah Shemkus, *Innovative Geothermal Micro-District Concept Moves ahead in Massachusetts*, ENERGY NEWS NETWORK (Dec. 3, 2020), https://energynews.us/2020/12/03/innovative-geothermal-micro-district-concept-moves-ahead-in-massachusetts/?utm_source=Sailthru&utm_medium=email&utm_campaign=Newsletter%20Weekly%20Roundup%3A%20Utility%20Dive%3A%20Daily%20Dive%2012-05-2020&utm_term=Utility%20Dive%20Weekender.

138. Mike Baker, *To Fight Climate Change, One City May Ban Heating Homes with Natural Gas*, N.Y. TIMES (Jan. 6, 2020), <https://www.nytimes.com/2020/01/05/us/bellingham-natural-gas-ban.html>. The heating transition would have to be complete 2035 or 2040. *Id.*; see also The Energy Mix, *Bellingham, Washington Considers Natural Gas Heating Ban*, ENERGY CENT. (Jan. 28, 2020, 9:15 PM), <https://energycentral.com/c/ec/bellingham-washington-considers-natural-gas-heating-ban>.

139. Mike Baker, *To Fight Climate Change, One City May Ban Heating Homes with Natural Gas*, N.Y. TIMES (Jan. 6, 2020), <https://www.nytimes.com/2020/01/05/us/bellingham-natural-gas-ban.html>. Seattle is adopting similar measures for city-owned buildings, requiring “[a]ll new and substantially altered city-owned buildings” to use electricity for “heating, cooling, cooking and other purposes.” Katie Pyzyk, *Seattle to Transition City-Owned Buildings Away from Fossil Fuels*,

Cooking also has readily available substitutions. Gas ovens have electric equivalents, and ovens do not, in most cases, elicit strong gas versus electric preferences from homeowners.¹⁴⁰ Gas cooktops, on the other hand, have a stronger emotional tie,¹⁴¹ and it will take more from a societal perspective to change preferences from gas to either electric or induction cooktops.¹⁴² “Probably the biggest stumbling block for most pondering an all-electric home is the prospect of not having a gas stove.”¹⁴³

Interestingly, some of the cities that have looked at banning natural gas are considering exempting cooking from the natural gas prohibition. Seattle’s legislation does not address cooking,¹⁴⁴ for example, “because

SMART CITIES DIVE (Jan. 10, 2020), <https://www.smartcitiesdive.com/news/seattle-jenny-durkan-green-new-deal-fossil-fuels-buildings/570158/>. See Exec. Order 2020-01: Advancing a Green New Deal for Seattle (Jan. 2020), https://durkan.seattle.gov/wp-content/uploads/sites/9/2020/01/Final-Executive-Order-2020-01-Advancing-a-Green-New-Deal-for-Seattle_.pdf.

140. Indeed, many view electric oven performance to be better due to a tighter temperature range with fewer fluctuations during cooking. Nancy Taylor, *Gas Oven vs Electric Oven In-Depth Comparison*, AROUND THE HOUSES (Feb. 18, 2020), <https://aroundthehouses.com/gas-oven-vs-electric-oven/#:~:text=Gas%20ovens%20reach%20higher%20cooking,the%20cooking%20temperature%20with%20it.&text=Electric%20cooktops%20and%20ovens%20take,you%20have%20turned%20it%20off>.

141. See, e.g., Sarah Kellner, *5 Reasons Top Chefs Prefer Gas Cooktops*, DAILY MEAL (Nov. 19, 2014), <https://www.thedailymeal.com/cook/5-reasons-top-chefs-prefer-gas-cooktops> (“[I]f I had to name the one single thing that has drastically improved my cooking game, it’s been switching to a gas cooktop. After making the change, I finally understood what my professional chef friend was raving about. There are so many advantages that gas ranges have over electric ones.”). See also Justin Gillis & Bruce Nilles, *Your Gas Stove Is Bad for You and the Planet*, N.Y. TIMES (May 1, 2019), <https://www.nytimes.com/2019/05/01/opinion/climate-change-gas-electricity.html> (“We know how you’ll feel reading those words. We used to love cooking with gas, too. . . . Nobody is going to shed a tear about having to switch to a more efficient furnace or water heater. But people feel emotional about gas stoves . . .”).

142. Induction cooktops, however, are starting to gain a following due to the higher efficiency (90% of the energy goes into the food, as opposed to 40–55% for gas) and the precision temperature control that they offer. Alison Prelusky, *Induction vs. Gas vs. Electric Cooktops*, P.C. RICHARD & SON (Dec. 1, 2017), <https://www.pcrichard.com/library/blogArticle/induction-vs-gas-vs-electric-cooktops/2300371.pcr>; *Cooktop Showdown: Electric vs. Gas vs. Induction*, AFT CONSTRUCTION, <https://aftconstruction.com/cooktop-showdown-electric-vs-gas-vs-induction/> (last visited Jan. 14, 2020). See also Elizabeth Weise, *No More Fire in the Kitchen: Cities are Banning Natural Gas in Homes to Save the Planet*, USA TODAY (Nov. 10, 2019, 10:33 AM), <https://www.usatoday.com/story/news/2019/11/10/climate-change-solutions-more-cities-banning-natural-gas-homes/4008346002/> (“Long popular in Europe and increasingly trendy in the United States, induction cooktops are different from the kind of traditional electric range where coils become red-hot. Induction ranges use electromagnetic energy to directly heat pots and pans. They are fast, energy-efficient and safe because there’s no open flame, and they are cool to the touch unless you’re a piece of metal.”).

143. See Weise, *supra* note 142.

144. Seattle, Wash., Ordinance 126.279 (Mar. 11, 2021), <http://seattle.legistar.com/View.ashx?M=F&ID=9196623&GUID=1852F762-48F7-42B9-A677-BBD0CD1705F1>; see also *Follow-Up: Mayor Sends Multifamily, Commercial Construction Natural-Gas Ban to Council* (Jan. 14, 2021, 10:43 AM), <https://westseattleblog.com/2021/01/followup-mayor-sends-multifamily-commercial-construction->

‘some of the construction experts we’ve talked to say there aren’t great alternatives at the moment for commercial-scale cooking without gas.’¹⁴⁵ Menlo Park, California, also allows new homes to have a gas stove so long as an electric hook-up is also included.¹⁴⁶ A member of Berkeley’s city council “admits stoves are the major sticking point. While homeowners may not have strong feelings about their water heaters, cooking is another matter.”¹⁴⁷ Due to concerns around cooking, “building owners will be able to apply for an exemption to the gas ban.”¹⁴⁸ The California Restaurant Association is suing the City of Berkeley, arguing that the “recently approved ban on the use of natural gas in newly constructed buildings will have ‘uniquely negative impacts’ on the culinary community.”¹⁴⁹ On the other hand, “[p]rofessional chefs say modern induction ranges are comparable to gas. The Culinary Institute of America in Hyde Park, New York, America’s preeminent cooking school, trains its chefs on both induction and gas stoves because they will encounter both types and must know how to use them.”¹⁵⁰

Restricting the use of natural gas to certain applications—with cooking and boilers being the most likely holdouts—within the home will lead to a decreasing volume of natural gas going through the natural gas distribution system. As already noted, the system must be maintained to ensure safety, and that continued investment spread over a smaller volume of gas will make

natural-gas-ban-to-council/ (discussing how the Seattle legislation addresses heat, hot water, building exteriors, solar, and buildings being ready for future electric conversion).

145. Daniel Beekman, *Seattle City Council to Consider Ban on Natural Gas for New Homes, Buildings*, SEATTLE TIMES (Sep. 5, 2019, 9:25 AM), <https://www.seattletimes.com/seattle-news/politics/seattle-city-council-to-consider-ban-on-natural-gas-for-new-buildings/>.

146. MENLO PARK, CALIF., ORD. 1057, §3 (2019), <https://www.codepublishing.com/CA/MenloPark/#!/html/MenloPark12/MenloPark1216.html> (“Note 1: If natural gas appliances are used in any of the above exceptions 1-4, natural gas appliance locations must also be electrically pre-wired for future electric appliance installation”). Sara Tabin, *Palo Alto Will Consider Limits on Natural Gas This Fall*, PALO ALTO DAILY POST (Sep. 19, 2019, 8:00 AM), <https://padailypost.com/2019/09/19/palo-alto-will-consider-limits-on-natural-gas-this-fall/>.

147. See Sommer, *supra* note 116.

148. *Id.*

149. Richard Gonzalez, *California Restaurant Industry Group Sues Berkeley Over Natural Gas Ban*, NPR (Nov. 21, 2019, 11:10PM), <https://www.npr.org/2019/11/21/781874235/california-restaurant-industry-group-sues-berkeley-over-natural-gas-ban>. In addition to a claim that the ban “violates state and federal laws regulating the enactment of energy use standards,” the group claims that “a shift to electric heat would change the cooking process and increase costs.” *Id.* . See Complaint at 2–3, Cal. Restaurant Ass’n v. City of Berkeley, No. 3:19-cv-07668 (N.D. Cal. Nov. 21, 2019) (The California Restaurant Ass’n is suing Berkeley, arguing that “Berkeley’s natural gas ban . . . will cause substantial adverse consequences for CRA’s members and the public.”). Based on a conversation the author had with a restaurateur in Menlo Park, CA in December 2019, the issue of cost was not only due to the higher initial cost of induction ranges, but the lack of a secondary market. He had typically purchased used equipment, and that would not be available

150. See Weise, *supra* note 142.

rates rise for remaining users.¹⁵¹ The increasing cost of operating natural gas appliances will provide an incentive for consumers to change to other alternatives where they are readily available.

Perhaps more importantly, the increasing cost will also drive technological innovation in applications where ready alternatives do not exist today, like boilers.¹⁵² Spreading the cost of the entire system over a smaller and smaller group of ratepayers has the potential to bring about a death spiral, as the high cost drives customers to other options. The California Energy Commission found that an increased focus on electrification could drive rate increases of up to 480% by 2050.¹⁵³ This option could also have the benefit of essentially no captive ratepayers paying for stranded assets at the end of natural gas usage, as customers would simply leave when they no longer wished to continue service.

From a business (and consumer) perspective, this is similar to the recent transition away from landline phones.¹⁵⁴ As consumers transitioned to cell phones and stopped service on their landlines, the costs of maintaining the infrastructure necessary for service was spread over fewer and fewer customers. That increasing cost then led more customers to choose to disconnect their service. As with the transition from landlines to cell phones, there are ready replacements for customers to choose from.

151. DAN AAS, ET AL., THE CHALLENGE OF RETAIL GAS IN CALIFORNIA'S LOW-CARBON FUTURE, CAL. ENERGY COMM'N (2020), <https://ww2.energy.ca.gov/2019publications/CEC-500-2019-055/CEC-500-2019-055-F.pdf>. See also Robert Walton, *California Natural Gas Costs Could Spike as State Decarbonizes: E3*, UC IRVINE, UTIL. DIVE (Jun. 10, 2019), <https://www.utilitydive.com/news/california-natural-gas-costs-could-spike-as-state-decarbonizes-e3-uc-irvi/556512/> (discussing the possibility of rising natural gas costs to remaining customers to the California Energy Commission).

152. See *supra* note 125 and accompanying text.

153. CAL. ENERGY COMM'N, 2018 INTEGRATED ENERGY POLICY REPORT UPDATE: VOLUME II (2018), <https://ww2.energy.ca.gov/2018publications/CEC-100-2018-001/CEC-100-2018-001-V2-CMF.pdf>. See also Phil McKenna, *Fearing for Its Future, a Big Utility Pushes 'Renewable Gas,' Urges Cities to Reject Electrification*, INSIDE CLIMATE NEWS (Nov. 13, 2019), <https://insideclimatenews.org/news/13112019/biogas-climate-change-renewable-gas-marketing-socialgas-reject-electrification-california>.

154. John R. Quain, *Is it Safe to Get Rid of Your Landline?*, AARP (Aug. 25, 2020), <https://www.aarp.org/home-family/personal-technology/info-2020/get-rid-of-landline.html> (noting how landline costs have risen); Gonzalo, *The Demise of the Land Lines and the Future of the Phone Service Industry*, DIGIT. INITIATIVE (last updated Sep. 12, 2015), <https://digital.hbs.edu/platform-digit/submission/the-demise-of-the-land-lines-and-the-future-of-the-phone-service-industry/> (discussing how "landline phones are rapidly losing relevance" and how "[e]ven as their landline subscribers decline, the transitioning phone companies still have to invest billions of dollars a year to maintain the old networks"); Michael James Thacker, *Essays on the Economics of Telephones and Evolving Technologies v* (June 2016) (unpublished Ph.D. dissertation, University of Oregon), https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/20446/Thacker_oregon_0171A_11528.pdf?isAllowed=y&sequence=1 (showing that with increased cellphone adoption, "[c]onsumers have become more price-sensitive, indicating that improvements to cell phones have provided an increasing competitive constraint on landline pricing.").

Although the equipment would either be replaced at the end of its useful life or when it becomes cheaper to convert, this option is not costless. First, some of the appliances mentioned—especially clothes dryers and ovens/cooktops—often require an electrical hookup that is more than a standard 120V/15A circuit.¹⁵⁵ Electric heat pumps for space heating and cooling and hot water heating are more likely to work with a standard plug. Often, these kitchen appliances are in finished spaces of the home where running new electrical lines will potentially require not only the new electrical service but also other interior finishing work (drywall, paint, etc.). Therefore, homeowners will likely want the increased efficiency combined with lower cost of use to offset not only with the capital cost but also the additional costs of electrical installations. Consequently, efficiency of installation and of the appliances will be very important.¹⁵⁶

There is also another issue with this approach which impacts many efficiency improvements: the renter/owner issue.¹⁵⁷ As with energy improvements like insulation or solar panels, if the capital is expended by the property owner but the savings flow to the renter (such as in situations where the renter is responsible for utility bills), there is little incentive for the property owner to expend the capital.¹⁵⁸ A similar situation could develop where a property owner is unwilling to spend the necessary capital to change out appliances, even as the renter is paying ever-increasing utility bills for using gas appliances.¹⁵⁹ Communication to renters here again will be key, but, as noted above, will be less impactful in tight housing markets, where other regulations or incentives may be needed.

155. *What Kind of Outlet Does My Appliance Need?*, AMERICAN MECH. (Apr. 25, 2014), <https://www.americanmechanicalva.com/blog/2014/april/what-kind-of-outlets-does-my-appliance-need/>.

156. Jon Harrod, *Does Your Electrification Project Require a Service Upgrade?*, GREEN BLDG. ADVISOR (Dec. 29, 2020), <https://www.greenbuildingadvisor.com/article/does-your-electrification-project-require-a-service-upgrade>.

157. While not directly applicable as the focus groups were in the Netherlands, studies suggest that both renters and landlords have different perceptions of the transition away from natural gas. Homeowners feel responsible for making the transition away from natural gas, renters feel it is the responsibility of others to transition. Sikke R. Jansman et al., *Kissing Natural Gas Goodbye? Homeowner Versus Tenant Perceptions of the Transition Towards Sustainable Heat in the Netherlands*, 69 *Energy Res. & Soc. Sci.* 101694 (2020), <https://www.sciencedirect.com/science/article/pii/S2214629620302693?via%3Dihub>.

158. *Creating an Energy Saving Win-Win for Owners and Tenants*, CONSORTIUM FOR BUILDING ENERGY INNOVATION <http://www.cbei.psu.edu/split-incentives-and-green-leases/index.html#:~:text=Traditional%20leasing%20agreements%20often%20create,benefits%20of%20reduced%20utility%20costs> (last visited May 11, 2021).

159. Some have recommended solving the renter/property owner split incentive by tying energy efficiency improvements to the meter. This might work for electrification as well. See BAHAV SEN ET AL., *Energy Efficiency with Justice: How State Energy Efficiency Policy Can Mitigate Climate Change, Create Jobs, and Address Racial and Economic Inequality* at 46 (2018), <https://ips-dc.org/wp-content/uploads/2018/08/Basav-report-final-online-1.pdf>.

4. Option Four: Restrictions Based on Source

A fourth way for regulators to manage the shutdown of the natural gas distribution system is to restrict use of gas based on source. This option would not require an entire shutdown of the system. While some utilities are looking to accelerate the use of “renewable natural gas” produced from landfills, dairies, and sewage treatment plants,¹⁶⁰ regulators have so far rejected this as a viable alternative to electrification.¹⁶¹ Scalability is a concern.¹⁶² The most optimistic projections show potential availability is limited.¹⁶³ Another challenge is the fact that renewable natural gas is not

160. SoCal Gas “executives say they’ve been frustrated that [California Public Utilities Commission] members and environmental groups are singularly focused on electrification without giving enough consideration to renewable gas produced from landfills and dairies . . .” The Times Editorial Board, *Editorial: SoCal Gas’ sleazy ‘Astroturf’ effort to keep fossil fuels flowing in California*, L.A. TIMES (Aug. 10, 2019), <https://www.latimes.com/opinion/story/2019-08-10/socalgas-astroturf-cpuc-aliso-canyon>. Minnesota regulators unanimously rejected a planned renewable gas offering from a regulated utility. *Staff Briefing Papers*, Minn. Pub. Utilities Comm’n (2019), <https://assets.documentcloud.org/documents/6224216/Briefing-Papers.pdf>. See also Catherine Morehouse, *Minnesota Regulators Unanimously Reject Centerpoint’s Renewable Natural Gas Program*, UTIL. DIVE [hereinafter Morehouse, *Minnesota Regulators*], <https://www.utilitydive.com/news/centerpoint-reveals-renewable-natural-gas-program-for-minnesota-customers/530980/> (last updated June 29, 2019). “The gas . . . comes from the digestion of landfill waste, manure, cornstalks or residue from wood and crops . . .” *Id.*

161. Order Denying Petition to Introduce a Renewable Natural Gas Pilot Program, *In re Centerpoint Energy*, No. G-008/M-18-547 (MINN. PUB. UTIL. COMM. Aug. 29, 2019). See also Catherine Morehouse, *Renewable Gas or Electrification? Minnesota’s High Stakes Experiment on Building Decarbonization*, UTIL. DIVE (Oct. 1, 2019) [hereinafter Morehouse, *Renewable Gas*], <https://www.utilitydive.com/news/renewable-gas-or-electrification-minnesotas-high-stakes-experiment-on-bui/564065/>.

162. See, e.g., Order Denying Petition, *In the Matter of Centerpoint*, at 5 (“[T]here remain many unanswered questions about the proposed pilot, including . . . how the scale of the program could grow beyond the pilot level.”); see also SASAN SAADAT ET AL., RHETORIC VS. REALITY: THE MYTH OF “RENEWABLE NATURAL GAS” FOR BUILDING DECARBONIZATION, EARTHJUSTICE & SIERRA CLUB 11 (2020), https://earthjustice.org/sites/default/files/feature/2020/report-decarb/Report_Building-Decarbonization-2020.pdf (describing how RNG production would be able to meet a fraction of U.S. gas demand); Emily Pontecorvo, *Is Renewable Natural Gas a Serious Alternative to ‘Electrify Everything’?*, GRIST (July 14, 2020), <https://grist.org/energy/is-renewable-natural-gas-buildings-a-serious-alternative-to-electrify-everything-heat-pumps/> (“even under the most optimistic scenario, RNG would meet only a fraction of the demand met with natural gas today.”); Helena Tavares Kennedy, *Vanguard Renewables and Dominion Energy Partner up on 1st Nationwide Network of Dairy Waste-to-Energy Projects*, BIOFUELSDIGEST (Dec. 15, 2019), <https://www.biofuelsdigest.com/bdigest/2019/12/15/vanguard-renewables-and-dominion-energy-partner-up-on-1st-nationwide-network-of-dairy-waste-to-energy-projects/> (touting a hope to have “five clusters in five states over the next five years” with each “cluster” being 3–5 dairies coordinating manure collection for RNG).

163. See NAT’L RENEWABLE ENERGY LAB’Y, BIOGAS POTENTIAL IN THE UNITED STATES (2013), <https://www.nrel.gov/docs/fy14osti/60178.pdf>. See McKenna, *supra* note 153. “The National Renewable Energy Laboratory calculates that biogas sources in California have the potential to provide just 2.7 percent of all natural gas currently used in the state.” *Id.* The Executive Director of Dairy Cares, a group working to ensure the long-term sustainability of California’s dairy farms, has described renewable gas as a “pipe dream.” Susie Cagle, *US Gas Utility Funds ‘Front’*

carbon neutral.¹⁶⁴ When it leaks, it still leaks methane into the atmosphere, and researchers have noted this could make renewable natural gas “climate intensive.”¹⁶⁵ It is also expensive.¹⁶⁶

Those promoting renewable natural gas point to successes—the San Antonio Water System, which processes 1.5 million cubic feet per day, and Phoenix, which processes approximately twice that.¹⁶⁷ Given that the US used 85.3 billion cubic feet per day in 2019,¹⁶⁸ these two projects provide less than 0.005% of the natural gas demand in the country currently. Even if the industry grows at the 30% annual growth rate the industry claims is possible,¹⁶⁹ without significant breakthroughs renewable natural gas is unlikely to have any measurable wide-scale impact in the timeframe needed to meet the scenarios listed by the IPCC.¹⁷⁰

Leaky systems are not just an issue for renewable natural gas, but for all other uses these systems might be repurposed for.¹⁷¹ Though some argue that hydrogen could be a possible use for the pipeline system and could be put to the same household needs as renewable natural gas, the engineering issues

Consumer Group to Fight Natural Gas Bans, GUARDIAN (July 26, 2019), <https://www.theguardian.com/us-news/2019/jul/26/us-natural-gas-ban-socalgas-berkeley>.

164. “As a greenhouse gas, methane is 25 times stronger than carbon dioxide, so small leakages of biogas have a strong negative effect on the total greenhouse gas performance of the energy production pathway.” Matthieu Dumont et al., *Methane Emissions in Biogas Production*, in THE BIOGAS HANDBOOK 248–66 (2013). See also Morehouse, *Renewable Gas*, *supra* note 161; Morehouse, *Minnesota Regulators*, *supra* note 160 (noting that renewable natural gas can be “25 times stronger than carbon dioxide” from a greenhouse gas perspective).

165. Emily Grubert, *At Scale, Renewable Natural Gas Systems Could Be Climate Intensive: The Influence of Methane Feedstock and Leakage Rates*, 15 ENV’T RSCH. LETTERS, at 1 (2020).

166. McKenna, *supra* note 153.

167. Michael Bakas, *Renewable Natural Gas: The Climate Change Solution With Limited Awareness of its Potential*, UTIL. DIVE (Aug. 28, 2019), <https://www.utilitydive.com/news/renewable-natural-gas-the-climate-change-solution-with-limited-awareness-o/561786/>.

168. Consumption reached 85.3 billion cubic feet per day (Bcf/d) in 2019. SHORT-TERM ENERGY OUTLOOK (STEO), U.S. ENERGY INFO. ADMIN. 11 (2020), <https://www.eia.gov/outlooks/steo/report/natgas.php>.

169. Bakas, *supra* note 167.

170. Dominion Energy and Smithfield Foods, for example, are hoping to use hog waste and convert it to “renewable natural gas.” *\$500M Dominion-Smithfield Venture Taking Manure and Making it into Renewable Gas*, POWER ENGINEERING (Oct. 25, 2019), <https://www.power-eng.com/2019/10/25/500m-dominion-smithfield-venture-taking-manure-and-making-it-into-clean-gas/#gref>. They are investing \$500 million over 10 years and hope that would “power more than 1,000 local homes and businesses at full capacity.” *Id.*; see also Brianna Jackson, *Dominion, Smithfield to Double Investment in Renewable Gas Projects to \$500M*, S&P GLOB. MARKET INTEL. (Oct. 23, 2019), <https://www.spglobal.com/marketintelligence/en/news-insights/trending/i5UqMjvE5kluRLS3hOqyxA2> (discussing another RNG project which is supplying 3,000 local homes and businesses).

171. See, e.g., Patrick Skahill, *New Study Shows Methane Leaks Prevalent in Connecticut Cities*, CONN. PUB. RADIO (Nov. 19, 2020), <https://www.wnpr.org/post/new-study-shows-methane-leaks-prevalent-connecticut-cities>.

with this option could require the full-scale replacement of the entire system.¹⁷² The majority (95%) of hydrogen today comes from steam reforming of natural gas, which also makes it carbon intensive.¹⁷³ Given the high cost¹⁷⁴ and the time (and R&D funding) needed to develop renewable hydrogen processes¹⁷⁵ combined with the time-scale scenarios listed by the IPCC, it is also unlikely that this is a realistic option for household consumption.¹⁷⁶

Another potential option would be to use the pipelines to supply reclaimed or “grey” water to homes. This could be beneficial in parts of the country where the likelihood of drought will increase with climate change, allowing for scarcer freshwater supplies to be used for uses like drinking, cooking, and bathing, rather than toilet flushing or irrigation. But that may not make sense in areas where freshwater supplies are abundant or where the natural gas system has pervasive leaks. A relatively new system that could be operated under the pressures necessary for water delivery with minimal

172. It is possible to inject a limited percentage of hydrogen into the natural gas system without issue. See, e.g., Rachel Cooper, *UK's first grid-injected hydrogen pilot gets underway*, CLIMATE ACTION (Jan. 2, 2020), Rachel Cooper, *UK's First Grid-Injected Hydrogen Pilot Gets Underway*, CLIMATE ACTION (Jan. 2, 2020), <http://www.climateaction.org/news/uks-first-grid-injected-hydrogen-pilot-gets-underway>; Canadian Press, *Enbridge Gas to Blend Hydrogen with Natural Gas for Consumers in Markham, Ont.*, TORONTO STAR (Nov. 18, 2020), <https://www.thestar.com/business/2020/11/18/enbridge-gas-to-blend-hydrogen-with-natural-gas-for-consumers-in-markham-ont.html> (adding 2% hydrogen into the system). The challenge is that the heating content of hydrogen is significantly lower than methane, and small amounts added to the natural gas burned will not significantly impact the negative climate effects of the natural gas. While the Massachusetts Petroleum Council has suggested that “gas distribution lines could eventually be used to deliver biofuels,” the Council did not address what use each household would have for biofuels, the development of appliances to use biofuels, nor the timeframe in which any transition to biofuels would occur. See Storrow, *supra* note 6.

173. Cameron Hepburn et al., *The Technological and Economic Prospects for CO₂ Utilization and Removal*, 575 *Nature* 87 (2019); see also David Roberts, *These Uses of CO₂ Could Cut Emissions — and Make Trillions of Dollars*, VOX (Nov. 27, 2019), <https://www.vox.com/energy-and-environment/2019/11/13/20839531/climate-change-industry-co2-carbon-capture-utilization-storage-ccu>; <https://www.woodmac.com/news/editorial/the-future-for-green-hydrogen/>. Stephen Lacey, *Could Green Hydrogen Become the 'New Oil'?*, GREENTECH MEDIA (Jan. 23, 2020), <https://www.greentechmedia.com/articles/read/could-green-hydrogen-become-the-new-oil> (noting that less than 1% of hydrogen currently comes from renewables).

174. Simon Flowers, *Future energy – Green Hydrogen*, WOOD MACKENZIE (Feb. 4, 2020), <https://www.woodmac.com/news/the-edge/future-energy-green-hydrogen/>.

175. Jason Deign, *The Reality Behind Green Hydrogen's Soaring Hype*, GREENTECH MEDIA (Nov. 28, 2019), <https://www.greentechmedia.com/articles/read/the-reality-behind-green-hydrogens-soaring-hype>.

176. *CCS, Hydrogen Won't be Ready by 2050, UK Academics Warn*, THE ENERGY MIX (Feb. 14, 2020), <https://theenergymix.com/2020/02/14/ccs-hydrogen-wont-be-ready-by-2050-uk-academics-warn/>; see also Jason Deign, *5 Early Applications for Green Hydrogen*, GREENTECH MEDIA (Jan. 2, 2020), <https://www.greentechmedia.com/articles/read/5-early-applications-for-green-hydrogen> (finding that uses for green hydrogen will not be for household or small commercial use, except where natural gas is expensive).

loss of water from leaks would be needed. Unfortunately, as noted above, that does not describe many of our natural gas distribution systems at this point in time.¹⁷⁷ Similarly, using the system for district geothermal would require significant replacements given the need for minimal leaks.¹⁷⁸

Whichever option regulators choose, it will have an impact on the value of the assets that remain in the system when it is shut down, and therefore will influence the calculation around stranded assets.

III. REGULATORY OPTIONS TO ADDRESS THE CHALLENGE

As one former utility commissioner noted, “[t]he current regulatory framework does not facilitate, or even readily accommodate, the innovation and rapidly changing technologies that utilities and other market players will need to deploy to achieve a renewable/clean/carbon free energy future.”¹⁷⁹ As another advocate noted, “it’s clear that existing institutions are not facilitating decarbonization at the pace that is necessary.”¹⁸⁰

Assuming that, indeed, the natural gas distribution system will need to be shut down (or shrunk dramatically) on a schedule anything close to what the scientific community is saying, then whatever is being spent on infrastructure now will become a stranded asset.¹⁸¹ As regulators confront

177. Another suggestion regarding the current infrastructure and water is to use the pipes to deliver completely untreated water (directly from surface sources) that could then be used as a source for heat pumps. Seamus Garvey, *We Can Decarbonise the UK’s Gas Heating Network by Recycling Rainwater – Here’s How*, THE CONVERSATION (Jan. 30, 2020), <https://theconversation.com/we-can-decarbonise-the-uks-gas-heating-network-by-recycling-rainwater-heres-how-129497>. Again, this is unlikely due to the leakage rates of the current natural gas system.

178. See Gerdes, *Massachusetts Pilot Project*, *supra* note 137.

179. Janet Gail Besser, *What’s Standing in the Way of a Carbon Free Future?*, SMART ELECTRIC POWER ALLIANCE (June 27, 2019), <https://sepapower.org/knowledge/whats-standing-in-the-way-of-a-carbon-free-future/>.

180. Miles Farmer & Amanda Levin, *Comparing America’s Grid Operators on Clean Energy Progress: PJM is Headed for a Climate Disaster*, UTIL. DIVE (July 2, 2019), <https://www.utilitydive.com/news/comparing-americas-grid-operators-on-clean-energy-progress-pjm-is-headed/557994/>.

181. Natural gas distribution lines can have a planned lifespan of anywhere between 20 to 75 years. Andy Balaskovitz, *Michigan Utilities Target Aging Natural Gas Distribution Lines for Upgrades*, ENERGY NEWS (Dec. 11, 2018), <https://energynews.us/2018/12/11/midwest/michigan-utilities-target-aging-natural-gas-distribution-lines-for-upgrades/>. LNG plants have an expected lifespan of around 40. *New Analysis Reveals ‘Clean’ Natural Gas as ‘The New Coal’*, THE ENERGY MIX (July 2, 2019), <https://theenergymix.com/2019/07/02/new-analysis-reveals-clean-natural-gas-as-the-new-coal/>. When Berkeley was discussing the potential ban on natural gas for new residential buildings, one councilwoman noted that allowing natural gas to be put into new buildings now “locks in greenhouse gases for 100-plus years.” Kristin Musulin, *Berkeley Sets Historic Law Banning Natural Gas from New Buildings*, UTIL. DIVE (July 18, 2019), <https://www.utilitydive.com/news/berkeley-sets-historic-law-banning-natural-gas-from-new-buildings/559026/>.

that reality—and are thinking about how to shut down the system—how regulators decide to address stranded assets will impact the eventual cost to captive ratepayers.¹⁸²

Regulated utilities are already actively running scenarios about what a world with no natural gas would look like and how that would impact their assets and revenues. Regulators need to be prepared and start addressing the same—or those with natural gas assets will develop a viewpoint and will be pushing regulators to adopt their position. The path of least resistance will be to keep operating the system under the assumption that it will continue to exist and expand as it has for over 100 years—without questioning investments—until it becomes clearer that we must eliminate the use of all natural gas. However, that path will lead to a transition away from natural gas use that will be more costly and likely take longer than would occur if legislators and regulators start thinking now about how to shut down the system. We need to start thinking about what the regulatory exit strategy will be regarding natural gas.¹⁸³

A. Potential Regulatory Strategies and Options

Learnings from past utility experiences with stranded assets may help minimize the cost as we now plan for stranded assets associated with the natural gas system. Both cancelled nuclear plants¹⁸⁴ and the deregulation/restructuring of the electricity industry are good examples of

182. And utilities expect this will be determined through state-level policy. Catherine Morehouse, *Duke VP Likens Gas Plant Buildout Strategy to 15-year Home Mortgage on Path to Zero Carbon*, UTIL. DIVE (Oct. 18, 2019), <https://www.utilitydive.com/news/duke-vp-likens-gas-plant-buildout-strategy-to-15-year-home-mortgage-on-path/565328/> (“[T]he issue will be ‘an accounting question . . . not a technological question,’ that could be solved through state-level policy, possibly through front-loading some of those costs to decrease the overall depreciation life.”).

183. See J.B. Ruhl & James Salzman, *Regulatory Exit*, 68 VAND. L. REV. 1295, 1295 (2015).

184. There are multiple examples of stranded assets in nuclear plants which were cancelled mid-build, as there were over 120 partially planned or built plants that were cancelled at various times. Brad Plumer, *Why America Abandoned Nuclear Power (And What We Can Learn from South Korea)*, VOX (Feb. 29, 2016), <https://www.vox.com/2016/2/29/11132930/nuclear-power-costs-us-france-korea> (“Utilities, scared off by soaring costs and stagnating electricity demand, canceled more than 120 reactor orders.”); Sonal Patel, *The Big Picture: Abandoned Nuclear Power Plants*, POWER (Feb. 1, 2018), <https://www.powermag.com/interactive-map-abandoned-nuclear-power-projects/> (noting about half of nuclear projects had been cancelled after construction had begun); These investments were found to have been prudent investments when they were made, but, due to changed conditions, it was deemed imprudent to continue construction. All these investments were made where there was a captive rate base to absorb the costs of the no-longer-prudent investment. See U.S. ENERGY INFO. ADMIN., NUCLEAR PLANT CANCELLATIONS: CAUSES, COSTS, AND CONSEQUENCES x (1983), <https://www.osti.gov/servlets/purl/6211281> (noting that the investments associated with 100 cancelled nuclear units between 1972 and 1982 was about \$10 billion, with “[m]ost of these cancellation costs . . . incurred since 1977 during which time 72 reactors have been cancelled, 42 of which involved abandonment costs of at least \$50 million per plant cancellation.”).

where this occurred.¹⁸⁵ However, in both cases, regulators were looking at what happened after the fact. Broadly, regulators did one of three things when confronted with a request to recover the amounts invested in a failed project: (1) allowed full recovery, including the utility's ROE; (2) allowed recovery of the capital invested in the project, but without the utility's ROE; or (3) did not allow recovery, but instead expected investors to incur the capital cost of the project. While those make up the first three options that regulators could use, there are other options for valuing potentially stranded assets as part of this transition, especially since, at least in some cases, these assets have not been approved or are not yet in the ground

1. Recovery Including Profit

One tried and true option for regulators is to provide full recovery by including the assets in rate base. This would allow investors to receive profit on the stranded assets, even if they were no longer used and useful. Recovery for the assets and the associated profit would continue until the assets were fully depreciated.

This has happened several times in the recent past. Some utility commissions allowed full cost recovery including profit for cancelled nuclear plants.¹⁸⁶ Additionally, the Federal Energy Regulatory Commission

185. FERC allowed 100% of stranded costs associated with the transition to competitive wholesale markets. See *Order No. 88*, FED. ENERGY REGUL. COMM'N. (last updated Aug. 5, 2020), <https://www.ferc.gov/industries-data/electric/industry-activities/open-access-transmission-tariff-oatt-reform/history-oatt-reform/order-no-888> (allowing "recovery of legitimate, prudent and verifiable stranded costs associated with providing open access and Federal Power Act section 211 transmission services."). Some states did not. See EISEN ET AL., *supra* note 62, at 778. Initial estimates put the stranded asset value at much higher, but it ended up being closer to \$10 billion rather than \$100–200 billion. CONG. BUDGET OFF., ELECTRIC UTILITIES: DEREGULATION AND STRANDED COSTS (1998), <https://www.cbo.gov/sites/default/files/105th-congress-1997-1998/reports/stranded.pdf> (noting that estimates ranged from \$10 billion to \$500 billion, but most were in the \$100 billion to \$200 billion range). See also Richard J. Pierce Jr., *Realizing the Promise of Restructuring the Electricity Market*, 40 WAKE FOREST L. REV. 451 (2005) (discussing demonstrated benefits and suggesting continued improvements in restructured markets). One of the main differences between the two is that, with deregulation/restructuring, the decision which required the stranded asset calculation was made long after the investments had been used and useful.

186. See U.S. ENERGY INFO. ADMIN., *supra* note 184, at 39, 44–45 ("If these four conditions are met, the costs of an abandoned project are considered to have been prudently incurred and eligible for recovery from ratepayers. Generally, there is little debate over the prudence of the decision to build the plants because when most of these plants were planned, nuclear power appeared to offer the cheapest source of baseload electricity . . . Finally, by the time a plant is cancelled, it is usually clear that the cancellation decision was sound, but there is often debate over whether the plant should have been cancelled sooner. If the commission determines that a unit should have been cancelled sooner, given the information available to the utility's management, the costs incurred after the prudent cancellation date are disallowed. Such costs are borne by the utility investors (predominantly the common shareholders) and by income taxpayers" and listing instances of where full recovery was allowed).

(“FERC”) allowed full recovery including profit for assets that it set rates for during the restructuring of the electric industry.¹⁸⁷

Of course, the major point against including stranded assets in the rate base is that they would no longer be in service, and therefore not actually providing a benefit to ratepayers. The question then becomes whether investors should still be allowed to profit on those assets.¹⁸⁸ As noted, “[a]dherence to the . . . insistence on the inclusion of prudent investments in the rate base would virtually insulate investors in public utilities from the risks involved in free market business. This would drastically diminish protection of the public interest by thrusting the entire risk of a failed investment onto the ratepayers”¹⁸⁹

2. Capital Recovery Not Including Profit

A second option for treating stranded assets is allowing investors to recover their undepreciated capital costs in the system but not provide a profit on that capital. This could be accomplished by not including these assets in the rate base, but by allowing recovery through amortization over a set period as part of a utility’s expenses.¹⁹⁰

This regulatory treatment also occurred for cancelled nuclear plants.¹⁹¹ A challenge with this treatment occurs if the stranded assets have been used and useful, and therefore are included in rate base, before they become stranded. If that is the case, regulators would need to move the stranded assets out of the rate base. Treatment for new assets using this method would, therefore, likely be easier than for existing assets.

3. Disallowing Recovery/Finding Investments Imprudent

A third treatment of stranded assets could be finding the capital spending imprudent, and therefore disallow any recovery. This would both require the shareholders to be responsible for any capital spending that occurred and would not provide a profit from ratepayers for the capital spent on the asset.

187. See *Order No. 888*, *supra* note 185 and accompanying text.

188. See EISEN ET AL., *supra* note 62, at 776–77 (discussing that investors have been compensated at sufficient levels to cover the risk of stranded assets and that investors are not protected from regulatory change). The current average ROE is around 10%, although it varies. See Heather Payne, *Public (Utility) Regulators*, 50 *Env’t. L.* 999 (2021).

189. EISEN ET AL., *supra* note 62, at 482.

190. U.S. ENERGY INFO. ADMIN., *supra* note 184, at 40–43.

191. *Id.* at 44–45 (showing list of nuclear plants that had costs amortized and over what period of time).

This option also occurred for cancelled nuclear plants.¹⁹² As with the second option, the challenge with this treatment is if the stranded assets have been *used and useful*, and therefore included in rate base, prior to them becoming stranded. As with the above option, regulators would need to move the stranded assets out of the rate base to utilize this option, making this option easier for new assets rather than existing assets.

4. Accelerated Depreciation

This option, along with securitization,¹⁹³ is seeing significant use with regulated coal assets.¹⁹⁴ Regulators are seeing significantly more industry requests for the use of accelerated depreciation to address coal assets which are having shorter lives based on decarbonization plans than originally forecast.¹⁹⁵ One state, California, has agreed to only use this option for coal plants that have firm retirement dates, ensuring that the greenhouse gas and criteria air pollutant emissions will cease by that date.¹⁹⁶ One utility, Duke Energy, has proposed accelerated depreciation for its natural gas assets.¹⁹⁷

5. Securitization

Securitization is relatively new for electric utilities. It allows the value of the stranded asset to be converted into a bond which can be sold in the

192. *Duquesne Light Co v. Barasch*, 488 U.S. 299, 301–02 (1989) (rejecting a Takings Clause challenge to a state statute under which the costs of cancelled nuclear plants were excluded from utility rates).

193. See *infra* Section III.A.5.

194. For an in-depth analysis of potential regulatory treatment of accelerated depreciation, see Tracey M. Roberts, *Stranded Assets and Efficient Pricing for Regulated Utilities: A Federal Tax Solution*, 11 COLUMBIA J. TAX L. 1 (2020). RMI has also suggested this as an option for new natural gas plants, suggesting that regulators “requir[e] accelerated amortization schedules that reflect the limited economic life of new gas-fired power plants.” CHARLES TEPLIN ET AL., *THE GROWING MARKET FOR CLEAN ENERGY PORTFOLIOS*, ROCKY MOUNTAIN INST. 12 (2019).

195. See, e.g., Southwestern Public Service Company’s Notice of 45-Day Update as Required by PURA § 36.112 and the Rate Filing Package at 2–3, Application of Southwestern Public Service Company for Authority to Change Rates, No. 49831 (2019) (requesting the Commission approve their proposed depreciation study and resulting depreciation rates, including shorter service lives for the Tolk Generating Station Units 1 and 2).

196. Decision on Test Year in 2019 General Rate Case *In the Matter of Application of PACIFICORP*, Decision 20-02-025, at 3 (Cal. Pub. Utilities Comm’n. Feb. 6, 2020), 2029https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M327/K565/327565618.PDF. See also Jeff Stanfield, *California Regulators Order PacifiCorp to Commit to Coal Plant Retirements*, S&P GLOBAL (Feb. 7, 2020), <https://www.spglobal.com/platts/en/market-insights/latest-news/coal/020720-california-regulators-order-pacificorp-to-commit-to-coal-plant-retirements>.

197. Catherine Morehouse, *Utilities Don’t See Stranded Assets as a Top Risk. Should They?*, UTIL. DIVE (Feb. 14, 2020), <https://www.utilitydive.com/news/utilities-dont-see-stranded-assets-as-a-top-risk-should-they/572246/>.

market.¹⁹⁸ By guaranteeing that the amount needed to pay off the bond will be allowed in rates and dedicated to debt service, regulators can create a low-risk instrument that will then likely carry a relatively low interest rate.¹⁹⁹ From a utility's perspective, securitization finalizes the value of the stranded assets and makes it impossible to change the treatment of the assets later.²⁰⁰ As one utility spokesman described it, it is the equivalent of "a rapid mortgage payoff in which utility investors forsake profits they otherwise might have made on the property."²⁰¹

Like accelerated depreciation, securitization has been used recently for coal plants that are being shut down as uneconomical, most visibly in New Mexico²⁰² and Wisconsin.²⁰³ It has also been proposed for coal plants in

198. Esther Whieldon et al., *Holes Remain in US Power Companies' Plans to Achieve Net-Zero Carbon Emissions*, S&P GLOBAL MARKET INTEL. (Nov. 11, 2019), https://www.spglobal.com/marketintelligence/en/news-insights/trending/gFEkONxlUSs3gJoOIQuu_g2 (noting how one option for cutting emissions from natural gas plants for utilities is to "take a page from their playbook for coal-fired retirements . . . by selling bonds that are paid off by ratepayers").

199. Regulatory Assistance Project, *Securitization: In Search of the Proverbial Free Lunch*, RAP ONLINE ISSUES LETTER (July 1, 1997), <https://www.raponline.org/wp-content/uploads/2016/05/rap-issuesletter-securitization.pdf>.

200. *Id.*

201. Morgan Lee, *New Mexico Utility Regulators Weigh Costs of Coal Phase-Out*, AP NEWS (Dec. 9, 2019), <https://apnews.com/article/c871ab9a93724cb33ece40ffbec42cbf>.

202. *See, e.g.*, Final Order on Request for Issuance of Financing Order, *In the Matter of Public Serv. Co. of New Mexico's Abandonment of San Juan Generation Station Units 1 and 4*, No. 19-00018-UT (N.M. Pub. Reg. Comm'n. Apr. 1, 2020). "New Mexicans 'have seen rate increases with fossil fuel-heavy portfolios . . . Because of expenditures for new solar and wind, rate increases cannot be ruled out, but they would be much steadier, slower, more manageable. And, with securitization for coal plant closures, rate increases will be lower than they would have been.' . . . Reduced interest rates will allow a \$4.7 billion investment in wind, solar, storage and natural gas replacement resources and potentially save the average residential customer over \$7 per month . . ." Herman K. Trabish, *The Unknown Costs of a 100% Carbon-Free Future*, UTIL. DIVE (Sept. 3, 2019), <https://www.utilitydive.com/news/the-unknown-costs-of-a-100-carbon-free-future/561639/>.

203. *See, e.g.*, Financing Order, *Application of Wisconsin Electric Power Co. for a Financing Order*, Docket No. 6630-ET-101 (Pub. Serv. Comm. Wis. Nov. 17, 2020). *See also* Chris Hubbuch, *We Energies Agrees to Lower Rate Hike, Forgo Some Profit on Shuttered Coal Plant*, WIS. STATE J. (Aug. 28, 2019), https://madison.com/wsj/business/we-energies-agrees-to-lower-rate-hike-forgo-some-profit/article_9429f348-bd95-5fa3-8ecd-f6b7267d3124.html ("WEC will use a 2003 law to refinance about \$100 million of its investment in the Pleasant Prairie coal-fired plant, which was shut down in 2018 because it was losing money. WEC would be allowed to continue earning a profit on about \$151 million of its investment."). Interestingly, the Sierra Club is using the decision to retire Pleasant Prairie and securitize part of the cost as a reason to question whether the remainder of the utility's coal plants should also be retired early as a potential cost-saving measure for ratepayers. *See* Sierra Club's Notice of Opposition to Proposed Settlement Agreement, *Application of Wisconsin Electric Company and Wisconsin Gas LLC for Authority to Adjust Electric, Natural Gas, and Steam Rates*, Docket No. 5-UR-109 (Pub. Serv. Comm'n. Wis. Sept. 30, 2019).

Kansas.²⁰⁴ While the action to use securitization was legislative in New Mexico and regulators appear to not be embracing its use,²⁰⁵ “regulators in Wisconsin have defended its use as ‘protecting customers from paying excessive rates’ stemming from the costs of obsolete investments.”²⁰⁶ North Carolina has recently approved securitization to be used for storm-related costs.²⁰⁷

Securitization could work in multiple ways. Especially where the utility needing the securitization is a gas-only utility, investors may be uncomfortable with accepting company-issued debt, even with that debt guaranteed by ratepayers. Another option would be for the securitized debt to be offered by the state, again with a note that the bond is guaranteed from all utility ratepayer funds (rather than general taxing authority). For combined gas and electric utilities, separate debt issued by the utility should be sufficient, again with the explicit understanding that the debt will be paid for by captive ratepayers and that the public utility commission in the state will allow those costs to be passed through for the duration of the bond.

6. *Committed Decommissioning*

If new assets are needed, another option for regulators is to establish committed decommissioning—essentially, regulators and the utility agree upon the end date of service at the point that the line is approved through a rate case or put into service. The regulatory equivalent of a sunset clause,

204. See Notice of Filing of Rate Study, *In the Matter of a General Investigation Regarding the Rate Study and Assessment Expenses Resulting from Substitute for Senate Bill No. 69*, Docket No. 20-GIME-068-GIE (State Corp. Comm. Kan. Jan. 8, 2020). See also Matthew Bandyk, *Kansas Considering Securitization for Aging Coal Plants, But Caution Urged*, UTIL. DIVE (Jan. 14, 2020), <https://www.utilitydive.com/news/kansas-considering-securitization-for-aging-coal-plants-but-caution-urged/570350/>.

205. While legislation allowing securitization of the utility’s coal assets helped minimize opposition, regulators are currently potentially attempting to bypass the legislation. Catherine Morehouse, *New Mexico Regulators Attempt to Bypass San Juan Securitization, to PNM’s Surprise*, UTIL. DIVE (July 12, 2019), <https://www.utilitydive.com/news/new-mexico-regulators-attempt-to-bypass-san-juan-securitization-to-pnms-s/558641/>.

206. See Final Decision, *Joint Application of Wisconsin Electric Power Co. and Wisconsin Gas LLC for Authority to Adjust, Electric, Natural Gas, and Steam Rates*, Docket No. 5-UR-109, at 51 (Pub. Serv. Comm’n. Wisc. Dec. 19, 2019); see also Chris Hubbuch, *Sierra Club: Shuttering Coal Plants Could Save Ratepayers \$138M a Year*, WIS. STATE J. (Aug. 29, 2019), https://madison.com/news/local/environment/sierra-club-shuttering-coal-plants-could-save-ratepayers-m-a/article_d5f6ca64-c50c-57b3-94f8-06b867cb0dc4.html.

207. See Senate Bill 559, Gen. Ass. of North Carolina, <https://www.ncleg.gov/Sessions/2019/Bills/Senate/PDF/S559v7.pdf>. See also Catherine Morehouse, *North Carolina Eliminates Controversial Duke Multiyear Rate Plan from Energy Legislation*, UTIL. DIVE (Oct. 31, 2019), <https://www.utilitydive.com/news/north-carolina-eliminates-controversial-duke-multiyear-rate-plan-from-energ/566246/>.

new affirmative legislative action would need to be taken to keep the asset in service longer.²⁰⁸

The benefit of this regulatory treatment would be two-fold. First, it would provide clarity and certainty to the investor and regulated community about how long the asset could be in service, allowing for a greater upfront consideration of cost and risk. Second, it would minimize any change for additional ratepayer costs for the assets being stranded, provided that the committed decommissioning date was a reasonable one and not farther in the future than what would be required for transition purposes.

This could also be used for existing assets—provided assets are currently fully depreciated or would be fully depreciated by the committed decommissioning date—and for utilities requesting upgrades or other capital be spent that would ordinarily have a longer life than when the regulator would want to decommission the asset.

7. *Abandonment Proceedings*

Regulators could also look to abandonment proceedings, which are currently used when a utility no longer wishes to serve part of its assigned geography.²⁰⁹ Typically, this occurs because a certain group of customers is no longer profitable for the utility to serve, in some cases because the capital required to be put into the system to serve those customers is unreasonable.

Of course, the difference with abandonment proceedings is that the utility is typically the one requesting it and, therefore, is interested in shutting down the system.²¹⁰ However, as utilities have a duty to serve, they must typically make provisions to move affected ratepayers off that service.²¹¹ This can be done through incentives, including outright replacements of appliances that utilize the service that will disappear.

208. See Rebecca M. Kysar, *Dynamic Legislation*, 167 U. PA. L. REV. 809, 825 (2019) (referring to sunset clauses as a type of “prompting” instrument designed to induce later legislative or regulatory action).

209. See, e.g., *Weinstock v. NRG Energy Center Harrisburg LLC*, No. A-2011-2239521, 2012 WL 6087495 Penn. Pub. Utilities Comm. issued Sept. 13, 2012) (approving joint petition for settlement); Pennsylvania Public Utility Commission, Docket No. C-20032233 (UGI Utilities, Inc. – Gas Division, Statement of the Office of Consumer Advocate in Support of the Joint Stipulation in Settlement of Consolidated Proceedings).

210. Cynthia B. Hall, *Regulatory Considerations on Debt Securitization Financing*, N.M. PUB. REGUL. COMM’N. (2013), <https://www.nmlegis.gov/handouts/WNR%20072618%20Item%206%20Regulatory%20Considerations%20on%20Securitization%20Financing.pdf> (noting that utilities cannot expect guaranteed recovery of costs where service has been abandoned).

211. See generally Jim Rossi, *The Common Law “Duty to Serve” and Protection of Consumers in an Age of Competitive Retail Public Utility Restructuring*, 51 VANDER. L. REV. 1233, 1257 (1998) (“Related to the duty to extend service is its opposite: an obligation to continue with existing service once it has commenced, or negative restrictions on the abandonment or termination of service.”).

At a minimum, regulators should use abandonment proceedings to require electric alternatives when abandonment of natural gas or steam is proposed (rather than propane or another fossil fuel solution). Additionally, as the likely outcome of the energy transition is more electrification, regulators should obviously not allow abandonment proceedings for electric service. Further, regulators could look at the incentives typically offered in abandonment proceedings as a starting point if they determine to shut down the natural gas system piecemeal.

Regulators could also use abandonment proceedings to stop the expansion or re-build of the natural gas distribution system. As noted, utilities have a duty to serve. They must provide customers with service on a non-discriminatory basis everywhere within their state-sanctioned monopoly service territory. However, it may not make sense for new service to be run into parts of the service territory, or to rebuild parts of the system in cases of significant natural disaster (flooding, wildfires, etc.). In those cases, the utility commission may want to work with the utility to proactively “abandon” those areas—making it so that those assets will not be stranded in the future. For areas that have not had installation of natural gas distribution infrastructure this would focus on incenting use of electric appliances and all-electric home buildout. For those areas that have suffered from a disaster where residents rebuilding may want to utilize natural gas, the commission would want to determine what the residents would want to use natural gas for, and then treat the situation similarly to more traditional abandonment proceedings, providing appliances and incentives which will enable that part of the natural gas distribution system to remain turned off.

8. Market Responses

While not compatible with all options for shutting down the natural gas system, another way for regulators to think about the system is to set up a trading regime for natural gas connections, at least as long as they are available. Rather than, for example, banning new construction from having a gas connection completely, every current meter in the system could become a tradeable commodity. If a building under construction would want a gas connection, that new building would need to find someone willing to completely remove their meter of equivalent or larger size. Ownership of that meter would then be transferred, and the gas connection at the supplying building would be terminated. No additional gas meters could be entered into the system.

This solution is a bit like owning a taxi medallion. A taxi medallion is a license which enables taxi drivers to provide a specific service; it can be

bought, sold, and used as collateral.²¹² The connection—like the medallion—will increase in value until, at some point in the future, the value collapses.²¹³ The collapse will occur when alternatives (like Uber and Lyft, in our taxi example) are better than the existing infrastructure (natural gas connection/taxi). While we have markets for any number of things in environmental law,²¹⁴ the main draw toward a market solution is that it will minimize cost.²¹⁵ This treatment, along with others, could enable a quicker transition under a restriction by application scenario by providing the capital for non-cooking uses to electrify using private funding.

This could have multiple benefits. Rather than make exceptions (as some cities, noted above, have done for cooking),²¹⁶ this would enable residents and businesses with existing connections to determine how much it would be worth to them to change appliances. Therefore, a resident with only a gas hot water heater could be paid the amount equivalent for an installed new, high-efficiency electric heat pump hot water heater. In exchange, someone who was building new and who wanted a gas range could have that meter.

9. Cross-subsidization

Regulators work very hard to ensure that there is no cross-subsidization within the system. For example, regulators try to avoid having industrial customers' payments supporting infrastructure that serves residential customers.²¹⁷ Regulators have historically also kept a firewall between the

212. Thompson S.H. Teo, et al., *The Rise and Fall of Taxi Club Management in New York*, 20 INFORMS TRANSACTIONS ON EDUC. 28 (2019).

213. Speculation did occur in the market for taxi medallions, leading in some cases to tragic consequences when the medallions lost value. Annie McDonough, *Taxi Medallion Owners Are Still Drowning under Bad Loans*, CITY & STATE N.Y. (Sep. 18, 2020), <https://www.cityandstateny.com/articles/politics/new-york-city/taxi-medallion-owners-are-still-drowning-under-bad-loans.html>. While speculation in natural gas connections might occur, this would increase the price of natural gas and would therefore further incent electrification.

214. Michael Pappas & Victor B. Flatt, *The Costs of Creating Environmental Markets: A Commodification Primer*, 9 U.C. IRVINE L. REV. 731 (2019). Sulfur dioxide (acid rain), wetlands impacts, and nitrogen and phosphorous runoff (nutrient pollution) to name a few. *Id.*

215. This is also true in the decarbonization space. See Danielle Spiegel-Feld, *Local Law 97: Emissions Trading for Buildings?*, 94 N.Y.U. L. REV. ONLINE 148, 168 (2019) (proposing to use the lessons learned from industrial trading programs to building decarbonization).

216. See *supra* note 144–149 and accompanying text.

217. This is not to say that cross-subsidization does not already happen. It does. It costs far more to supply a rural customer with electricity than an urban one, and if they are part of the same utility, they will probably be charged the same rates—as they are both part of a residential customer class. But regulators try to minimize these costs and benefits between customer classes. See generally Jim Lazar, *Dividing the Pie: Cost Allocation, the First Step in the Rate Design Process*, REGULATORY ASSISTANCE PROJECT (2016).

electric and gas parts of the same utility—even when the service territories are the same.

Through this transition, regulators may find that the best way to address winding down the natural gas distribution system is to allow some degree of cross-subsidization between electric and gas utilities, especially where they are part of the same parent company and have largely overlapping service territories.²¹⁸ This is the case because of what is happening on the ground. As applications within the home switch from natural gas to electric, the usage on the electric system—likely both from a capacity and a volumetric perspective—will increase.²¹⁹ Therefore, regulators could work with utilities that have both natural gas and electric infrastructure and customers—with both the utilities and regulators recognizing that as capital and customers are driven off the natural gas system—in increasing the long-term health and viability of the electric side of the utility. Some form of a “grand bargain” could then be reached. However, with gas-only utilities, of course, this will not be possible—there will be no upside. For regulators, therefore, gas-only utilities may be much harder to address, specifically because of the lack of any possibility for cross-subsidization.

B. Assets Already In the Ground

As noted with some of the options listed above, treatment of assets already in the ground may be different than those approved after a state determines a date for partial or full decarbonization. When assets have already been used and useful and have already been included in rate base, it would be highly unusual to remove them from the rate base and then treat them differently (for example, with no compensation). While it could be done, investors would likely need an understanding of whether this was going to become commonplace with every switch in technology or whether regulators viewed this as a one-time occurrence based on a looming unprecedented global catastrophe.

Although highly unusual, it has been done before. The San Onofre Nuclear Generating Station (“SONGS”) was shut down unexpectedly in

218. The utilities themselves may want that as well. Jeff St. John, *PG&E Gets on Board with All-Electric New Buildings in California*, GREENTECH MEDIA (June 26, 2020), <https://www.greentechmedia.com/articles/read/pge-gets-on-board-with-all-electric-new-buildings-in-california> (“Pacific Gas & Electric has become the first combined natural gas and electric utility in California to express support for an emerging plan to require ‘efficient, all-electric new construction’ in the state, telling regulators that it wants to ‘avoid investments in new gas assets that might later prove underutilized’ under the state’s long-term decarbonization goals.”).

219. Justin Gerdes, *‘Electrification of Everything’ Would Spike US Electricity Use, but Lower Final Energy Consumption*, GREENTECH MEDIA (July 30, 2018), <https://www.greentechmedia.com/articles/read/widespread-electrification-could-increase-u-s-electricity-consumption>.

2013, before the end of its expected operating life.²²⁰ The undepreciated value of the plant in rate base was removed from the rate base, moved to a separate account, and a lower rate of return was realized on that capital.²²¹ Similar regulatory treatments could happen with natural gas distribution systems.

That said, it is likely that regulators would use a more cautious treatment of assets currently in the ground—some combination of leaving them in rate base until fully depreciated, accelerated depreciation, securitization, pulling them out of the rate base (as with SONGS) and applying a different rate of return, or committed decommissioning for new expenditures on the existing system. Recovery of capital without profit could be another treatment for new expenditures on the existing system.

There are several reasons regulators may want to choose a more traditional or conservative treatment for assets already in the ground. The first is investor expectations. Investors have very different expectations before and after a political or regulatory decision is made to stop the household uses of natural gas. Before that legislative, executive, or regulatory decision, investors could (however implausibly) claim that they expected the assets going into the ground now to be used and useful until the end of their natural (material-based) lives.²²² After that decision is made, investors can no longer claim that as an expectation.

Regulators might also choose one of these more traditional treatments for assets already in the ground in order to incent natural gas system owners to maintain the safety of the system. As safety is of paramount importance, allowing investors to recoup the capital put into improving natural gas system infrastructure before deciding to shut it down would encourage a continued focus on the safety of existing distribution systems..

220. *San Onofre Nuclear Generating Station*, WIKIPEDIA (last updated Apr. 27, 2021) https://en.wikipedia.org/wiki/San_Onofre_Nuclear_Generating_Station (discussing capital improvements that were completed on Unit 2 in 2009 and Unit 3 in 2011 and were intended to operate until at least 2022 when the plant's current operating license expired). "The \$680 million upgrade was supposed to add up to 40 years to the life of the plant." Jeff McDonald, *Utility Customers Win \$775 Million back from San Onofre Deal Criticized as Lopsided Against Them*, SAN-DEIGO UNION TRIBUTE (Jan. 30, 2018 8:00 PM PST), <https://www.sandiegouniontribune.com/news/watchdog/sd-me-settlement-deal-20180130-story.html>.

221. Settlement Agreement Between Southern California Edison Company, San Diego Gas & Electric Company, The Office Of Ratepayer Advocates, & The Utility Reform Network (Cal. Pub. Utilities Comm'n Mar. 27, 2014), <https://www.sec.gov/Archives/edgar/data/86521/000008652114000017/ex991.htm>.

222. I say implausibly because, as states adopt economy-wide zero-carbon goals, it should be obvious that this includes household uses moving away from fossil fuels, including natural gas. The IPCC reports have also provided ample warning that fossil fuel infrastructure might become stranded, and not able to be used for its entire natural life.

Of course, in situations where it becomes obvious that capital investments were imprudent when made (and it could be shown that the utility was aware of that), it is also likely that customer advocates may request rate proceedings to be reopened.²²³ If it can be shown that utilities kept information away from regulators or the public which would have led to a different rate outcome, the lack of disclosure may warrant a different treatment.²²⁴

C. Investment Starting Now

For new investments in the system, the treatment could be very different than for assets already in the ground. The first way to decrease the potential for stranded assets is to not have the investment occur in the first place. For the existing system, as mentioned previously, that can be difficult due to safety considerations. For potential expansions of the natural gas distribution system, however, the best strategy might be to not allow them at all.²²⁵

Marbletown, New York, for example—having never been connected to a natural gas supply line—has been able to “to cost-effectively leapfrog to all-electric buildings, in the same way many countries in Africa were able to leapfrog over the installation of costly telephone infrastructure when wireless phones became available.”²²⁶ Parts of northern New England, “which lacks widespread gas infrastructure,” could do the same.²²⁷ Berkeley, California, recently banned natural gas infrastructure in new low-rise residential buildings starting in 2020, and all new buildings must be ready for full

223. For example, with SONGS, there was additional litigation around the prudence of the settlement, which ended up having money returned to customers. See McDonald, *supra* note 220.

224. The lack of transparency around lobbying efforts by natural gas companies could become an issue in the future depending on how regulators end up treating new assets.

225. This has also already started to happen with electricity generation. Minnesota recently rejected Xcel purchasing a natural gas plant out of concerns that ratepayers would be left with “hundreds of millions of dollars in stranded asset costs” if the plant’s “capacity was deemed unnecessary earlier than anticipated.” Catherine Morehouse, *Minnesota Rejects Xcel’s 720 MW Mankato Gas Plant Purchase over Stranded Asset Concerns*, UTIL. DIVE (Oct. 1, 2019), <https://www.utilitydive.com/news/minnesota-rejects-xcels-720-mw-mankato-gas-plant-purchase-over-stranded-as/564029/>. This is also true of new plants. According to an RMI analysis:

[E]conomic trends imply significant risk for gas project investors. If gas generators are cost-effectively replaced by [clean energy portfolios] at a cost savings to customers, investors will be unable to meet the revenue targets needed to pay off the remaining gas plant book value and may not be able to cover outstanding debt or provide return on equity to investors. If planned projects are built, investors will likely face tens of billions of dollars’ worth of stranded assets in the 2030s

Charles Teplin et al., *supra* note 194, at 9.

226. See Tom Konrad, *A Small New York Town Plans a Profitable 100% Renewable Energy Future*, ALTERNATIVE ENERGY STOCKS (Feb. 21, 2019), <http://www.altenergystocks.com/archives/2019/02/a-small-new-york-town-plans-a-profitable-100-renewable-energy-future/>.

227. Storrow, *supra* note 6.

electrification.²²⁸ Sacramento Municipal Utility District (“SMUD”)—the municipal utility for Sacramento, California—has partnered with D.R. Horton to build 104 all-electric homes, with no natural gas infrastructure in two new subdivisions.²²⁹ In total, “nine large developers are building [four hundred] all-electric homes in SMUD territory over . . . [twenty-four] months.”²³⁰ Unlike the government of the United Kingdom, which has announced plans to end fossil fuel heating in new houses starting in 2025, the United States has not widely adopted plans to stop utilizing natural gas.²³¹ Additional plans are being made to continue electrification efforts, or to speed them up.

In some states, an ongoing question is whether there will be natural gas hookups available. Rather than expand the fossil fuel infrastructure with new pipelines—which state leaders know is antithetical to their stated climate goals—New York has thwarted additional pipeline buildout.²³² In parts of New York, where National Grid has refused new service due to supply constraints, new buildings exemplify how others can electrify. For one developer, “[i]nstead of gas, electricity will be now used for heating in the [115 flat] building, backstopped by a diesel generator”²³³

However, eliminating additional capital input into the natural gas system may not always be an option. Indeed, how regulators want to treat new assets may depend on which option they determine is best for shutdown. For a system that is shut down all at once, for example, committed decommissioning with the decommission date being that date the system will be shut down could be the best option. For systems that will be shut down by application, a market approach might make the most sense. A system

228. Musulin, *supra* note 181. The ban does not apply to renovations. *Id.*

229. Justin Gerdes, *All-Electric Homes are Becoming the Default for New Residential Construction in Sacramento*, GREENTECH MEDIA (Nov. 13, 2018), <https://www.greentechmedia.com/articles/read/all-electric-homes-are-becoming-the-default-for-new-residential-constructio#gs.sdqklr>. The homes include “heat pump space heating and cooling, heat pump water heating, induction stoves.” *Id.*

230. *Id.*

231. See COMMITTEE ON CLIMATE CHANGE, UK HOUSING: FIT FOR FUTURE? 9 (2019). See also Rachel Cooper, *UK Government Announces End of Fossil Fuel Heating Systems in New Houses from 2025*, CLIMATE ACTION (Mar. 13, 2019), http://www.climateaction.org/news/uk-government-announces-end-of-fossil-fuel-heating-systems-in-new-houses-fr_. Interestingly, the report that the action was based on “recommended that by 2025, no new homes should connect to the gas grid.” *Id.*

232. Vivian Wang & Michael Adno, *New York Rejects Keystone-Like Pipeline in Fierce Battle over the State’s Energy Future*, N.Y. TIMES (May 15, 2019), <https://www.nytimes.com/2019/05/15/nyregion/williams-pipeline-gas-energy.html>.

233. Gregory Meyer & Nathalie Thomas, *After State Rejects Gas Pipeline Permit, Utility Pushes Back. One Result: New Buildings Go Electric.*, INSIDE CLIMATE NEWS (Sept. 9, 2019), <https://insideclimatenews.org/news/09092019/natural-gas-pipeline-rejected-new-york-climate-change-national-grid-wililams-electrification>.

which is shut down by source may end up with no stranded assets. Industrial customers who want to use the limited renewable gas available would pay for the full upkeep of the system, with no cost recovery available on the portion of the system that is deactivated and no longer serving customers who have elected to discontinue gas service.

Moving forward, regulators could treat similar classes of assets differently. This would enable proper regulatory treatment based on what we currently know needs to happen to quickly transition and minimize warming of the planet. For example, regulators could maintain separate sets of books—intentionally—essentially starting a new ledger for any investments made after the decision to transition away from the natural gas system. Rates charged for projects developed after a new paradigm was approved and maintained in a separate account would ensure that those funds would only be used to retire the assets, leaving no stranded costs to be paid by the ratepayers for those projects. The funds would not be accessible to be used, for example, for other, existing parts of the distribution network.

As regulators think about how to address the current investment in natural gas infrastructure, the utilities' arguments around solar power purchase agreements ("PPAs") may also be instructive. Duke Energy has argued "that longer contracts are bad for ratepayer interests, locking them into longer term rates when energy prices are subject to fluctuations."²³⁴ The same could be said to be true for technology and infrastructure—so where "10 years is reasonable"²³⁵ for the duration that ratepayers would be expected to purchase electricity at a price agreed upon today, regulators could mandate that any investment in gas infrastructure also be recouped in the same period of time. This would ensure three things: (1) that ratepayers are not left with stranded costs; (2) that financial considerations around stranded costs do not slow the transition to lower carbon generation; and (3) that risk is reduced if the transition to a completely carbon-free society worldwide has to happen even more quickly than currently anticipated.

Some utilities are already doing something similar. For example, [Arizona Public Service] has also pursued ways to procure capacity from merchant gas plants in shorter time increments . . . like seven years instead of 20. That allows the utility to get capacity it needs in the short term, without committing to an unnecessary expense in the long run.²³⁶

234. Catherine Morehouse, *South Carolina Compromises on PURPA Contracts, Eliciting Duke Support for Pro-Solar Bill*, UTIL. DIVE (May 2, 2019), <https://www.utilitydive.com/news/south-carolina-compromises-on-purpa-contracts-eliciting-duke-support-for-p/553895/>.

235. *Id.*

236. Julian Spector, *Arizona Regulators Freeze New Gas Plants, Demand More Clean Energy Planning From Utilities*, GREENTECH MEDIA (Mar. 16, 2018),

Regulators could adopt a similar rule, and only approve projects that will not be charged to ratepayers after a certain date—2030, for example, or 2035. This would essentially put an “expiration date” on the project at the outset—the date when that project would be expected to be taken out of service or at least would no longer be charged to ratepayers. If the financials would not support the project for that limited duration, regulators could either find another path to meet that specific need, or seriously question whether the project should go forward at all.²³⁷

D. Utility Responses

As could be expected, the natural gas industry has not taken lightly to calls for its demise. Responses have included calls for the maintenance of customer choice, suggestions of how the industry is actually part of the solution, arguments based on cost and economic development, and astroturfing. At least one utility has declared that they support the transition but has been found actively working against it behind the scenes,²³⁸ and a leaked joint utility slide deck focused on “fear-driven tactics such as ‘take advantage of power outage fear,’ to make people wary of electrification.”²³⁹ The largest gas association has declared that maintaining natural gas infrastructure a “battle” that requires them to “marshal boots on the ground.”²⁴⁰

<https://www.greentechmedia.com/articles/read/arizona-regulators-freeze-new-gas-plants-renewables-planning#gs.rxakfq>.

237. One estimate is that a major pipeline “may need at least a potentially unworkable 30 plus-year period for a sufficient capital repayment and return on investment.” Kalen, *supra* note 60, at 321. Given the immediacy of the need for an energy transition, pipelines constructed after 2020—and even some constructed then—may not have 30 years in service. While not the focus of this Article, regulators should also be putting the same focus on gas supply contracts that utilities are signing. Gas distribution companies are often the primary contract holder for new pipeline capacity, even though electric generators are increasingly the largest users of pipelines, because gas distribution companies resell their capacity rights to generators. Gas utilities rely on these revenues to keep costs low for their customers; a loss of revenue in the secondary market due to falling power sector demand will effectively raise the price paid by captive gas customers. Gas utility regulators considering proposed gas utility positions in new pipeline capacity should carefully assess the risks imposed on customers if expected electric sector demand fails to materialize, and allocate risks and incentives accordingly. MARK DYSON, GRANT GLAZER & CHARLES TEPLIN, ROCKY MOUNTAIN INST., PROSPECTS FOR GAS PIPELINES IN THE ERA OF CLEAN ENERGY 12 (2019), <https://rmi.org/insight/clean-energy-portfolios-pipelines-and-plants>.

238. *A Leading US Utility Stealthily Fights the Electrification of Heating Systems*, YALE ENVIRONMENT 360 (May 4, 2021), <https://e360.yale.edu/digest/a-leading-u-s-utility-stealthily-fights-the-electrification-of-heating-systems>.

239. Natalie Karas, *4 Opportunities for Gas Utilities to Accelerate the Energy Transition Today*, POWERGRID INT’L (May 24, 2021), <https://www.power-grid.com/executive-insight/4-opportunities-for-gas-utilities-to-accelerate-the-energy-transition-today/>.

240. Tom DiChristopher, *AGA Takes Steps to Counter Gas Bans, State Opposition to Pipelines*, S&P GLOB. MKT. INTEL. (Jan. 27, 2020), <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/aga-takes-steps-to-counter-gas-bans-state-opposition-to-pipelines->

The customer choice frame is a common one, which was also used in the Trump Administration's rollback of lightbulb efficiency standards.²⁴¹ "Let's preserve the choice for consumers that also meet our objectives, that also meet affordability and energy security."²⁴² As the American Gas Association chief executive has said, "[t]he average American likes choice and doesn't want to be told what kind of fuel to use in their homes."²⁴³ Regulatory filings from SoCalGas also state than limiting natural gas use "usurps customer choice."²⁴⁴ The most commonly noted way that this would work is renewable natural gas.²⁴⁵

Similar to the customer choice argument, the natural gas industry has argued that they are part of the solution. The American Petroleum Institute, for example, launched "an advertising campaign portraying oil and gas energy as a way to combat climate change . . . The campaign touts oil and gas energy as a way to reduce climate change by lowering carbon levels."²⁴⁶ According to Richard Meyer, the American Gas Association's managing director of energy analysis, "renewable natural gas, made from organic waste material, and high-efficiency gas furnaces paired with weatherization initiatives also can slash greenhouse gas emissions associated with buildings."²⁴⁷ SoCalGas has lamented that regulators and environmental groups place too much emphasis on electrification rather than considering

56763558. Interestingly, in discussing mobilization, a gas executive said of locals: "When you start the conversation with so many of these groups, . . . they begin to understand that their livelihood depends on your success—in other words, their success . . ." *Id.*

241. Matthew Bandyk, *DOE finalizes rejection of Obama lightbulb efficiency standards, but excludes LEDs from analysis*, UTIL. DIVE (Dec. 23, 2019), <https://www.utilitydive.com/news/trump-administration-finalizes-rejection-obama-lightbulb-efficiency-DOE-standards/569566/>. Of course, increased energy efficiency is actually what is needed to maintain a livable world and meet the goals of the Paris Agreement. Robert Walton, *RMI: World is 'Badly Off Track' on Paris Climate Goals, Needs Heightened Focus on Energy Efficiency*, UTIL. DIVE (Nov. 19, 2019), <https://www.utilitydive.com/news/rmi-world-is-badly-off-track-on-paris-climate-goals-needs-heightened-fo/567548/> (noting that "the Trump Administration has worked to slow, hinder or roll back rules related to appliances, light bulbs, vehicle efficiency and more.").

242. Storrow, *supra* note 6.

243. *See* Mufson, *supra* note 13.

244. *See* Reply Comments Of Southern California Gas Company on Order Instituting Rulemaking Regarding Building Decarbonization 3 (Cal. Pub. Utilities Comm'n Jan. 31, 2019).

245. *Id.*

246. Rachel Frazin, *Oil and Gas Group Launches Campaign Touting its Efforts as Good for Climate*, HILL (Jan. 7, 2020, 5:16 PM), <https://thehill.com/policy/energy-environment/477213-oil-and-gas-organization-launches-campaign-to-portray-itself-as>. The advertising buy is "seven-figure[s]." *Id.*

247. Storrow, *supra* note 6.

renewable natural gas.²⁴⁸ As noted above, renewable natural gas is unlikely to be able to meet climate change or affordability goals.²⁴⁹ At a more profound level, however, there are many instances where we are allowed to choose to take specific actions. In many cases, those options are limited by regulation due to safety and health concerns. Looking at the science, the customer choice aspects pale in comparison with the harm from climate change to others—a situation where we have found regulation and requiring an activity to be ceased completely acceptable.

Perhaps because of the belief that their industry is threatened, SoCalGas has been accused of astroturfing. Astroturfing “is the attempt to create an impression of widespread grassroots support for a policy, individual, or product, where little such support exists.”²⁵⁰ In a brief filed before the California Public Utilities Commission, Sierra Club pointed to information showing how SoCalGas created, developed, and funded a non-profit group to “amplify their agenda and obfuscate the actual extent of independent stakeholder support for [SoCalGas’s] positions.”²⁵¹ SoCalGas has denied taking part in astroturfing despite this evidence to the contrary.²⁵² There is an ongoing investigation to determine whether SoCalGas has used ratepayer funds—rather than investor funds—to pay for this advocacy work.²⁵³ The company used the same non-profit group to promoted the use of fossil fuels near ports; the company’s involvement with those who publicly supported their efforts have only recently been revealed.²⁵⁴ On the other side of the country, a new report found that Dominion, Duke, and Southern Company

248. See Reply Comments of Southern California Gas Company on Order Instituting Rulemaking Regarding Building Decarbonization, Docket No. 19-01-011 (Cal. Pub. Util. Comm’n. Mar. 26, 2019); see also Times Editorial Board, *supra* note 160.

249. See *supra* notes 160–170 and accompanying text.

250. “Multiple online identities and fake pressure groups are used to mislead the public into believing that the position of the astroturfer is the commonly held view.” Adam Bienkov, *Astroturfing: What Is It and Why Does It Matter?*, GUARDIAN (Feb. 8, 2012, 10:17 AM), <https://www.theguardian.com/commentisfree/2012/feb/08/what-is-astroturfing>.

251. See Motion to Deny Party Status to Californians for Balanced Energy Solutions, *Order Instituting Rulemaking Regarding Building Decarbonization*, Docket No. 19-01-011, at 1 (Cal. Pub. Utilities Comm’n. May 14, 2019).

252. Cagle, *supra* note 163.

253. See Assigned Commissioner’s Amended Scoping Memo and Ruling for Order to Show Cause Against Southern California Gas Company at 4, Cal. P.U.C. Docket No. R.13-11-005 (Dec. 2, 2019) (directing SoCalGas to submit testimony detailing its energy efficiency codes and standards advocacy activities. See also Mark Chediak, *U.S. Gas Utility Ordered to Return Cash Used in Climate Lobbying*, BLOOMBERG L. (Apr. 22, 2021 2:31 PM), <https://news.bloomberglaw.com/environment-and-energy/u-s-gas-utility-ordered-to-return-cash-used-in-climate-lobbying> (noting that SoCalGas was found to have misused customer funds and ordering the repayment of those funds to customers).

254. Colby Bermel, *How SoCalGas Leveraged Mayors and Minority Groups to Score a Fossil Fuel Win*, POLITICO (Sep. 24, 2020 7:57 PM), <https://bit.ly/2TkCseJ>.

had spent more than \$109 million lobbying for a new pipeline.²⁵⁵ While the utilities touted a poll showing support for the pipeline, the organization that ran the poll did not disclose Dominion or other utilities as members or that it had received money from Dominion in the past.²⁵⁶ And Entergy used paid actors to voice support at a city council meeting for a new natural gas plant in New Orleans, paying up to \$200 for those who read a prepared script in support of the plant.²⁵⁷

On cost, “[t]he American Gas Association, a trade group, pointed to federal projections showing an average Northeastern home’s heating with electricity [in the winter of 2019] would cost \$1,391, compared to \$712 for heating with natural gas.”²⁵⁸ However, others who have reviewed those comparisons have disputed the validity of the assumptions used in the calculations. Despite the clear externalities of fossil fuel use, the socialized costs of fossil fuel development and use have not stopped some from pushing for its continued use, or even expansion.²⁵⁹

In the Southeast, infrastructure development has often been tied to economic development.²⁶⁰ The argument is currently being made that South

255. Frank Bass, *The \$109 Million Lobbying Effort to Run a Pipeline Through National Treasures*, HUFFPOST (Sept. 25, 2019 3:48 PM), https://www.huffpost.com/entry/atlantic-coast-pipeline-dominion-duke_b_5d8b9843e4b08d7f82bc9f07.

256. David Pomerantz, *Front Group Paid by Dominion Releases Shady Poll Showing Support for Dominion’s Atlantic Coast Pipeline*, ENERGY & POL’Y INST. (May 22, 2017), <https://www.energyandpolicy.org/front-group-cea-releases-poll-showing-support-dominion-atlantic-coast-pipeline/>. The Consumer Energy Alliance has also sent comment letters on behalf of dead people to FERC supporting pipelines among other questionable activities. *Id.* In reality, many of the comments received by FERC expressed concerns about the project. Bass, *supra* note 255. Utilities also do not confine their use to natural gas. FirstEnergy drafted supportive statements for county and school officials in Ohio around the bailout of their coal plants. Dave Anderson, *FirstEnergy Drafted Testimony for Pro-Bailout County, School Officials in Ohio*, ENERGY & POL’Y INST. (Oct. 21, 2019), <https://www.energyandpolicy.org/firstenergy-drafted-testimony/>.

257. Ivan Penn, *Natural Gas or Renewables? New Orleans Choice Is Shadowed by Katrina*, N.Y. TIMES (Nov. 8, 2019), <https://www.nytimes.com/2019/11/08/business/energy-environment/gas-power-plants.html?searchResultPosition=1>. A Sierra Club official noted that utility behavior seemed to be “about locking in as much as you can now” around natural gas plants and infrastructure. *Id.*

258. Storrow, *supra* note 6. However, for New England, “while the region has high electric rates, its strong energy efficiency programs mean electric bills are well in line with the national average.” *Id.* So, gas may not be a cheaper alternative. *Id.*

259. See, e.g., Stephen Moore, Opinion, *Natural Gas Is Crushing Wind and Solar Power—Why Isn’t Anyone Talking About It?*, FOX BUS. (Feb. 25, 2020), <https://www.foxbusiness.com/markets/natural-gas-is-crushing-wind-and-solar-power-why-isnt-anyone-talking-about-it>; Brent Alderfer, Opinion, *It’s the Roaring 20s for Renewables—Will Natural Gas Join the Party?*, UTIL. DIVE (Feb. 26, 2020), <https://www.utilitydive.com/news/its-the-roaring-20s-for-renewables-will-natural-gas-join-the-party/572655/>.

²⁶⁰260. See, e.g., *Economic Development*, TENNESSEE VALLEY AUTHORITY (last visited May 12, 2021), <https://www.tva.com/economic-development#:~:text=About%20TVA%20Economic%20Development&text=TVA%20Economic%20Development%20works%20to,grow%20in%20a%20sustainable%20way>.

Carolina needs to support the Atlantic Coast Pipeline precisely for the economic development potential it would create. Overly ambitious economic development projects can lead to sunk costs and stranded assets. Ratepayers, still paying for defunct coal and nuclear power projects, worry new natural gas infrastructure will end up also being paid for by captive utility customers.²⁶¹

Additionally, SoCalGas has also been urging city councils “to pass a resolution opposing any state regulation mandating ‘electrification’ in buildings.”²⁶² They have circulated a model resolution promoting biogas and “supporting balanced energy solutions.”²⁶³ More than 100 towns and counties have, on their request, “passed non-binding resolutions opposing any future state rule that might require electrification.”²⁶⁴ More sinisterly, the local union president for SoCalGas threatened San Luis Obispo’s city council with ignoring social distancing guidelines, emailing when the council was prepared to adopt electrification measures:

‘If the city council intends to move forward with another reading on a gas ban I can assure you there will be no social distancing in place . . . I strongly urge the city council to kick this can down the road to adhere to public health safety measures. Please don’t force my hand in bussing in hundreds and hundreds of pissed off people potentially adding to this pandemic.’²⁶⁵

Action of this type is not limited to California; utilities, unions, and the natural gas industry have opposed similar electrification goals in a village in Ohio.²⁶⁶

261. Editorial Staff, *Editorial: Will SC Need Gas Pipeline Like It Needed Abandoned Coal, Nuclear Plants?*, POST & COURIER (Oct. 19, 2019), https://www.postandcourier.com/opinion/editorials/editorial-will-sc-need-gas-pipeline-like-it-needed-abandoned/article_c152b7bc-eeca-11e9-9d6b-03db26dac483.html (noting ratepayers were charged \$242 million for development of a coal plant which was never built and \$9 billion for two partially-constructed nuclear units before the project was cancelled).

262. McKenna, *supra* note 153.

263. See SoCalGas, Model Resolution Supporting Balanced Energy Solutions and Maintaining Local Control of Energy Solutions, <https://www.documentcloud.org/documents/6536572-SoCalGas-Model-Resolution.html>; see also McKenna, *supra* note 153.

264. McKenna, *supra* note 153; see also SoCalGas, *SoCalGas Applauds More Than 100 Local Governments in Southern California that Pass Resolutions in Support of Balanced Energy Policies*, PR NEWSWIRE (Oct. 3, 2019), <https://www.prnewswire.com/news-releases/socalgas-applauds-more-than-100-local-governments-in-southern-california-that-pass-resolutions-in-support-of-balanced-energy-policies-300931093.html>.

265. Sammy Roth, *How to Stop a Climate Vote? Threaten a ‘No Social Distancing’ Protest*, L.A. TIMES (May 6, 2020, 5:00 AM), <https://www.latimes.com/environment/story/2020-05-06/socalgas-union-leader-protest-threat-no-social-distancing>.

266. Kathiann M. Kowalski, *Utilities, Gas Industry Coordinate to Oppose Ohio Village’s Clean Energy Goal*, ENERGY NEWS NETWORK (May 6, 2020), <https://energynews.us/2020/05/06/midwest/utilities-gas-industry-coordinate-to-oppose-ohio->

In addition to astroturfing, intimidation, and legislative lobbying, the natural gas industry is trying to influence consumers directly. Despite the mounting scientific evidence that cooking with gas indoors creates unhealthy levels of indoor air pollution,²⁶⁷ the American Gas Association and the American Public Gas Association are paying influencers on Instagram to use the hashtag #cookingwithgas.²⁶⁸ One gas utility has coloring books to teach children to love natural gas,²⁶⁹ and the industry has a website dedicated to millennials.²⁷⁰

In addition to the industry generally pushing specific messages, utilities are already using heating and cooking to pressure legislators and regulators to allow additional investment and pipelines. Attempting to apply political pressure and therefore obtain approval for new infrastructure, ConEd took “the extreme step of imposing a moratorium on new gas hookups in a large swath of Westchester,” saying its existing network could not satisfy increasing demand.²⁷¹ National Grid likewise indicated they would stop

villages-clean-energy-goal/ (showing emails coordinating actions against local governments by the American Gas Association, utilities First Energy and Dominion, and unions).

267. David Roberts, *Gas Stoves Can Generate Unsafe Levels of Indoor Air Pollution*, VOX (May 11, 2020, 4:52 PM), <https://www.vox.com/energy-and-environment/2020/5/7/21247602/gas-stove-cooking-indoor-air-pollution-health-risks> (quoting BRADY ANNE SEALS & ANDEE KRASNER, ROCKY MOUNTAIN INST., HEALTH EFFECTS FROM GAS STOVE POLLUTION 6 (2020)) (“One major source of indoor air pollution, it turns out, is the familiar gas stove, which relies on the direct combustion of natural gas. . . . [G]as stoves may be exposing tens of millions of people to levels of air pollution in their homes that would be illegal outdoors under national air quality standards.”). See also Johnathan Mingle, *Why Experts Are Sounding the Alarm about the Hidden Dangers of Gas Stoves*, QUARTZ (Dec. 4, 2020), https://qz.com/1941254/experts-are-sounding-the-alarm-about-the-dangers-of-gas-stoves/?utm_source=google-news%3Cspan%20id=%22ms-outlook-android-cursor%22%3E!~OMSelectionMarkerEnd~.

268. Rebecca Leber, *The Gas Industry Is Paying Instagram Influencers to Gush Over Gas Stoves*, MOTHER JONES (June 17, 2020), <https://www.motherjones.com/environment/2020/06/gas-industry-influencers-stoves/>.

269. Nathalie Graham, *Puget Sound Energy Wants Your Kids to Love Natural Gas*, STRANGER (June 26, 2020, 4:30 PM), <https://www.thestranger.com/slog/2020/06/26/43974948/puget-sound-energy-wants-your-kids-to-love-natural-gas>. See also Steve LeBlanc, *Utility-backed natural gas booklets spark backlash at school*, ASSOCIATED PRESS (May 11, 2021), <https://www.power-grid.com/ap-news/utility-backed-natural-gas-booklets-spark-backlash-at-school> (discussing Eversource’s use of coloring books as “propaganda” with elementary school students).

270. NATURAL GAS GENIUS, <https://www.naturalgasgenius.com/> (last visited Oct. 4, 2020).

271. Debra West, *Con Ed Cuts Off New Gas Hookups in New York Suburb*, N.Y. TIMES (Mar. 21, 2019), <https://www.nytimes.com/2019/03/21/nyregion/con-ed-natural-gas.html>. Con Ed found a way to increase capacity in a current pipeline, which required an agreement with the pipeline owner to upgrades to compression facilities outside the state. If approved, the moratorium would be lifted once the additional capacity is available, which is expected to be in November 2023. Iulia Gheorghiu, *Con Edison Announces Deal to End Westchester Moratorium on Gas Hookups*, UTIL. DIVE (Apr. 25, 2019), <https://www.utilitydive.com/news/con-edison-announces-deal-to-end-westchester-moratorium-on-gas-hookups/553448/>. In the meantime, the N.Y. Public Service Commission (“PSC”) approved \$223 million for energy efficiency and electrification to reduce system demand between now and 2023. Robert Walton, *New York Regulators Move to Address Con Edison’s Moratorium on New Gas Service*, UTIL. DIVE (Feb. 8, 2019),

approving applications for new service without the state's approval of a new pipeline from New Jersey through New York Bay,²⁷² and issued a formal moratorium after the original water quality certification permit was denied.²⁷³ Governor Cuomo threatened to revoke the company's authority due to the moratorium for "fail[ing] to provide [customers with] . . . 'reliable service,'" arguing that the utility was either "grossly negligent" or "deliberately defrauded" customers.²⁷⁴ It looks like the dispute has been temporarily settled, as National Grid found "a 'previously unavailable source of short-term peaking supplies'" which the company "declined to provide further details on."²⁷⁵ It is unlikely, however, to be the last dispute over natural gas infrastructure.²⁷⁶

Other utilities—even those who have committed to large renewable or clean energy targets by mid-century—are hoping to continue building gas assets.²⁷⁷ Depending on when regulators take action, all of the infrastructure

<https://www.utilitydive.com/news/new-york-regulators-move-to-address-con-edisons-moratorium-on-new-gas-serv/548014/>.

272. West, *supra* note 271.

273. Iulia Gheorghiu, *National Grid Says No New NYC Gas Customers Until State Approves Pipeline*, UTIL. DIVE (May 22, 2019), <https://www.utilitydive.com/news/national-grid-says-no-new-nyc-gas-customers-until-state-approves-pipeline/555283/>. The state is currently reviewing a revised application for the pipeline in question. *Id.*

274. See Letter from Governor Andrew Cuomo to National Grid, Office of the Governor of New York State (Nov. 12, 2019), [https://www3.dps.ny.gov/pscweb/webfileroom.nsf/ArticlesByCategory/32DF6B203D52A5BC852584B0004F8E65/\\$File/gov%20issues%20ltr%20notify%20ngrid%20of%20intent111219.pdf?OpenElement](https://www3.dps.ny.gov/pscweb/webfileroom.nsf/ArticlesByCategory/32DF6B203D52A5BC852584B0004F8E65/$File/gov%20issues%20ltr%20notify%20ngrid%20of%20intent111219.pdf?OpenElement).

275. Given the lack of detail, this may strike some as evidence that the moratorium was for political leverage, rather than due to actual supply challenges. National Grid was given three months to propose solutions for the gas supply issues. Kavya Balaraman, *National Grid Lifts Gas Moratorium Following Deal with New York*, UTIL. DIVE (Nov. 25, 2019), <https://www.utilitydive.com/news/national-grid-lifts-gas-moratorium-following-deal-with-new-york/568044/>.

276. See Objection by National Grid to Request for Party Status by Aztec Geothermal, LLC and New York Geothermal Energy Association, *Application of National Grid for Certificate of Environmental Compatibility and Public Need*, Docket No. 19-T-0069 (N.Y. Pub. Serv. Comm'n. April 16, 2019), <https://assets.documentcloud.org/documents/6571442/National-Grid-Objection-to-Aztec-Party-Status.pdf> (objecting to affording party status to organizations seeking to show how alternatives to natural gas appliances were already feasible).

277. See, e.g., DUKE ENERGY, 2019 ANNUAL ENERGY REPORT 7–8 (2019), https://materials.proxyvote.com/Approved/26441C/20200309/AR_421242.PDF. See also Catherine Morehouse, *Duke CEO Decries 'Assault' on Natural Gas as Shareholders, Others Target Company's Resource Plans*, UTIL. DIVE (May 13, 2020), <https://www.utilitydive.com/news/duke-ceo-decries-assault-on-natural-gas-as-shareholders-others-blast-com/577815/> ("Duke has been criticized by some for its plans to build out natural gas infrastructure, as well as its perceived slow progress on other clean energy investments. That concern was echoed by shareholders during the company's 2020 shareholder meeting on Thursday, who asked the utility a number of questions related to its progress, especially relative to other utilities.").

being proposed could become stranded and be needlessly costly for ratepayers.

Some states are taking action to address these issues.²⁷⁸ California is reviewing a wide range of issues linked to natural gas, including rules for pipelines (especially for electric generation units), reliability, and cost allocation. Massachusetts is developing a plan to guide the evolution of the natural gas industry given the state's decarbonization roadmap and the Massachusetts Clean Energy and Climate Plan for 2030. Since that docket opened, the governor's climate road map identified electrification of heating as key and he signed a climate bill allowing municipalities to adopt a net-zero energy code for buildings.²⁷⁹

Predictably, the natural gas industry is suing to stop states from taking action limiting or reducing the use of natural gas. For example, A gas distribution utility, the union representing its workers, and a company that provides renewable natural gas for the transportation market filed a lawsuit in California state court alleging that the California Energy Commission (CEC) had disregarded state law by deciding "to substantially eliminate" use of natural gas in the state. The plaintiffs alleged that the CEC violated the California Natural Gas Act when it issued a 2019 Integrated Energy Policy Report (IEPR) with an appendix intended to satisfy its Natural Gas Act obligations. The plaintiffs said the CEC was required to publish a separate Natural Gas Act Report "as a separate document that identifies strategies and options to maximize the benefits of natural gas"²⁸⁰ for each of 10 statutory criteria. They contended that the "Anti-Natural Gas Policy" embodied in the 2019 IEPR was an "underground regulation" that violate the California Administrative Procedure Act's rulemaking requirements.²⁸¹ Additionally,

278. See, e.g., Order Instituting Rulemaking to Establish Policies, Processes, and Rules to Ensure Safe and Reliable Gas Systems in California and Perform Long-Term Gas System Planning, Docket No. R-20-01-007 (Cal. Pub. Utilities Comm'n. Jan. 16, 2020), <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M325/K641/325641802.PDF>; Vote and Order Opening Investigation, MASS. DEP'T OF PUB. UTILITIES (Oct. 29, 2020), <https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/12820821>.

279. Tom DiChristopher, *Mass. Building Gas Ban Movement Expands after 2020 Setback*, S&P GLOB. MARKET INTEL. (Feb. 16, 2021), <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/mass-building-gas-ban-movement-expands-after-2020-setback-62026427>.

280. Tiffany Challe, Sabin Ctr. for Climate Change, *August 2020 Updates to the Climate Case Charts*, CLIMATE L. BLOG (Aug. 12, 2020), <http://blogs.law.columbia.edu/climatechange/2020/08/12/august-2020-updates-to-the-climate-case-charts/>.

281. Southern California Gas Co. v. California State Energy Resources Conservation and Development Commission, No. ___ (Cal. Super. Ct., filed July 31, 2020), http://blogs2.law.columbia.edu/climate-change-litigation/wp-content/uploads/sites/16/case-documents/2020/20200731_docket-na_complaint.pdf?mc_cid=c559235420&mc_eid=0a6d4e7891.

some state legislatures are coming to the aid of special interest groups who prefer to not have local action around the use—or lack of use—of natural gas.²⁸² For example, Flagstaff, Arizona, was blocked from banning new gas infrastructure or mandating all-electric buildings.²⁸³ Describing actions states have taken around natural gas infrastructure as holding “infrastructure projects hostage,” the Trump Administration adopted rules that place limitations on state action around natural gas infrastructure based on climate change grounds.²⁸⁴ The new rule limits the scope of a state’s 401 certification to “assuring that a discharge from a Federally licensed or permitted activity will comply with water quality requirements.”²⁸⁵ Therefore §401 certification may no longer “regulate and consider effects of an activity rather than a discharge”²⁸⁶ but instead is limited to the “applicable provisions of sections 301, 302, 303, 306, and 307 of the Clean Water Act, and state or tribal regulatory requirements for point source discharges into waters of the United States.”²⁸⁷ This will limit any state from refusing to grant a 401 certification, for example, based on a complete lack of analysis around greenhouse gas emissions from a pipeline, or for the pipeline being inconsistent with state greenhouse reduction mandates.

Industry experts are advising gas utilities that they need to adapt to consumer electrification. Noting a lack of innovation in gas utilities, experts have suggested that gas utilities “must adapt to changing consumption

282. Jeff Brady & Dan Charles, *As Cities Grapple with Climate Change, Gas Utilities Fight to Stay in Business*, NPR (Feb. 22, 2021 4:19 PM ET), <https://www.npr.org/2021/02/22/967439914/as-cities-grapple-with-climate-change-gas-utilities-fight-to-stay-in-business> (showing four states that have passed laws prohibiting local natural gas bans and fourteen states considering such legislation). Erin Stone, *From hero to zero: Arizona was a leader in climate policy 15 years ago. What happened?*, AZCENTRAL (Sept. 25, 2020), <https://www.azcentral.com/story/news/local/arizona-environment/2020/09/25/arizona-was-once-climate-policy-leader-in-west-what-happened/5841376002/>.

283. HB 2686, 54th Leg., 2d Sess. (Ariz. 2020), <https://legiscan.com/AZ/text/HB2686/id/2149908/Arizona-2020-HB2686-Chaptered.html>; see also Brady & Charles, *supra* note 282. See also Erin Stone, *From hero to zero: Arizona was a leader in climate policy 15 years ago. What happened?*, AZCENTRAL (Sept. 25, 2020), <https://www.azcentral.com/story/news/local/arizona-environment/2020/09/25/arizona-was-once-climate-policy-leader-in-west-what-happened/5841376002/>.

284. Lisa Friedman, *E.P.A. Limits States’ Power to Oppose Pipelines and Other Energy Projects*, N.Y. TIMES (June 1, 2020), <https://www.nytimes.com/2020/06/01/climate/trump-clean-water-pipelines.html>.

285. EPA, Clean Water Act Section 401 Certification Rule, 85 Fed. Reg. 42250 (July 13, 2020).

286. *Id.* at 42230.

287. *Id.* “The American Gas Association, which represents natural gas distribution and transmission companies, praised the changes and described states’ objections to pipelines and other projects as ‘abuse.’” Lisa Friedman, *E.P.A. Limits States’ Power to Oppose Pipelines and Other Energy Projects*, N.Y. TIMES (June 1, 2020), <https://www.nytimes.com/2020/06/01/climate/trump-clean-water-pipelines.html>.

patterns and competition with electrification.”²⁸⁸ Options for gas utilities may include rate structure changes, including seasonal pricing, to improve revenue and efficiency and diversifying what gas is used for to stem decreasing volumes of natural gas being sold.²⁸⁹ Even with all the possible intimidation, however, cities are still taking action. San Luis Obispo, California recently passed local measures supporting all-electric new buildings.²⁹⁰

E. Other Considerations

Of course, regulators will want to take a myriad of other considerations—electric reliability, transition costs, technological innovation, to name a few—into account when determining how to regulate the natural gas system over the next decade or longer. We can only reduce greenhouse gas emissions by electrifying everything if more of our electricity comes from renewable sources and if the grid is reliable.²⁹¹

Whatever path chosen, perhaps the most important thing for regulators is to ensure the preservation of optionality.²⁹² As “[c]lean energy portfolios . . . are cheaper than 90% of the 88 gas-fired projects proposed across the U.S.,” there is a good likelihood that gas pipelines will increasingly not be used for electricity generation or transportation, and with regulators turning to residential uses of natural gas, “natural gas investments may not be prudent 10 years down the line.”²⁹³ As noted above, regulators are in a

288. Ahmad Faruqui et al., *Tariffs of the Future for Gas Utilities*, THE BRATTLE GROUP at 23 (June 28, 2018), https://brattlefiles.blob.core.windows.net/files/14225_tariffs_of_the_future_for_gas_utilities.pdf.

289. *Id.*

290. Nick Wilson, *SLO City Council passes energy policy encouraging all-electric new buildings*, TRIBUNE (June 17, 2020), <https://www.sanluisobispo.com/news/local/article243581397.html>.

291. The outages happening in CA may make it harder to convince people that electrification is the right answer, without more focus on reliability. Sammy Roth, *California’s Blackouts Could Make Fighting Climate Change Even Harder*, L.A. TIMES (Oct. 29, 2019), <https://www.latimes.com/environment/story/2019-10-29/california-power-outages-wildfires-climate-change>.

292. Robert Walton, *PGE Plans 150 Mwa Renewables, 4 MW Storage, Finds Wind Cheaper Than Gas to Meet Future Capacity*, UTIL. DIVE (July 23, 2019), <https://www.utilitydive.com/news/pge-plans-150-mw-new-solar-by-2023-finds-wind-cheaper-than-gas-to-meet-fut/559291/> (“Though the analysis found wind would likely be cheaper than natural gas at that time, a high degree of uncertainty highlights ‘the importance of taking incremental actions to procure renewable resources, while preserving optionality with respect to technology, resource type, and location in competitive solicitations.’”).

293. Catherine Morehouse, *Renewables, Storage Poised to Undercut Natural Gas Prices, Increase Stranded Assets: RMI*, UTIL. DIVE (Sept. 11, 2019), <https://www.utilitydive.com/news/renewables-storage-poised-to-undercut-natural-gas-prices-increase-stranded/562674/>; see also Stephen Lacey, *The Stranded Asset Threat to Natural Gas*, GREENTECH MEDIA (Sept. 27, 2019), <https://www.greentechmedia.com/articles/read/the-stranded->

unique position: they can determine the treatment of assets *before* they are placed into service, knowing that the life is much more limited than would typically be expected. “Ideally, we should answer these questions before society . . . invests billions in infrastructure that might become stranded assets” or “unduly tilts future decisions toward a continuation of natural gas when it is no longer necessary.”²⁹⁴ Utilities—and their investors—would also benefit from the certainty that legislative and regulatory action would provide. Regulators, then, should determine the treatment of any new natural gas infrastructure now, before it goes in the ground, to minimize the magnitude of stranded assets. And utilities should own the risk of investments they make from here forward.

IV. CONCLUSION

As one commenter put it, “people don’t necessarily want kilowatt hours. We want hot showers and cold beer.”²⁹⁵ Energy infrastructure is not good at being temporary. A developer in New York worried about a proposed development noted, “[t]o shut the spigot off entirely without a well-thought-out plan is just irresponsible.”²⁹⁶ Legislators and regulators should heed that warning, and develop a plan to transition home heating, cooking, clothes-drying and hot water.²⁹⁷ “Where . . . utility commissioners now focus on gas service, they need to focus more on heating services in the future. That would allow consideration of more non-gas alternatives.”²⁹⁸ And all-electric homes

asset-threat-to-natural-gas (noting that 12–15 year life for gas assets is less than what developers and utilities are planning for).

294. See Kalen, *supra* note 60, at 362.

295. See Lacey, *supra* note 293, at 10:00.

296. Debra West, *Con Ed Cuts Off New Gas Hookups in New York Suburb*, N.Y. TIMES (Mar. 21, 2019), <https://www.nytimes.com/2019/03/21/nyregion/con-ed-natural-gas.html>.

297. There is even some research that says focusing on heating and cooling would be cheaper than focusing on EVs. Jason Deign, *UK Electrification Strategy Should Emphasize Heating Over EVs*, RESEARCHER SAYS, GREENTECH MEDIA (July 5, 2019), <https://www.greentechmedia.com/articles/read/uk-electrification-strategy-should-emphasize-heating-over-evs>.

298. See Storrow, *supra* note 6.

are gaining in popularity and prevalence, from the perspective of utilities,²⁹⁹ regulators,³⁰⁰ developers³⁰¹ and consumers.³⁰²

As recent research notes, “households will only reduce about half of what they should to reach the reduction targets commensurate with reaching the 1.5°C goal” with voluntary actions.³⁰³ We need legislative and regulatory action to electrify household functions to survive in a carbon-constrained world. California has started this work, with pilot programs to decarbonize homes.³⁰⁴ More work will be needed to determine the specific incentives and programs to both communicate and switch households, with particular emphasis on low-income communities and renter protections.³⁰⁵ However, that work will only be made more difficult—and more expensive—the longer we wait to act.

299. Justin Gerdes, *Sacramento Wants to Electrify Its Homes, Low-Income Families Included*, GREENTECH MEDIA (Dec. 6, 2019) [hereinafter Gerdes, *Sacramento*], <https://www.greentechmedia.com/articles/read/sacramento-wants-to-electrify-its-homes-low-income-families-included>.

300. Kayva Balaraman, *California PUC Proposes Pilot Programs to Decarbonize Buildings*, UTIL. DIVE (Feb. 18, 2020), <https://www.utilitydive.com/news/epuc-pilots-programs-decarbonize-buildings/572391/>.

301. Brady & Charles, *supra* note 282 (developer discussing how they expected all-electric buildings to be more expensive but were incorrect and now share their all-electric building blueprints and budgets with others).

302. Justin Gerdes, *A Boom Is Coming for All-Electric Homes Despite Lagging Customer Awareness*, GREENTECH MEDIA (Mar. 25, 2020), <https://www.greentechmedia.com/articles/read/a-boom-is-coming-for-all-electric-homes-despite-lag-in-consumer-awareness>.

303. Ghislain Dubois et al., *It Starts at Home? Climate Policies Targeting Household Consumption and Behavioral Decisions are Key to Low-Carbon Futures*, 52 ENERGY RES. & SOC. SCI. 144, 152 (June 2019), <https://doi.org/10.1016/j.erss.2019.02.001>.

304. Balaraman, *supra* note 300.

305. Sacramento—served by SMUD, a municipal utility—is looking at ways to ensure that low-income families are included in electrification efforts by embedding electrification in its existing low-income energy efficiency program. See Gerdes, *Sacramento*, *supra* note 299; see also Rachel Golden, SIERRA CLUB, BUILDING ELECTRIFICATION ACTION PLAN FOR CLIMATE LEADERS (2019), <https://www.sierraclub.org/sites/www.sierraclub.org/files/Building%20Electrification%20Action%20Plan%20for%20Climate%20Leaders.pdf>.

Appendix A – List of Investor-Owned Natural Gas Distribution Companies

OPERATOR NAME	OFFICE STATE	HQ STATE
ALASKA PIPELINE CO	AK	AK
NORGASCO INC	AK	AK
WHEELER BASIN NATURAL GAS CO	AL	AL
UNISOURCE ENERGY SERVICES	AZ	AZ
PACIFIC GAS & ELECTRIC CO	CA	CA
SAN DIEGO GAS & ELECTRIC CO	CA	CA
SOUTHERN CALIFORNIA GAS CO	CA	CA
ATMOS ENERGY CORPORATION - COLORADO/KANSAS	CO	TX
ATMOS ENERGY CORPORATION - COLORADO/KANSAS	CO	TX
COLORADO NATURAL GAS INC.	CO	CO
PUBLIC SERVICE CO OF COLORADO	CO	CO
CONNECTICUT NATURAL GAS CORP	CT	CT
SOUTHERN CONNECTICUT GAS CO	CT	CT
YANKEE GAS SERVICES CO	CT	CT
CHESAPEAKE UTILITIES CORPORATION	DE	DE
CHESAPEAKE UTILITIES CORPORATION	DE	DE
DELMARVA POWER & LIGHT COMPANY	DE	DE
CENTRAL FLORIDA GAS CORP	FL	FL
FLORIDA PUBLIC UTILITIES CO	FL	FL
PEOPLES GAS SYSTEM INC	FL	FL
SEBRING GAS SYSTEM, INC	FL	FL
ST JOE NATURAL GAS CO INC	FL	FL
LIBERTY ENERGY (GEORGIA) CORP D/B/A LIBERTY UTILITIES GEORGIA	GA	GA
ALLERTON GAS CO	IA	IA
MIDAMERICAN ENERGY COMPANY	IA	IA
MIDAMERICAN ENERGY COMPANY	IA	IA
MIDAMERICAN ENERGY COMPANY	IA	IA
MIDAMERICAN ENERGY COMPANY	IA	IA
AMEREN ILLINOIS COMPANY	IL	IL
COMMUNITY NATURAL GAS INC	IL	IN

CONSUMERS GAS CO	IL	IN
MT CARMEL PUBLIC UTILITY CO	IL	IL
NORTH SHORE GAS CO	IL	IL
PEOPLES GAS LIGHT & COKE CO	IL	IL
INDIANA GAS CO INC	IN	IN
INDIANA NATURAL GAS CORP	IN	IN
INDIANA UTILITIES CORP	IN	IN
MIDWEST NATURAL GAS CORP	IN	IN
NORTHERN INDIANA PUBLIC SERVICE CO	IN	IN
OHIO VALLEY GAS CORP	IN	IN
OHIO VALLEY GAS CORP	IN	IN
OHIO VALLEY GAS INC	IN	IN
SOUTHERN INDIANA GAS & ELECTRIC CO	IN	IN
SWITZERLAND COUNTY NATURAL GAS CO	IN	IN
WESTFIELD GAS CORP	IN	IN
LOUISVILLE GAS & ELECTRIC CO	KY	KY
LOUISVILLE GAS & ELECTRIC CO	KY	KY
NATURAL ENERGY UTILITY CORPORATION	KY	KY
ENTERGY LOUISIANA, LLC	LA	LA
ENTERGY NEW ORLEANS, LLC	LA	LA
EVANGELINE GAS CO, INC	LA	LA
JPC ENERGY, LLC	LA	LA
PIERRE PART NATURAL GAS INC	LA	LA
SOUTH COAST GAS CO INC	LA	LA
BERKSHIRE GAS CO	MA	MA
NSTAR GAS COMPANY	MA	MA
BALTIMORE GAS AND ELECTRIC COMPANY	MD	MD
BANGOR NATURAL GAS CO.	ME	ME
MAINE NATURAL GAS	ME	ME
SUMMIT NATURAL GAS OF MAINE, INC.	ME	CO
AURORA GAS CO	MI	MI
CITIZENS GAS FUEL CO	MI	MI
CONSUMERS ENERGY CO	MI	MI
DTE GAS COMPANY	MI	MI
MICHIGAN GAS UTILITIES CO	MI	MI
SEMCO ENERGY GAS COMPANY	MI	MI
GREATER MINNESOTA GAS INC.	MN	MN

GREATER MINNESOTA TRANSMISSION, LLC	MN	MN
MINNESOTA ENERGY RESOURCES CORPORATION	MN	MN
NORTHERN STATES POWER CO OF MINNESOTA	MN	MN
NORTHERN STATES POWER CO OF MINNESOTA	MN	MN
AMERENUE	MO	MO
LIBERTY UTILITIES (MIDSTATES NATURAL GAS) CORP. D/B/A LIBERTY UTILITIES	MO	MO
LIBERTY UTILITIES (MIDSTATES NATURAL GAS) CORP. D/B/A LIBERTY UTILITIES	MO	MO
LIBERTY UTILITIES (MIDSTATES NATURAL GAS) CORP. D/B/A LIBERTY UTILITIES	MO	MO
SPIRE MISSOURI INC. EAST	MO	MO
SPIRE MISSOURI INC. WEST	MO	MO
SUMMIT NATURAL GAS OF MISSOURI	MO	CO
THE EMPIRE DISTRICT GAS COMPANY	MO	MO
ATMOS ENERGY CORPORATION - MISSISSIPPI	MS	TX
SPIRE MISSISSIPPI INC	MS	MS
NORTHWESTERN CORPORATION	MT	SD
ENERGY NORTH NATURAL GAS INC	NH	NH
PUBLIC SERVICE CO OF NORTH CAROLINA	NC	NC
GREAT PLAINS NATURAL GAS CO	ND	ND
GREAT PLAINS NATURAL GAS CO	ND	ND
MONTANA - DAKOTA UTILITIES CO	ND	ND
MONTANA - DAKOTA UTILITIES CO	ND	ND
MONTANA - DAKOTA UTILITIES CO	ND	ND
MONTANA - DAKOTA UTILITIES CO	ND	ND
BLACK HILLS ENERGY	NE	NE
BLACK HILLS ENERGY	NE	NE
BLACK HILLS ENERGY	NE	NE
BLACK HILLS ENERGY	NE	NE
BLACK HILLS ENERGY	NE	NE
BLACK HILLS ENERGY	NE	NE
ENERGY NORTH NATURAL GAS INC	NH	NH
FITCHBURG GAS & ELECTRIC LIGHT CO	NH	MA
NORTHERN UTILITIES INC (ME)	NH	NH
NORTHERN UTILITIES, INC. (NH)	NH	NH
NEW JERSEY NATURAL GAS CO	NJ	NJ

PUBLIC SERVICE ELECTRIC & GAS CO	NJ	NJ
SOUTH JERSEY GAS CO	NJ	NJ
NEW MEXICO GAS COMPANY	NM	NM
RATON NATURAL GAS COMPANY	NM	NM
SOUTHWEST GAS CORP	NV	NV
SOUTHWEST GAS CORP	NV	NV
SOUTHWEST GAS CORP	NV	NV
BOSTON GAS CO	NY	MA
CAPE COD GAS CO (DIV OF COLONIAL GAS CO)	NY	MA
CENTRAL HUDSON GAS & ELECTRIC CORP	NY	NY
CONSOLIDATED EDISON CO OF NEW YORK	NY	NY
CORNING NATURAL GAS CORP	NY	NY
KEYSPAN ENERGY DELIVERY - LONG ISLAND	NY	MA
KEYSPAN ENERGY DELIVERY - NY CITY	NY	MA
NATIONAL FUEL GAS DISTRIBUTION CORP	NY	NY
NATIONAL FUEL GAS DISTRIBUTION CORP - NEW YORK	NY	NY
NEW YORK STATE ELECTRIC & GAS CORP	NY	NY
NIAGARA MOHAWK POWER CORP	NY	MA
NIAGARA MOHAWK POWER CORP	NY	MA
ORANGE & ROCKLAND UTILITY INC	NY	NY
ROCHESTER GAS & ELECTRIC CORP	NY	NY
COLUMBIA GAS OF KENTUCKY INC	OH	KY
COLUMBIA GAS OF MARYLAND INC	OH	PA
COLUMBIA GAS OF MASSACHUSETTS	OH	MA
COLUMBIA GAS OF OHIO INC	OH	OH
COLUMBIA GAS OF PENNSYLVANIA	OH	PA
COLUMBIA GAS OF VIRGINIA INC	OH	VA
DOMINION ENERGY OHIO	OH	OH
DUKE ENERGY KENTUCKY	OH	OH
DUKE ENERGY OHIO	OH	OH
KNG ENERGY INC	OH	OH
PIEDMONT NATURAL GAS CO INC	OH	NC
PIEDMONT NATURAL GAS CO INC	OH	NC
PIEDMONT NATURAL GAS CO INC	OH	NC
VECTREN ENERGY DELIVERY OF OHIO	OH	IN
WATERVILLE GAS & OIL CO	OH	OH

ENABLE OKLAHOMA INTRASTATE TRANSMISSION, LLC	OK	OK
KANSAS GAS SERVICE COMPANY, A DIVISION OF ONE GAS, INC.	OK	KS
KANSAS GAS SERVICE COMPANY, A DIVISION OF ONE GAS, INC.	OK	KS
MID-CONTINENT MARKET CENTER	OK	OK
OKLAHOMA NATURAL GAS COMPANY, A DIVISION OF ONE GAS, INC.	OK	OK
OKTEX PIPELINE COMPANY, LLC	OK	OK
ONEOK FIELD SERVICES COMPANY, L.L.C.	OK	OK
ONEOK FIELD SERVICES COMPANY, L.L.C.	OK	OK
ONEOK GAS TRANSPORTATION, LLC	OK	OK
ONEOK TRANSMISSION COMPANY	OK	OK
ONEOK WESTEX TRANSMISSION, LLC	OK	OK
TEXAS GAS SERVICE COMPANY, A DIVISION OF ONE GAS, INC.	OK	TX
NATIONAL FUEL GAS SUPPLY CORP	PA	NY
NATIONAL FUEL GAS SUPPLY CORP	PA	NY
PECO ENERGY CO	PA	PA
PIKE COUNTY LIGHT & POWER CO	PA	PA
SIGEL GAS	PA	PA
UGI UTILITIES, INC	PA	PA
UGI UTILITIES, INC	PA	PA
SOUTH CAROLINA ELECTRIC & GAS CO	SC	SC
NORTHWESTERN CORPORATION	SD	SD
NORTHWESTERN CORPORATION	SD	SD
ATMOS ENERGY CORPORATION - KY/MID- STATES (KENTUCKY)	TN	TX
ATMOS ENERGY CORPORATION - KY/MID- STATES (MID-STATES)	TN	TX
ATMOS ENERGY CORPORATION - KY/MID- STATES (MID-STATES)	TN	TX
ATMOS ENERGY CORPORATION - MID-TEX	TX	TX
ATMOS ENERGY CORPORATION - WEST TEXAS	TX	TX
CENTERPOINT ENERGY INTRASTATE PIPELINES, INC.	TX	TX
CENTERPOINT ENERGY RESOURCES CORP.	TX	TX
CENTERPOINT ENERGY RESOURCES CORP.	TX	TX

CENTERPOINT ENERGY RESOURCES CORP.	TX	TX
CENTERPOINT ENERGY RESOURCES CORP.	TX	TX
CENTERPOINT ENERGY RESOURCES CORP., DBA CENTERPOINT ENERGY MINNESOTA GAS	TX	TX
CENTERPOINT ENERGY RESOURCES CORPORATION	TX	TX
CENTERPOINT ENERGY RESOURCES CORPORATION	TX	TX
CENTERPOINT ENERGY RESOURCES CORPORATION	TX	TX
CONSUMERS GAS COMPANY, INC.	TX	TX
CORIX UTILITIES (TEXAS)	TX	TX
GAS ENERGY, LLC	TX	TX
LDC, LLC.	TX	TX
NATGAS INC.	TX	TX
SIENERGY, LP	TX	TX
STERLING NATURAL GAS INC	TX	TX
UNIVERSAL NATURAL GAS, INC.	TX	TX
WEST TEXAS GAS INC	TX	TX
WEST TEXAS GAS INC	TX	TX
APPALACHIAN NATURAL GAS DISTRIBUTION COMPANY	VA	VA
ROANOKE GAS CO	VA	VA
VIRGINIA NATURAL GAS	VA	VA
AVISTA CORP	WA	WA
AVISTA CORP	WA	WA
AVISTA CORP	WA	WA
CASCADE NATURAL GAS CORP	WA	WA
CASCADE NATURAL GAS CORP	WA	WA
INTERMOUNTAIN GAS CO	WA	ID
PUGET SOUND ENERGY	WA	WA
CITY GAS CO	WI	WI
MADISON GAS & ELECTRIC CO	WI	WI
NORTHERN STATES POWER CO OF WISCONSIN	WI	WI
NORTHERN STATES POWER CO OF WISCONSIN	WI	WI
SUPERIOR WATER LIGHT & POWER CO	WI	WI
WISCONSIN ELECTRIC POWER COMPANY DBA WE ENERGIES	WI	WI
WISCONSIN GAS LLC DBA WE ENERGIES	WI	WI

2021]

THE NATURAL GAS PARADOX

761

WISCONSIN GAS LLC DBA WE ENERGIES	WI	WI
WISCONSIN PUBLIC SERVICE CORP	WI	WI
APPALACHIAN NATURAL GAS DISTRIBUTION COMPANY, BLUEFIELD DIVISION	WV	VA
DOMINION ENERGY WEST VIRGINIA	WV	WV

Appendix B – Natural Gas Distribution Companies & Current Valuation

UTILITY	VALUE
PACIFIC GAS AND ELECTRIC COMPANY	\$11,112,794,189 ³⁰⁶
SOUTHERN CALIFORNIA GAS COMPANY	\$10,096,491,751 ³⁰⁷
ATMOS ENERGY CORPORATION	\$8,141,733,000 ³⁰⁸
PUBLIC SERVICE ELECTRIC AND GAS COMPANY	\$7,854,000,000 ³⁰⁹
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.	\$7,223,220,281 ³¹⁰

306. Pac. Gas & Elec. Co., Annual Report (FERC Form 2) at 208 (Apr. 16, 2019), https://www.pge.com/pge_global/common/pdfs/about-pge/company-information/regulation/FERCForm2.pdf.

307. Attachment D—Plant Investment and Accumulated Depreciation, *Application of Southern California Gas Company Regarding Year 25 (2018-2019) of Its Gas Cost Incentive Mechanism*, Docket No. A-16-06-009, at D-2 (Cal. Pub. Util. Comm’n. (June 14, 2019), https://www.socalgas.com/regulatory/documents/a-19-06-009/GCIM_Yr_25_Application_Final.pdf (“Original Costs”).

308. ATMOS ENERGY CORP., ANNUAL REPORT (FORM 10-K) 73 (Nov. 13, 2018), http://www.atmosenergy.com/sites/default/files/10-k_18_0.pdf (rounded to the nearest thousand, as reflected).

309. PUB. SERV. ELEC. & GAS CO., ANNUAL REPORT (FORM 10-K) 107 (Feb. 27, 2019), <http://d18m0p25nwr6d.cloudfront.net/CIK-0000788784/460bd33f-12d7-43ee-a9bb-f6dc91054ac2.pdf> (rounded to the nearest million, as reflected) (“Gas Distribution and Transmission”).

310. CONSOLIDATED EDISON CO. OF N.Y., ANNUAL REPORT 62 (Apr. 30, 2019), <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={DDF7CA82-E3D8-4D88-933D-1BEEEBB765A9}>.