Repurposing Fossil Infrastructure

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ABSTRACT

Our built environment includes infrastructure dedicated to fossil fuels: wells, pipelines, compressor stations, refineries, fossil gas storage caverns, gas stations. One challenge as we decarbonize is how we will repurpose these locations and networks as we move toward a decarbonized world.

This Article imagines the outcomes for three distinct pieces of our fossil fuel infrastructure and how each could be a part of our decarbonized future. First, given the challenges seen building long distance transmission, local sources of renewable electricity will become even more critical. In many places, the most plentiful of these is rooftop solar, but it faces a storage problem. I posit that gas stations —ubiquitous but which will increasingly become unnecessary with the switch to EVs—could be perfect locations for large battery storage, able to accept extra solar power from the local distribution grid,

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enabling additional adoption without costly grid upgrades, and then discharging back onto the local grid during the evening.

Second, fossil gas distribution pipes may be able to be used as the conduit for undergrounding electrical lines in residential neighborhoods. While unsuitable for higher voltages, many of the reliability issues facing the grid are in low voltage distribution systems. We will need reliability as we electrify everything, and repurposing this infrastructure can both make undergrounding easier by removing an obstacle (fossil gas lines make undergrounding electric lines harder if they remain in service) and cheaper by using existing conduits.

Third, with modifications, the existing interstate gas pipeline system could be used for green hydrogen to supply electric peaking facilities. While major replacements would need to occur, these corridors can provide access to current electric generation facilities. All these will require new regulations and come with costs as well as benefits. All can aid in achieving our decarbonized future.

I. INTRODUCTION

Climate change is accelerating, and its impacts are becoming more pronounced.[1] Climate change-induced hurricanes, wildfires, and other severe weather events are happening more frequently, with 23 events causing more than $1 billion in damages each in the United States in just the first eight months of 2023.[2] It is even possible that the world may exceed the Paris Accord-linked aspirational warming target of 1.5 degrees Celsius this year.[3]

The worsening impacts make one thing clear: we must move faster than we have been away from fossil fuels. Focusing on the United States and

1. *NASA Announces Summer 2023 Hottest on Record*, NASA GLOBAL CLIMATE CHANGE (Sept. 14, 2023), https://climate.nasa.gov/news/3282/nasa-announces-summer-2023-hottest-on-record/ [https://perma.cc/NNL6-GSSE]; Saima Baig, *2023 on track to be the warmest year on record – September 2023 warmest ever yet*, 360 ON HISTORY (Oct. 5, 2023), https://www.360onhistory.com/climate-change/2023-track-warmest-year-record-september-2023-warmest-record/ [https://perma.cc/7U5Q-B4K7].

2. Robert Hart, *2023 Worst Year on Record for Billion–Dollar Climate Disasters, NOAA Says*, FORBES (Sept. 12, 2023, 7:04 AM), https://www.forbes.com/sites/roberthart/2023/09/12/2023-worst-year-on-record-for-billion-dollar-climate-disasters-noaa-says/?sh=7cc3588b42f2 [https://perma.cc/TX9X-92WD].

3. Stephanie Ebbs & Melissa Griffin, *Record-High summer temps give a 'sneak peak' into future warming*, ABC NEWS (Sept. 15, 2023), https://ca.finance.yahoo.com/news/record-high-summer-temps-sneak-162600960.html [https://perma.cc/9DNW-FK9Q] (noting that with the high summer temperatures "there's a 50/50 chance that 2023 will end up being the first year to exceed that average warming point").

our major emissions sources, we must do more to electrify transportation, generate all of our electricity using carbon-free means, electrify current industrial uses of fossil fuels, and electrify the current uses of fossil fuels within our buildings.[4]

The good news is that we have rapidly developing technological solutions in each of these areas. In the transportation sector, electric vehicles ("EVs") are rapidly gaining market share of new vehicles, with more than 7% of new vehicles sold in the United States in 2023 being EVs and "more than 50% of shoppers . . . interested in adding an EV" to their household.[5] While that may not seem like much, it is a 67% year-over-year increase.[6] Additional tax incentives encourage more EV purchases, and now include used EVs for the first time.[7] In addition to increased electrification of passenger vehicles, other types of vehicles—school buses,[8] semi-trucks,[9]

4. *See Sources of Greenhouse Gas Emissions,* U.S. EPA, https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions [https://perma.cc/RB6N-AVSY] (last visited Feb. 29, 2024).

5. *Electric Vehicle Sales in Q2 Strike Another Record, but Growth Ahead Will Be Hard Fought,* COX AUTOMOTIVE (July 12, 2023), https://www.coxautoinc.com/market-insights/q2-2023-ev-sales/ [https://perma.cc/6VEP-UPTM]. Additionally, EV sales are growing much faster than the overall light duty vehicle market, not only in the US but also globally. *See* Felix Kuhnert & Jörn Neuhausen, *Electric Vehicle Sales Review Q2-2023*, STRATEGY&, https://www.strategyand.pwc.com/de/en/industries/automotive/electric-vehicle-sales-review-2023-q2.html [https://perma.cc/T52M-MTR7] (last visited Feb. 29, 2024).

6. Kuhnert & Neuhausen, *supra* note 5, at 1.

7. *See* Zayina Syed, *How the Inflation Reduction Act can help you save cash and energy*, POPULAR SCI. (Jan. 12, 2023, 6:00 AM), https://www.popsci.com/diy/how-to-get-tax-credits-for-solar-electric-cars/ [https://perma.cc/TJJ4-XQRX].

8. Sebastian Blanco, *You're About to See Way More Electric School Buses—Here's Why,* CAR AND DRIVER (May 6, 2023), https://www.caranddriver.com/news/a43795823/electric-school-buses-latest-details/ [perma.cc/W8GN-3F9S]; *New York Becomes First U.S. State to Adopt Statewide Electric School Bus Mandate,* WORLD RES. INST. (June 2, 2023), https://www.wri.org/outcomes/new-york-becomes-first-us-state-adopt-statewide-electric-school-bus-mandate [perma.cc/CX2J-P8U4].

9. Jeff St. John, *Electric Big Rigs are Going Farther and Charging Faster*, CANARY MEDIA (Sept. 25, 2023), https://www.canarymedia.com/articles/electric-vehicles/electric-big-rigs-are-going-farther-and-charging-faster [perma.cc/Z8HU-EBT7]; Steven Nadel, *Utilities Need to Prepare the Power Grid for Electric Truck Fleets*, ACEEE (Sept. 21, 2023), https://www.aceee.org/blog-post/2023/09/utilities-need-prepare-power-grid-electric-truck-fleets [perma.cc/U8EY-KYJC].

delivery vans,[10] and garbage trucks[11]—are being electrified. Other forms of transport are also being decarbonized—freight[12] and passenger trains,[13] personal boats,[14] and ferries[15] among them. To reduce the use of fossil fuels where full electrification is not currently possible, other solutions are being implemented that reduce the need for fossil fuels and reduce emissions. For example, ocean-going vessels are experimenting with sails which could lower their climate impact by as much as 90%.[16]

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10. Jacob Kurowicki, *Future EVs that Deliver: Electric Delivery Trucks and Workhorses*, CAR & DRIVER (Apr. 14, 2023), https://www.caranddriver.com/features/g38842224/future-evs-that-deliver-electric-delivery-trucks-and-workhorses/ [perma.cc/ZEB6-LQTK]; Jonathan M. Gitlin, *Amazon has 5,000+ Rivian EV delivery vans on the Road*, ARS TECHNICA (July 7, 2023, 5:57 AM), https://arstechnica.com/cars/2023/07/amazon-has-5000-rivian-ev-delivery-vans-on-the-road/ [https://perma.cc/AE8W-UHMP].

11. Lizzy Rosenberg, *Electric refuse trucks could soon be coming to pick up your weekly trash*, WORLD ECON. F. (Feb. 27, 2023), https://www.weforum.org/agenda/2023/02/electric-garbage-truck-energy-mobility/ [https://perma.cc/3DYS-GSEU]; Rob Vergear, *Electric garbage trucks are the quiet, clean titans of waste collection*, POPULAR SCI. (Aug. 18, 2021, 11:31 AM), https://www.popsci.com/technology/nyc-sanitation-acquires-mack-electric-garbage-trucks/ [https://perma.cc/3N7A-H6NY]; *Fairfax County Launches First All-Electric Trash Truck*, FAIRFAX CNTY. (Aug. 25, 2023), https://www.fairfaxcounty.gov/news/fairfax-county-launches-first-all-electric-trash-truck [https://perma.cc/2EWF-ZUY3]; Maria Gallucci, *The humble trash truck is ready for an all-electric upgrade*, CANARY MEDIA (Nov. 14, 2023), https://www.canarymedia.com/articles/electric-vehicles/the-humble-trash-truck-is-ready-for-an-all-electric-upgrade [https://perma.cc/FN4P-XUN2].

12. Maria Gallucci, *Full steam ahead for electric freight trains*, CANARY MEDIA (Nov. 3, 2023), https://www.canarymedia.com/articles/transportation/full-steam-ahead-for-electric-freight-trains [https://perma.cc/WWW8-5U6L].

13. Benjamin Schneider (@urbenschneider), X (Sept. 19, 2023, 5:42 PM), https://twitter.com/urbenschneider/status/1704249714642755887 [https://perma.cc/387K-MXMQ] (with the added benefits of electric trains being faster); *see also* CALTRAIN, CALTRAIN ELECTRIFICATION PROPOSED SERVICE PLAN FOR FALL 2024 AGENDA ITEM 10 (2023), https://www.caltrain.com/media/31624/download?fbclid=IwAR2W_BMRxuaVJkcDgTq%20rz8v5mTKos2fsEyiNNhq0ajzFjVEmM04dRqUklyA_aem_AdhYLg-ypRC7_0ZbB4_wGDIAHud6PmKzqI7dv_ACOB5Yk0bQHS6jfrQLqpfFcLRQu9E [https://perma.cc/E5CK-Y7ZN].

14. Dan McCarthy, *Is solar the future of boating? This engineer turned boat-builder says yes*, CANARY MEDIA (Dec. 5, 2023), https://www.canarymedia.com/articles/sea-transport/is-solar-the-future-of-boating-this-engineer-turned-boat-builder-says-yes [https://perma.cc/EC6P-3HGE].

15. Maria Gallucci, *America's first hydrogen-powered ferry is set to sail*, CANARY MEDIA (Nov. 16, 2023), https://www.canarymedia.com/articles/sea-transport/americas-first-hydrogen-powered-ferry-is-set-to-sail [https://perma.cc/44P4-2BWZ].

16. Manuela Andreoni, *The climate crisis is also a health crisis*, N.Y. TIMES: CLIMATE FORWARD (Oct. 3, 2023), https://messaging-custom-newsletters.nytimes.com/template/oakv2?campaign_id=54&emc=edit_clim_20231003&instance_id=104309&nl=climate-forward&productCode=CLIM&regi_id=95594363&segment_id=146387&te=1&uri=nyt%3A%2F%2Fnewsletter%2F1f5c2d0e-ea34-5df1-a07e-d808c57d7b08&user_id=f961f9c4b4fb056fceafd24ca83cdc0e [https://perma.cc/67XY-X7RU]. Global shipping accounts for approximately 3% of worldwide GHG emissions. *Id*.

Electric generation is transforming as well. Over the last twenty years, coal has gone from being the largest source of electric generation in 32 states to being the largest in only 15.[17] While much of that generation capacity shifted to fossil gas, which is now the single largest source, other resources have continued to increase.[18] Indeed, in three of those 32 states, the largest source of electric generation moved from coal to wind.[19] Additionally, the amount of electricity generated from renewable sources has surpassed that from coal since 2021.[20] As almost all prospective new generation is renewable,[21] it is incredibly likely that, as older plants retire, electricity generation will continue to become less carbon intensive. Storage technology is also maturing and diversifying,[22] with increasing

17. U.S. ENERGY INFO. ADMIN., *Coal was the largest source of electricity generation for 15 states in 2021* (Dec. 7, 2022), https://www.eia.gov/todayinenergy/ detail.php?id=54919 [https://perma.cc/D77J-ZX5G] [hereinafter Coal in 2021].

18. U.S. ENERGY INFO. ADMIN., *Electricity Explained: Electricity in the United States* (June 30, 2023), https://www.eia.gov/energyexplained/electricity/electricity-in-the-us.php#:~:text=Most%20electricity%20is%20generated%20with,wind%20turbines%2C%20and%20solar%20photovoltaics [https://perma.cc/M6GH-E6RL] [hereinafter Electricity Explained].

19. Coal in 2021, *supra* note 17.

20. Electricity Explained, *supra* note 18.

21. *Grid connection requests grow by 40% in 2022 as clean energy surges, despite backlogs and uncertainty*, BERKELEY LAB, ENERGY MKTS. & POL'Y, (Apr. 6, 2023), https://emp.lbl.gov/news/grid-connection-requests-grow-40-2022-clean [https://perma.cc/2JNJ-3UBN] (finding 95% of all new capacity in interconnection queues is solar, battery storage and wind).

22. Kavya Balaraman, *Geothermal energy storage is cost competitive with lithium-ion batteries, pumped hydro: pilot*, UTIL. DIVE (Sept.13, 2023), https://www.utilitydive.com/news/sage-geosystems-geothermal-energy-storage-pilot/693494/ [https://perma.cc/8GCE-LBQS] (noting that storage is not just lithium-ion batteries and conventional pumped hydro anymore); Marija Maisch, *Sodium-seawater batteries for short, long-term stationary energy storage,* PV MAG. (Oct. 9, 2023), https://www.pv-magazine.com/2023/10/09/sodium-seawater-batteries-for-short-long-term-stationary-energy-storage/ [https://perma.cc/TS6C-GNXZ]; Cosmo Sanderson, *US military to trial novel energy storage tech for resiliency Amid climate and blackout risk*, RECHARGE (Oct. 6, 2023, 4:10 PM), https://www.rechargenews.com/energy-transition/us-military-to-trial-novel-energy-storage-tech-for-resiliency-amid-climate-and-blackout-risk/2-1-1531224?utm_source=Sailthru&utm_medium=email&utm_campaign=Issue%3A%2B2023-10-10%2BUtility%2BDive%2BStorage%2B%5Bissue%3A55328%5D&utm_term=Utility%2BDive%3A%2BStorage [https://perma.cc/MQM6-KV4W]; David L. Chandle, *New Breakthrough in Energy Storage – MIT Engineers Create Supercapacitor out of Ancient Materials*, SCITECHDAILY (Oct. 4, 2023), https://scitechdaily.com/new-breakthrough-in-energy-storage-mit-engineers-create-supercapacitor-out-of-ancient-materials/?utm_source=Sailthru&utm_medium=email&utm_campaign=Issue:%202023-10-10%20Utility%20Dive%20Storage%20%5Bissue:55328%5D&utm_term=Utility%20Dive:%20Storage#google_vignette [https://perma.cc/ZJ6N-T2JU].

installations[23] positively impacting the entire system.[24] The cost decreases in storage are making the economics of building new fossil gas plants less favorable.[25] These trends mirror what is occurring in the rest of the world; the International Energy Agency predicts that fossil fuel use will peak globally by 2030,[26] and another analysis indicates that more than half the world is already past peak fossil use.[27]

While challenges persist, there are also positive technological developments where industry is concerned.[28] Two significant sources of emissions—concrete[29] and steel[30]—have started to electrify and are easier to produce with lower emissions than initially thought.[31] Another significant industrial

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23. *US Solar Power by the Numbers Q2 2023*, S&P GLOB. MKT. INTEL., https://pages.marketintelligence.spglobal.com/rs/565-BDO-100/images/Q2-23-Solar-Wind-Energy-Storage-by-the-Numbers-infographic.pdf [https://perma.cc/EAA7-MEVP] (last visited Feb. 29, 2024).

24. *See, e.g.*, Joey Politano (@JosephPolitano), X (Oct. 4, 2023, 11:30 AM), https://twitter.com/josephpolitano/status/1709637162143003008?s=43&t=LNPLnREHmYkQUYDJtENVxw [https://perma.cc/2N6C-MF6G] (noting that up to 13% of California's evening power is being supplied by batteries).

25. Sarah McFarlane & Susanna Twidale, *Giant batteries drain economics of gas power plants*, REUTERS (Nov. 21, 2023, 9:38 AM), https://www.reuters.com/business/energy/giant-batteries-drain-economics-gas-power-plants-2023-11-21/?utm_source=Sailthru&utm_medium=email&utm_campaign=Issue:%202023-11-21%20Utility%20 Dive%20Newsletter%20%5Bissue:56663%5D&utm_term=Utility%20Dive [https://perma.cc/M299-GSUH].

26. Brad Plumer, *Energy Agency Sees Peaks in Global Oil, Coal and Gas Demand by 2030*, N.Y. TIMES (Oct. 24, 2023), https://www.nytimes.com/2023/10/24/climate/international-energy-agency-peak-demand.html [https://perma.cc/CBJ4-989H].

27. *Half the World is 5 Years Past Peak Fossil Power, Analysis Finds*, THE ENERGY MIX (Oct. 19, 2023), https://www.theenergymix.com/half-the-world-is-5-years-past-peak-fossil-power-analysis-finds/?utm_source=The+Energy+Mix&utm_campaign=741bc57653-TEM_RSS_EMAIL_CAMPAIGN&utm_medium=email&utm_term=0_dc146fb5ca-741bc57653-431644561 [https://perma.cc/Q5R9-5PHJ].

28. Dan McCarthy, *Five things to know about decarbonizing cement, steel, and chemicals*, CANARY MEDIA (Oct. 30 2023), https://www.canarymedia.com/articles/clean-industry/five-things-to-know-about-decarbonizing-cement-steel-and-chemicals [https://perma.cc/9PHL-MR5J].

29. Maria Gallucci, *Startup hits milestone in its bid to cut concrete's dirtiest ingredient*, CANARY MEDIA (Sept. 21, 2023), https://www.canarymedia.com/articles/clean-industry/startup-hits-milestone-in-its-bid-to-cut-concretes-dirtiest-ingredient [https://perma.cc/EPJ4-6WGD].

30. Paul Fennell et al., *Cement and steel – nine steps to net zero*, NATURE (Mar. 23, 2022), https://www.nature.com/articles/d41586-022-00758-4#:~:text=Production%20of%20cement%20creates%202.3,CO2%20emissions%2C%20respectively1 [https://perma.cc/Q6QK-RE87]; Maria Gallucci, *Major steel users band together to place first big 'green steel' Order*, CANARY MEDIA (Sept. 20, 2023), https://www.canarymedia.com/articles/clean-industry/major-steel-users-band-together-to-place-first-big-green-steel-order [https://perma.cc/5CP3-4VXS].

31. *Steel Industry Pivoting to Electric Furnaces, Analysis Shows,* YALE ENV'T 360 (July 20, 2023), https://e360.yale.edu/digest/steel-industry-carbon-coal-electric-arc-

sector for emissions, fertilizer, is seeing substantial investment in low-carbon pathways,[32] as is aluminum.[33] Chemicals manufacturing also has identified strategies to reduce emissions,[34] including electrifying the production process for ethylene.[35]

Likewise, buildings are the subject of policy and regulatory change that will lead to decarbonization. Some cities are mandating all-electric new construction.[36] Others are implementing emissions accounting for buildings and punishing financially those who do not meet the new metrics.[37] To ensure that low-income residents can make upgrades, cities and states are implementing programs to aid specific population segments with electrification.[38] Utilities are working with homebuilders

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furnaces [https://perma.cc/S8CH-LRVP]; Pavitra Srinivasan & Neal Elliott, *Low-Carbon Cement Could Be Sped to Market with Climate Law Funds*, ACEEE (Dec. 23, 2022), https://www.aceee.org/blog-post/2022/12/low-carbon-cement-could-be-sped-market-climate-law-funds [https://perma.cc/J6HV-A62N]; John Smillie (@JohnSmillie42), X (Sept. 18, 2023, 4:52 PM), https://twitter.com/JohnSmillie42/status/1703874729054994589 [https://perma.cc/MJH7-DVBV].

32. *Low-carbon ammonia production gaining traction as countries aim to cut carbon footprint*, S&P GLOB. COMMODITY INSIGHTS (May 31, 2023), https://www.spglobal.com/commodityinsights/en/market-insights/blogs/agriculture/053123-fertecon-ammonia-australia-india-china [https://perma.cc/AA45-YCSD].

33. Alison F. Takemura, *Can the US lead on clean aluminum? Ford, GM and others hope so*, CANARY MEDIA (Oct. 5, 2023), https://www.canarymedia.com/articles/clean-energy-manufacturing/can-the-us-lead-on-clean-aluminum-ford-gm-and-others-hope-so [https://perma.cc/6B9Q-JS8A].

34. Eric Wesoff, *How to clean up the dirtiest parts of chemical manufacturing*, CANARY MEDIA (Oct. 26, 2023), https://www.canarymedia.com/articles/clean-industry/how-to-clean-up-the-dirtiest-parts-of-chemicals-manufacturing [https://perma.cc/A7U3-777D].

35. Maria Gallucci, *This key chemical is super dirty to make. Can an electric furnace help?*, CANARY MEDIA (Oct. 26, 2023), https://www.canarymedia.com/articles/clean-industry/this-key-chemical-is-super-dirty-to-make-can-an-electric-furnace-help [https://perma.cc/72JT-2DLF].

36. *Cities & States Moving to All-Electric Buildings*, CLIMATENEXUS, https://gas.climatenexus.org/gas-free-buildings [https://perma.cc/LF3H-X7NV] (last visited Feb. 29, 2024); *see, e.g.*, Lauren Urbanek, *New Buildings in NY to Be Electric, but the Job Is Not Done*, NAT. RES. DEF. COUNCIL (May 22, 2023), https://www.nrdc.org/bio/lauren-urbanek/new-buildings-ny-be-electric-job-not-done [https://perma.cc/39MG-XMY5].

37. *See, e.g.*, Jeff St. John, *NYC's big building-decarbonization law faces its first major test*, CANARY MEDIA (Sept. 20, 2023), https://www.canarymedia.com/articles/carbon-free-buildings/nycs-big-building-decarbonization-law-faces-its-first-major-test [https://perma.cc/4T5W-GKY5].

38. Laura Feinstein, *With Subsidies, Pollution-Preventing Heat Pump Upgrades Can Be Affordable for Low-Income Bay Area Households*, SPUR (Feb. 21, 2023), https://www.spur.org/news/2023-02-21/subsidies-pollution-preventing-heat-pump-upgrades-can-be-affordable-low-income-bay [https://perma.cc/734H-7SR9]; *see, e.g.*, Kari Lydersen, *Chicago*

to design entire all-electric neighborhoods,[39] including affordable housing developments.[40] As an alternative to fossil fuel heat, research shows that heat pumps work well and maintain their efficiency even in cold climates, outperforming boilers and furnaces.[41] Installations of heat pumps are increasing, with "more heat pumps than gas furnaces" purchased in the U.S. in 2022.[42] The Inflation Reduction Act ("IRA") provides incentives for electrification, including for heat pump installation, electrical panel upgrades, and additional building envelope improvements like insulation.[43]

Governors are looking to do even more.[44] Given the detrimental impact of fossil gas appliances on indoor air quality,[45] there is a growing awareness that other, non-fossil-fuel options are better for both the planet and our health (and that induction actually does cook even better).[46] Households

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to pay for electric stoves, heat pumps for lower-income homes, ENERGY NEWS NETWORK (July 31, 2023), https://energynews.us/2023/07/31/chicago-to-pay-for-electric-stoves-heat-pumps-for-lower-income-homes/ [https://perma.cc/Z97V-D9FN].

39. 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 [https://perma.cc/3TNM-AJL7].

40. Sean Wolfe, *Ground broken on first "zero-energy" Maryland housing community*, POWERGRID INT'L (Oct. 10, 2023), https://www.power-grid.com/der-grid-edge/ground-broken-on-first-zero-energy-maryland-housing-community/ [https://perma.cc/EQ9W-KLKX].

41. Alison F. Takemura, *Heat pumps outperform boilers and furnaces – even in the cold*, CANARY MEDIA (Sept. 13, 2023), https://www.canarymedia.com/articles/heat-pumps/heat-pumps-outperform-boilers-and-furnaces-even-in-the-cold [https://perma.cc/M4X5-4CU8]; Kelley Christensen, *Study shows homeowners with PV are subsidizing their* neighbors, RENEWABLE ENERGY WORLD (Feb. 11, 2021), https:// www.renewableenergyworld.com/solar/study-shows-homeowners-with-pv-are-subsidizing-their-neighbors/ [https://perma.cc/E3W9-MUC8] (noting that installing solar and heat pumps in Michigan and Canada can save money versus using natural gas).

42. Takemura, *supra* note 41.

43. Nadja Popovich & Elena Shao, *This Guide Can Help You Save Money and Fight Climate Change*, N.Y. TIMES (Feb. 20, 2024), https://www.nytimes.com/interactive/2024/climate/tax-breaks-inflation-reduction-act.html [https://perma.cc/7VMU-3QBW]; *How much money can you get with the Inflation Reduction Act?*, REWIRING AM., https://www.rewiringamerica.org/app/ira-calculator [https://perma.cc/3LP6-H466] (last visited Feb. 29, 2024); *see also* Syed, *supra* note 7.

44. Robert Walton, *Governors' coalition plans to quadruple US heat pump installations by 2030*, UTIL. DIVE (Sept. 22, 2023), https://www.utilitydive.com/news/governors-climate-alliance-heat-pumps-siemens-schneider/694450/ [https://perma.cc/UF3N-GKD9]; Jeff St. John, *New plan aims to quadruple heat-pump adoption in 25 states*, CANARY MEDIA (Sept. 21, 2023), https://www.canarymedia.com/articles/heat-pumps/new-plan-aims-to-quadruple-heat-pump-adoption-in-25-states [https://perma.cc/DUQ8-NV4V] (noting that the pledge covers 55% of the US population).

45. Heather Payne & Jennifer D. Oliva, *Warrantying Health Equity*, 70 UCLA L. REV. 1030 (2023).

46. *Id.*; Emily Farris, *Induction vs. Gas: Why I Said Goodbye to Open-Flame Cooking*, EPICURIOUS (Aug. 16, 2022), https://www.epicurious.com/shopping/induction-vs-gas-why-i-said-goodbye-to-open-flame-cooking [https://perma.cc/CB6E-BYTC].

that previously had fossil gas connections are requesting that their service be permanently disconnected and their meter removed.[47] As one article noted, the "home of the future" is "climate-friendly, electrified and closer than ever."[48]

We find ourselves, therefore, in the position where we must start considering the impact of these changes on our built environment. For some parts of our infrastructure, there will be little difference; highways do not change just because the cars, SUVs and trucks traveling upon them are propelled by electric motors rather than internal-combustion engines. Our homes will remain largely the same whether the space heating inside them is provided by fossil gas furnaces or electric heat pumps. The transmission lines that carry electricity from where it is produced to where it is consumed look the same whether those electrons are produced by wind turbines or by a coal-fired power plant.

However, there will be profound changes to other parts of our fossil-centric infrastructure. This article focuses on three distinct pieces of our built environment that will change as we transition away from fossil fuels: gas stations, fossil gas distribution systems, and interstate fossil gas pipelines. Each of these present enticing opportunities for reusing spaces that could support movement toward a carbon-free future and electrification efforts.

47. *See, e.g.*, Laura Klivans, *Electric Avenue: One Oakland Block's Improbable Journey to Ditch Gas*, KQED (Oct. 30, 2023), https://www.kqed.org/science/1984963/electric-avenue-one-oakland-blocks-improbable-journey-to-ditch-gas [https://perma.cc/7TMQ-2QED]; *Gas Removal or Suspension*, CITY OF PALO ALTO, https://www.cityofpaloalto.org/Departments/Utilities/Customer-Service/Start-Stop-or-Change-Utilities-Service/Gas-Removal-or-Suspension [https://perma.cc/6C63-7FGD] (last visited Mar. 7, 2024). This is happening often enough that gas utilities are starting to recognize it as a long-term threat to their business model, and some have started considering making customers pay hefty disconnection fees. *See* Mark Chediak, *Oklahoma Utility Wants Customers to Pay Up to $1,375 to Quit Gas*, BLOOMBERG (Nov. 5, 2021), https://www.bloomberg.com/news/articles/2021-11-05/oklahoma-utility-wants-to-charge-as-much-as-1-375-to-quit-gas [https://perma.cc/QHV9-7ZNU].

48. Jeff St. John, *Home of the future: Climate-friendly, electrified and closer than ever*, CANARY MEDIA (Feb. 6, 2023), https://www.canarymedia.com/articles/electrification/home-of-the-future-climate-friendly-electrified-and-closer-than-ever [https://perma.cc/YX9Z-D376].

II. GAS STATIONS

Gas stations are a fixture of modern American infrastructure.[49] Often on multiple corners of an intersection, they dot our landscapes. EVs, however, do not need petroleum products. Additionally, the vast majority of EV charging happens at home.[50] Charging that does not occur at home tends to be for longer road trips,[51] and for those situations, fast chargers will need to exist along major interstates.[52]

As we need fewer filling stations, the question becomes what to do with these locations. Certainly, a few will survive for snacks and other convenience-store items.[53] But many more will become economically unviable without a different business model.[54] While other retail or infill housing (especially affordable housing) might seem to be a preferable option, these uses may be stymied by the potential cleanup costs; gas stations, with their underground storage tanks, are often contaminated by an assortment of petroleum components, fuel additives, and other solvents.[55] While standards vary,[56] cleaning up these sites so they can be used for

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49. David Ferris, *The Gas Station's Hidden Battle to Survive*, POLITICO (Oct. 28, 2022, 4:30 AM), https://www.politico.com/news/magazine/2022/10/28/electric-vehicles-fueling-station-gas-utilities-infrastructure-00063398 [https://perma.cc/XS2P-UYRN].

50. Gabe Shenhar & Alex Knizek, *Can Electric Vehicle Owners Rely on DC Fast Charging?*, CONSUMER REPORTS (Nov. 7, 2022), https://www.consumerreports.org/cars/hybrids-evs/can-electric-vehicle-owners-rely-on-dc-fast-charging-a7004735945/ [https://perma.cc/Y9NM-U8KQ] (noting that Department of Energy research indicates 80% of charging happens at home).

51. *Id.*

52. Ferris, *supra* note 49. A discussion of the issues facing gas stations which are transitioning to serve as charging locations for EVs is outside the scope of this article. For one perspective on these issues, *see* Shenhar & Knizek, *supra* note 50.

53. Ferris, *supra* note 49.

54. This is already happening—50,000 stations have closed since 1991. *See* Ronda Kaysen, *A Clean New Life for Grimy Gas Stations*, N.Y. TIMES (July 10, 2012), https://www.nytimes.com/2012/07/11/realestate/commercial/a-clean-new-life-for-grimy-gas-stations.html [https://perma.cc/YH9F-USH3]. Additionally, we have likely reached peak petroleum in the United States.

55. Kate Yoder, *The environmental disaster lurking beneath your neighborhood gas station*, GRIST (June 14, 2023), https://grist.org/accountability/gas-stations-underground-storage-tank-leaks-environmental-disaster/ [https://perma.cc/TGL2-CMMM]. A perusal of any state's brownfields or known contaminated sites will also illustrate a high number of petroleum-contaminated sites. *See also* Governing the Gasoline Spigot, COLTURA, https://www.coltura.org/governing-the-gasoline-spigot/ (last visited Mar. 7, 2024) [https://perma.cc/PKT4-CTST] (putting the "current backlog of leaking underground storage tanks awaiting cleanup" in the United States at 63,677 and noting that "abandoned and contaminated gas stations . . . account for roughly one-half of America's 450,000 brownfields").

56. Matthew N. Metz & Janelle London, *Governing the Gasoline Spigot*, 51 ENV'T. LAW REP. 1 (2021) (noting how cleanup standards are governed by state and local law), https://www.eli.org/sites/default/files/docs/elr_pdf/51.10054.pdf [https://perma.cc/4Y5X-LLPT].

housing is expensive.[57] Also, as the vast majority of these locations are franchised, there are no deep pockets to fund necessary remediation.

Due to their location close to human populations,[58] an alternate use may be more beneficial: installations for large-scale storage. In fact, at least one gas station location is already planning on adding a large-scale battery to minimize demand charges.[59] As we electrify everything (including our buildings and vehicles) and have increasing amounts of renewable generation, it is apparent that we need more storage.[60] This is especially true if we want to maximize the amount of distributed generation, such as rooftop solar, that would minimize the need for utility-scale solar installations on agricultural land or landscapes that could otherwise be conserved for wildlife.

While large-scale transmission could reduce the need for more localized solutions, it is proving incredibly difficult to build, and we are not building it anywhere near fast enough to meet our decarbonization goals.[61] Indeed,

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57. Emily Gibson, *Mission's New Condos Built Atop Old Gas Stations (and Leaky Gas Tanks)*, MISSION LOCAL (Dec. 18, 2013, 6:00 AM), https://missionlocal.org/2013/12/developers-turn-old-gas-stations-into-new-condos/ [https://perma.cc/E55G-2V27] (noting that housing development construction where old gas stations sat only occurs where real estate prices are high because high real estate prices are needed to justify the cleanup costs); Joel Schlesinger, *Life after Corner Gas: The challenges of developing old service stations*, THE GLOBE & MAIL (Oct. 3, 2016), https://www.theglobeandmail.com/report-on-business/industry-news/property-report/life-after-corner-gas-the-challenges-of-developing-old-service-stations/article32219739/ [https://perma.cc/7JY6-N6BN] ("Empty former gas station lots number in the thousands, many in prime locations—corners of prominent intersections in cities and towns across the country. But extensive soil contamination, requiring cleanup that can take years at great cost, is often a tall hurdle to overcome even in the midst of the booming Canadian real-estate market"); *Gas Stations Leave Behind Toxic Pollution as Business 'Starts to Crumble'*, ENERGY MIX (July 30, 2023), https://www.theenergymix.com/gas-stations-leave-behind-toxic-pollution-as-business-starts-to-crumble [https://perma.cc/ZZE5-RSC3] (noting that "[c]leaning up a single gas station can cost USD $1 million").

58. Kaysen, *supra* note 54.

59. Ferris, *supra* note 49.

60. Mark Shenk, *Rising curtailments in Texas magnify grid, storage shortfalls*, REUTERS (Oct. 11, 2023), https://www.reutersevents.com/renewables/wind/rising-curtailments-texas-magnify-grid-storage-shortfalls?utm_campaign=NEP-11OCT23-Newsletter%20Wind-A&utm_medium=email&utm_source=Eloqua [https://perma.cc/SF8E-34J3].

61. Jeff St. John, *The US is building power lines faster, but not fast enough*, CANARY MEDIA (Sept. 18, 2023), https://www.canarymedia.com/articles/transmission/the-us-is-building-power-lines-faster-but-not-fast-enough [https://perma.cc/U8JS-FGE2]; Ethan Howland, *Failing to expand the grid may be biggest threat to US energy transition: National Academies,* UTIL. DIVE (Oct. 19, 2023), https://www.utilitydive.com/news/transmission-grid-energy-transition-decarbonization-national-academies-report/697143/ [https://perma.cc/V445-4WSA].

a recent paper found that batteries can be built faster than new transmission infrastructure.[62]

Unlike transmission, states and localities are adding large battery storage installations.[63] Batteries helped both the Texas and California grids survive record heat over the summer.[64] Additionally, battery duration is getting longer.[65] While these long-duration storage facilities are often constructed where other generation facilities have shuttered to take advantage of existing transmission interconnections,[66] this is at least partially due to how long interconnection queues have become.[67] Putting these facilities closer to load and attached to the distribution system would help solve this problem, in addition to other challenges.

Having large batteries close to human populations could solve multiple grid issues, which would aid a transition to a low-carbon economy. First, with large batteries close to residential areas, the excess electrical generation

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62. Julie Mulvaney Kemp et al., *Interactions between hybrid power plant development and local transmission in congested regions*, 10 ADVANCES IN APPLIED ENERGY 1, 2 (2023), https://www.sciencedirect.com/science/article/pii/S2666792423000124?via%3Dihub [https://perma.cc/53DP-2TNY].

63. *See, e.g.*, Julian Spector & Maria Virginia Olano, *Chart: The remarkable rise of California's grid battery capacity*, CANARY MEDIA (Sept. 22, 2023), https://www.canarymedia.com/articles/batteries/chart-the-remarkable-rise-of-californias-grid-battery-capacity [https://perma.cc/D48T-ZUVY]; Julian Spector, *Sacramento utility rolls out its first long-duration grid batteries*, CANARY MEDIA (Sept. 18, 2023), https://www.canarymedia.com/articles/long-duration-energy-storage/sacramento-utility-rolls-out-its-first-long-duration-grid-batteries [https://perma.cc/G7UL-FSW8]; Kelsey Misbrener, *PG&E announces new $200 million microgrid grant program*, SOLAR POWER WORLD (Oct. 11, 2023), https://www.solarpowerworldonline.com/2023/10/pge-announces-new-200-million-microgrid-grant-program/?utm_source=Sailthru&utm_medium=email&utm_campaign=Issue:%202023-10-18%20Utility%20Dive%20Load%20Management%20%5Bissue:55591%5D&utm_term=Utility%20Dive:%20Load%20Management [https://perma.cc/3TMF-PJSN].

64. Julian Spector, *Grid batteries have never been more abundant – or more useful*, CANARY MEDIA (Oct. 2, 2023), https://www.canarymedia.com/articles/energy-storage/grid-batteries-have-never-been-more-abundant-or-more-useful [https://perma.cc/74U9-RHLW].

65. *Energy Department announces $325M for batteries that can store clean electricity longer*, POWERGRID INT'L (Sept. 22, 2023*)*, https://www.power-grid.com/energy-storage/energy-department-announces-325m-for-batteries-that-can-store-clean-electricity-longer/ [https://perma.cc/7CJW-3QD5].

66. *DOE to fund $70 million for two 100-hour battery projects*, POWERGRID INT'L (Sept. 22, 2023), https://www.power-grid.com/energystorage/doe-to-fund-70-million-for-two-100hour-battery-projects/ [https://perma.cc/7BN4-35GE]; Sarah Shemkus, *A big battery is replacing this old Massachusetts fossil power plant*, CANARY MEDIA (Sept. 13, 2023), https://www.canarymedia.com/articles/batteries/a-big-battery-is-replacing-this-oldmassachusetts-fossil-power-plant [https://perma.cc/Q9QY-26TC].

67. Ethan Howland, *FERC issues rule to speed grid connections for storage, renewables, other generators amid 2-TW backlog*, UTIL. DIVE (July 28, 2023), https://www.utilitydive.com/news/ferc-interconnection-rule-queue-renewable-energy/689289/ [https://perma.cc/9V69-2S3J].

from distributed solar[68] during the middle of the day would not have to travel far on the local grid to go into storage, leading to fewer distribution and transmission grid upgrades.[69] This will therefore minimize costs for captive ratepayers.

Second, large batteries close to residential populations could serve as the basis for microgrids, leading to additional climate resilience as extreme weather makes the larger grid less reliable.[70] These microgrids could ensure that essential services—grocery stores, ATMs, urgent care clinics, emergency service providers, and community centers—remain open and operational during the grid-outage events which are becoming ever more frequent.[71] While projects with battery storage are starting to be built,[72] having many additional locations would aid reliability greatly.

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68. This will be increasingly important for areas where policy is encouraging residential PV installations. *See, e.g.*, *Rooftop solar adoption is increasing in ComEd's service territory*, POWERGRID INT'L (Oct. 9, 2023), https://www.power-grid.com/renewable-energy/rooftop-solar-adoption-is-increasing-in-comeds-service-territory/?utm_source=powergrid_weekly_newsletter&utm_medium=email&utm_campaign=2023-10-10 [https://perma.cc/9NG5-TGQZ] (noting "an annual growth rate of 53%" in rooftop solar systems and the impact of climate legislation on the installation growth).

69. Ysabelle Kempe, *California's urban roofs provide more value for community solar+storage than rural areas: report*, UTIL. DIVE (June 13, 2023), https://www.utilitydive.com/news/community-rooftop-solar-plus-storage-california-cities-rural/652866/ [https://perma.cc/3JVS-XL3L].

70. These installations could also provide other grid services. Sara Baldwin, *Skepticism persists around clean energy and grid reliability. Here's how to fix that.*, UTIL. DIVE (Oct. 5, 2023), https://www.utilitydive.com/news/skepticism-persists-around-clean-energy-and-grid-reliability-heres-how-to/695393/ [https://perma.cc/S47S-CX5L].

71. *See, e.g.*, Robert Walton, *NineDot Energy signs Starbucks as anchor customer for NYC community battery storage*, UTIL. DIVE (Oct. 17, 2023), https://www.utilitydive.com/news/ninedot-energy-starbucks-NYC-community-storage-battery/696761/ [https://perma.cc/SSL8KVF]; *see also* Gaye Taylor, *Mobile Microgrid Builder Makes Renewable Power Beautiful*, ENERGY MIX (Oct. 19, 2023), https://www.theenergymix.com/mobile-microgrid-builder-makes-renewable-power-beautiful/ [https://perma.cc/K46M-V3U8].

72. *Microgrid with long-duration energy storage to help power California children's hospital,* RENEWABLE ENERGY WORLD (Sept. 27, 2023), https://www.renewableenergyworld.com/storage/microgrid-with-long-duration-energy-storage-to-help-power-california-childrens-hospital/ [https://perma.cc/5RJL-5LCE]; *California Children's Hospital Replaces Diesel Plant with Solar+Storage Microgrid*, ENERGY MIX (OCT. 4, 2023), https://www.theenergymix.com/california-childrens-hospital-replaces-diesel-plant-with-solarstorage-microgrid/ [https://perma.cc/4AMK-BL2F]; Robert Walton, *DOE announces $125M in grid modernization, power resilience grants*, UTIL. DIVE (Sept. 6, 2023), https://www.utilitydive.com/news/department-of-energy-grid-modernization-power-resilience-grants/692897/ [https://perma.cc/3FXS-G63W] (discussing grant for "battery backup for critical care and emergency facilities"); Misbrener, *supra* note 63 (discussing airport microgrid); Maeve Allsup, *Will a new tariff solve California's microgrid woes?*, LATITUDE MEDIA

Third, because electricity would be stored near where it would be used, there would be fewer line losses, which could lower costs. The two-way flow of electricity from distributed solar when the sun is shining to the battery and then back from the battery to those residential units and small commercial businesses after the sun goes down could also reduce peaking and improve utilization of the distribution grid, both of which would help keep the costs associated with the energy transition lower.

While these installations could benefit many communities in the form of resilience, they will be more impactful where transmission constraints currently exist. For example, the Delmarva peninsula often pays more for electricity during peak times than neighboring balancing areas as transmission is constrained into the area.[73] By siting large-scale batteries at locations with these conditions, it will have the maximum impact on peak wholesale transmission prices, providing an incentive for battery owners by allowing them to make a profit while lowering costs for users in the area.[74]

This conversion from gas station to local distribution grid storage location has two additional benefits that also are worth mentioning, one economic and one environmental justice-related. First, as gas stations close, local governments will lose both the property tax and sales tax revenue associated with that business. Having a viable alternative use will at least enable the property tax revenues to continue. Second, from an environmental justice perspective, since the harms from fossil fuels are

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(Nov. 8, 2023), https://www.latitudemedia.com/news/microgrids-debate-california [https://perma.cc/ARY4-Y5U9] (noting 4,000 microgrids in development in the US and discussing airport project).

73. Transmission Congestion on the Delmarva Peninsula, No. PA03-12-000 (FERC 2003) (testimony of Frank Wolak); NRG Power Marketing LLC, No. ER22-1539-000 (FERC 2022), https://web.stanford.edu/group/fwolak/cgi-bin/sites/default/files/files/2003,%20Sept_Transmission%20Congestion%20on%20the%20Delmarva%20Peninsula_Wolak.pdf#:~:text=market%20power%20is%20that%20transmission%20constraints%20limit,compete%20with%20local%20ge [https://perma.cc/X4ZN-2NGM]; (protest by Md. Office of People's Counsel), https://opc.maryland.gov/Portals/0/Files/Publications/Others/NRG%20RMR%20Protest%20MD%20OPC%20FERC%20ER22-1539.pdf?ver=uIiIU4z_4CJsRvFPMCrvcQ%3d%3d#:~:text=The%20electric%20transmission%20constraints%20of%20the%20electric%20grid%20on%20the%20Delmarva%20p [https://perma.cc/G3HH-NAUM] (noting the Delmarva Peninsula is an area with "chronic transmission constraints" and that "[t]he electric transmission constraints of the electric grid on the Delmarva peninsula, owing to its unique geography, are a recurring, long-standing problem").

74. Kathryne Cleary & Karen Palmer, *US Electricity Markets 101*, RESOURCES FOR THE FUTURE (Mar. 3, 2020), https://www.rff.org/publications/explainers/us-electricity-markets-101/ [https://perma.cc/5SVH-WC39] ("High prices in the energy market, typically caused by low supply and high demand, provide an economic signal for more generators to enter the market, which can then lower energy prices and provide a signal that enough generating capacity is available to meet demand").

disproportionately borne by poor and minority communities, closing and replacing gas stations will have a positive community health impact.[75]

III. FOSSIL GAS DISTRIBUTION SYSTEM

Inapposite to addressing the climate crisis, fossil gas distribution systems continue to expand and increase in size.[76] While still relatively uncommon in rural areas, many urban and suburban houses have fossil gas piped directly to them.[77] Fossil gas distributed in this way is used for space heating, water heating, clothes drying, and, most commonly, cooking.[78] Due to a prolonged advertising campaign by the American Gas Association, the trade group for fossil gas utilities, many are convinced that cooking with fossil fuels provides a superior experience.[79]

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75. Timothy Q. Donaghy et al., Fossil fuel racism in the United States: How phasing out coal, oil, and gas can protect communities, 100 ENERGY RSCH. & SOC. SCI. (2023), https://www.sciencedirect.com/science/article/pii/S2214629623001640?dgcid=raven_sd_via_email [https://perma.cc/8ZB2-8WXC].

76. Robert Walton, *The number of natural gas customers will continue to rise, even as US decarbonizes: AGA report*, UTIL. DIVE (Feb. 9, 2022), https://www.utilitydive.com/news/the-number-of-natural-gas-customers-will-continue-to-rise-even-as-us-decar/618558/ [https://perma.cc/43XP-WCN4] (noting that the "U.S. gas industry added 900,000 new residential customers between 2019 and 2020"). This is perhaps unsurprising given that a recent survey found "only 43% of utility participants said their organization always or usually accounts for climate change impacts when making capital investment decisions." That means more than half of those asked only sometimes or rarely consider climate change when making decisions. *Utility Capital Investment Planning: Reach Beyond Reliability to Climate Resilience*, COPPERLEAF (last visited Mar. 7, 2024).

77. *Rural vs Urban Natural Gas Distribution Challenges*, ENERGY5 YOUR WAY, https://energy5.com/rural-vs-urban-natural-gas-distribution-challenges [https://perma.cc/M9J7-HFZ8] ("However, the distribution of natural gas is not equally accessible across different geographical areas. Urban communities generally benefit from more extensive natural gas infrastructure, pipelines, and distribution networks. As a result, they enjoy reliable and affordable access to this clean and efficient energy source. In contrast, rural areas often struggle to access natural gas due to factors such as distance, infrastructure limitations, and low population density. This lack of availability leaves rural communities heavily reliant on alternative energy sources, such as electricity, propane, or heating oil").

78. Heather Payne, *The Natural Gas Paradox: Shutting Down a System Designed to Operate Forever*, 80 MD. L. REV. 693 (2021).

79. Rebecca Leber, *How the Fossil Fuel Industry Convinced Americans to Love the Gas Stove*, MOTHER JONES (June 17, 2021), https://www.motherjones.com/environment/2021/06/how-the-fossil-fuel-industry-convinced-americans-to-love-gas-stoves/ [https://perma.cc/R5X4-A4S4]; Rebecca Leber, *The Gas Industry Is Paying Influencers to Gush Over Gas Stoves*, MOTHER JONES (June 17, 2020), https://www.motherjones.com/environment/2020/06/gas-industry-influencers-stoves/ [https://perma.cc/APP2-K5UJ].

However, fossil gas distribution systems need significant maintenance.[80] Gas systems have the very unfortunate problem of exploding as pipes age and their condition deteriorates.[81] Rather than maintain their system such that it will not explode—which would be expected for a monopoly—gas utilities allowed their systems to degrade, keeping prices low while encouraging current and expanded use of fossil gas. Thus, the initial regulatory oversight was obviously insufficient. Once safety became a greater concern and attracted the attention of regulators, fossil gas utilities pushed gas main replacement programs designed to replace thousands of miles of old pipe.[82] These programs give utilities the ability to spend vast quantities of capital, increasing the rate base and, therefore, their profits. While regulatory oversight of gas main replacement programs continue, some states that adopted them (and therefore increased the amount of ratepayer funds going into the gas system) have now determined that to meet state decarbonization goals fossil gas use must end.[83] When that use ceases, the capital that had been sunk into the gas distribution system through the gas main replacement program becomes a stranded asset, or, at least, one with considerably less value given expected uses and timeline. Maintaining the system for the continued use of fossil gas allows utilities to spend tens of millions of dollars annually on the wrong thing.[84]

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80. *See, e.g.*, COPPERLEAF, *supra* note 76 (noting that National Grid "plans to invest $25 billion over the next 20 years to improve the climate resilience of its gas network").

81. I do not make light of the hazard to life and property that these explosions cause. Aging pipelines cause explosions. ARNOLD & ITKIN, 4 LEADING CAUSES OF PIPELINE EXPLOSIONS, https://www.arnolditkin.com/blog/oilfield-accidents/4-leading-causes-of-pipeline-explosions/ [https://perma.cc/EUG6-SNYH]. The largest accident thus far—on PG&E's line in San Bruno, California—caused the death of 13 people and razed entire blocks. More recently, along with one death, an entire neighborhood outside Boston was not able to use gas appliances installed in their homes for more than six months after an explosion made the local distribution system unusable. But it does seem that, after all the "thoughts and prayers" platitudes from utility executives and public relations folks, each situation becomes something that the gas utility just feels it needs to "deal with" in terms of bad publicity—and then use such accidents as a way to invest more capital into the system and gain more profit from these deaths. Faster replacements would increase costs. ASHITA GONA & MIKE HENCHEN, US CAN'T MEET CLIMATE GOALS WHILE SPENDING BILLIONS ON GAS INFRASTRUCTURE (Aug. 2, 2021), https://rmi.org/us-cant-meet-climate-goals-while-spending-billions-on-gas-infrastructure/#:~:text=Tripling%20the%20rate%20of%20gas,on%20zero%2Dcarbon%20building%20upgrades [https://perma.cc/JZ8T-8PTN].

82. Ashita Gona & Mike Henchen, US Can't Meet Climate Goals While Spending Billions on Gas Infrastructure, RMI (Aug. 2, 2021), https://rmi.org/us-cant-meet-climate-goals-while-spending-billions-on-gas-infrastructure/ [https://perma.cc/VKP2-L47P].

83. *See e.g.*, Dan Gearino, *Massachusetts Just Took a Big Step Away from Natural Gas. Which States Might Follow?,* INSIDE CLIMATE NEWS (Dec. 7, 2023), https://insideclimatenews.org/news/07122023/massachusetts-natural-gas-ruling/.

84. To be clear, the cost of the infrastructure is what is expensive, not the fossil gas itself. *See, e.g.*, Joel Rubano (@TCK_Jrubano), X (Sept. 15, 2023, 1:07 PM), https://twitter.com/tck_jrubano/status/1702730871243960587?s=43&t=LNPLnREHmYkQUY

Our current trajectory is a future where captive ratepayers are paying continually increasing rates as less and less gas is used, and regulators will need to address how to shut down the fossil gas distribution system.[85] However, that alone will not address the fact that a large amount of infrastructure will be left behind when the system is shut down.

Rather than have this become a stranded asset with no value, regulators could repurpose this infrastructure in a way that would help with the transition to electrification. One of the largest challenges of the electric grid is reliability. Without sufficient reliability, full electrification is stymied as households and small businesses are loathe to give up an alternative source of energy that could be used when the grid goes down (despite the fact that most gas appliances require electricity to function). Therefore, continued poor reliability—and electric reliability in the United States is the worst among industrialized economies and worsening[86]—will delay our transition to a carbon-free future.

The infrastructure left behind by the fossil gas distribution system, however, could actually help in solving this problem. The vast majority of reliability problems are not due to a lack of supply; generation resources are typically sufficient to meet the need.[87] Rather, the issue is in the distribution system, where, for example, falling trees, squirrels and other animals coming into contact with the system, and vehicles hitting poles cause reliability issues.[88]

DJtENVxw [https://perma.cc/M2YK-RPLP] ("Paying my natural gas bill and, of the total amount, 6% is the cost of the natural gas and 94% is the cost of transporting it to my home. Wow.").

85. *See* Payne, *supra* note 78; *see also* Isaac Sevier, *Building Decarbonization has a Natural Gas Pipeline Problem*, CLIMATE + CMTY. PROJECT (May 17, 2023), https://www.climateandcommunity.org/building-decarb-natural-gas-problem [https://perma.cc/2JG3-5U5J].

86. Paul Mauldin, *U.S. Power Reliability: Are We Kidding Ourselves?*, T&D WORLD (Jan. 13, 2015), https://www.tdworld.com/grid-innovations/article/20966117/us-power-reliability-are-we-kidding-ourselves [https://perma.cc/UAB6-Y2K2].

87. Situations like what happened in Texas with Winter Storm Uri are the exception. However, incidents like that—where there is insufficient supply—are also tied to fossil fuels. Both in Texas and other states where the issue has been generation, renewable resources oversupplied in relation to the forecast. However, fossil fuels underperformed, with significant unanticipated downtime. *See, e.g.*, Ethan Howland, *Record 13% of Eastern Interconnect capacity failed in Winter Storm Elliott: FERC, NERC*, UTIL. DIVE (Sept. 22, 2023), https://www.utilitydive.com/news/winter-storm-elliott-ferc-nerc-report-power-plant-outages/694451/ [https://perma.cc/W52T-U49X].

88. Mark Specht, *Why Did My Power Go Out? Four Ways the Grid Can Fail and Cause an Outage*, UNION OF CONCERNED SCIENTISTS (Aug. 16, 2020, 7:20 PM),

One of main ways that distribution system reliability can be improved is through undergrounding. A significant challenge with undergrounding is the amount of work—and, therefore, cost—associated with actually putting the lines underground.[89] This is partially because fossil gas lines make undergrounding electric lines difficult if the gas lines remain in service because they must be worked around. The existing fossil gas distribution system, however, could provide a much cheaper way to solve the electric distribution problem by providing an existing conduit for the electric wires.

While impractical for higher voltage parts of the electrical grid, this would solve the most significant problems of undergrounding in the distribution system. Additionally, especially in places where the same utility provides both fossil gas and electric service, the easements or other property rights would already be owned by the company, and most utility easement descriptions can likely be read to allow for either fossil gas or electric service. This conversion, therefore, would allow for assets that would otherwise be stranded to be used, would allow for electric reliability to be improved, thereby providing certainty in electric service, and would do so without significant increased cost. Instead of being a detriment to the low-carbon transition, the fossil gas distribution system could be converted into an aid in electrification.

Fossil gas utilities will likely block this conversion without strong regulatory intervention. The utilities will argue that these local distribution systems should be converted for use by a low-carbon fuel, such as hydrogen, that could be used for the same applications for which fossil gas is currently used.[90] There are multiple reasons why regulators should not allow utilities to use this rationale as either a delaying tactic (postponing the shutdown the fossil gas distribution system) or as a reason to allow

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https://blog.ucsusa.org/mark-specht/why-did-my-power-go-out-four-ways-the-grid-can-fail-and-cause-an-outage/ [https://perma.cc/NTJ7-6872]; Aliza Chasan, *Thousands lost power in a New Jersey town after an unexpected animal fell on a transformer*, CBS NEWS (Aug. 16, 2023, 5:14 PM), https://www.cbsnews.com/news/new-jersey-sayreville-residents-lost-power-unexpected-animal-fell-on-a-transformer/ [https://perma.cc/EC28-WF64]; Christopher Ingraham, *A terrifying and hilarious map of squirrel attacks on the U.S. power grid*, THE WASHINGTON POST (Jan. 12, 2016, 12:32 PM), https://www.washingtonpost.com/news/wonk/wp/2016/01/12/a-terrifying-and-hilarious-map-of-squirrel-attacks/ [https://perma.cc/8GC7-XTAY].

89. BRAD JOHNSON, OUT OF SIGHT, OUT OF MIND? A study on the costs and benefits of undergrounding overhead power lines (Jan. 2004) (independent study) (on file with Edison Electric Institute), https://pdi2.org/wp-content/uploads/2021/03/51-EdisonElectInst1.pdf [https://perma.cc/V4G3-LXDK].

90. Sammy Roth, *California declared war on natural gas. Now the fight is going national*, L.A. TIMES (Feb. 9, 2023, 6:00 AM), https://www.latimes.com/environment/newsletter/2023-02-09/california-declared-war-on-natural-gas-now-the-fight-is-going-national-boiling-point [https://perma.cc/2N7T-EMYP].

additional capital expenditures on the fossil gas distribution system, including maintenance activities to prolong the life of the system until these future options become available. First, because of the incompatibility of the current piping materials with compounds like hydrogen, the entire fossil gas distribution network would need to be replaced in order for this to be a feasible solution.[91] This would be an incredibly expensive undertaking, which, because of the way utilities make money and pass costs onto ratepayers, would make consumer rates very expensive.[92] The exorbitant expense will lead customers who can electrify to do so, which will lead to even lower volumes flowing through the system, leading to even higher rates charged to an ever-shrinking customer base.[93] It is entirely likely that the utility will then ask for their stranded costs to be paid by others, either electric ratepayers or taxpayers.

Second, hydrogen is highly explosive and not suitable for household or small commercial use for space heating, water heating, cooking, or clothes drying.[94] It is unlikely that the buildings where we live and work would have all the plumbing torn out of the walls and replaced, which would result in a high hydrogen leakage rate and an extreme safety hazard.[95] As hydrogen also indirectly contributes to climate change, any leakage furthers our climate problem rather than being a climate solution.[96]

Third, appliances that operate on fossil gas cannot burn hydrogen or similar compounds without additional changes first being made.[97] New

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91. Rachel Parkes, *Evidence does not support view that existing gas network can safety handle blend of hydrogen and methane, says US government,* HYDROGEN INSIGHT (Jan. 27, 2023, 9:13 AM), https://www.hydrogeninsight.com/industrial/evidence-does-not-support-view-that-existing-gas-network-can-safely-handle-blend-of-hydrogen-and-methane-says-us-government/2-1-1394325 [https://perma.cc/2X92-QSXR].

92. Michael Barnard, *Hydrogen Heating & Cooking Would Cost Homeowners $100,000+ Extra Over 15 Years*, CLEANTECHNICA, https://cleantechnica.com/2021/10/14/hydrogen-heating-cooking-would-cost-homeowners-100000-extra-over-15-years/ [https://perma.cc/7YHG-ZSMB] (last visited Mar. 8, 2024).

93. Severir, *supra* note 85.

94. *How Dirty Hydrogen Projects Threaten Our Climate and Health,* EARTHJUSTICE (Oct. 13, 2023), https://earthjustice.org/feature/hydrogen-climate-health-threat [https://perma.cc/D3Y8-GCH5].

95. *Hydrogen's Global Warming Impacts*, CLEAN ENERGY GROUP (2023), https://www.cleanegroup.org/wp-content/uploads/Hydrogens-Global-Warming-Impacts.pdf [https://perma.cc/GW7X-8XWN].

96. *Id.*

97. Jeff St. John, *Green Hydrogen in Natural Gas Pipelines: Decarbonization Solution or Pipe Dream?*, GREENTECH MEDIA (Nov. 30, 2020), https://web.archive.org/web/20201202212330/https://www.greentechmedia.com/articles/read/green-hydrogen-

orifices and piping are needed if possible at all, with the risk of leakage and explosion again being a primary concern. Therefore, it is likely that customers will need to purchase new appliances to run on any replacement fuel. With a limited market and options, these appliances are likely to be expensive and would not solve the issue of piping within the structure. It would be better, if new appliances need to be purchased, for these to be electric. Widely available and without explosion and indoor air quality hazards, these appliances will become less carbon-intensive as the electric grid is increasingly supplied by zero-carbon generation sources.

Another likely utility talking point is that the local distribution system could be converted to a non-fuel use, like geothermal district heating and cooling, and that therefore it should not be decommissioned or converted to use for the electric grid. However, this argument should also be viewed with suspicion. As with any new fuel, the entire local distribution system would need to be replaced with new pipes, especially in systems that have a high number of leaks, of which there are many.[98] This would translate to high rates, which would make it expensive for customers to use the district infrastructure. Given how efficient air source heat pumps are, even in very cold temperatures, it is much more practical and economical to ensure excellent electric grid reliability and install electric appliances.

IV. INTERSTATE FOSSIL GAS PIPELINES

If we are not using the fossil gas distribution system for traditional household uses, then most of the interstate fossil gas pipelines would also not be necessary for their current use because the volumes would be too small. While there might be some continued uses for a limited time for some industries which cannot be easily electrified, those will dwindle over

in-natural-gas-pipelines-decarbonization-solution-or-pipe-dream?utm_medium=email&utm_source=Storage&utm_campaign=GTMStorage [https://perma.cc/C7CS-KYTG] (noting that hydrogen "'burns almost as an explosion'" and that equipment "'must be explosion-proof . . . because hydrogen ignites with almost any air-to-fuel ratio'").

98. *Local leaks impact global climate*, ENV'TL DEF. FUND, https://www.edf.org/climate/methanemaps [https://perma.cc/E69K-CYR5] (last visited Mar. 8, 2024); Gregory Korte, *A gas leak every mile: Google Street View cars find problems that utilities don't*, USA TODAY (Nov. 2, 2018, 9:19 AM), https://www.usatoday.com/story/news/nation/2018/11/02/google-cars-sniff-natural-gas-leaks-old-utility-pipelines-explosions/1683173002/ [https://perma.cc/B93E-QQKM]; Bruce Lieberman, *Google 'street view' cars hunt for methane*, YALE CLIMATE CONNECTIONS (Apr. 13, 2017), https://yaleclimateconnections.org/2017/04/google-street-view-cars-hunt-for-methane/ [https://perma.cc/9GJP-PA7F].

time.[99] However, those hard-to-electrify industries could potentially use alternatives such as hydrogen or methanol.[100]

There are multiple challenges for this conversion, however. The first is that any of these replacements will only be additive to the transition to a low-carbon future if these compounds are processed with renewable energy, which is by no means certain.[101] Even if hydrogen is produced with carbon capture and sequestration, it will cause an increase in emissions if produced with fossil fuels.[102] "By contrast, hydrogen produced using electrolysis and zero-emissions electricity does not create [greenhouse gas] emissions."[103] As both methods are being discussed for hydrogen production, it is important to recognize the difference, especially taking realistic fugitive emissions and carbon capture rates into account. A recent study found

> that emissions from gas or coal based hydrogen production systems could be substantial even with [carbon capture and storage], and the cost of [carbon capture and storage] is higher than often assumed. Carbon avoidance costs for high capture rates are notable. Carbon prices of $22–46/tCO2e would be required to make hydrogen from fossil fuels with [carbon capture and storage] competitive with hydrogen produced from fossil fuels without [carbon capture and storage]. At the same time there are indications that electrolysis with renewable energy could become cheaper than fossil fuel with [carbon capture and storage] options, possibly in the near-term future. Establishing hydrogen supply chains on the basis

99. The hard to decarbonize industries typically discussed are cement, iron, steel, chemicals, and plastics. Ricardo Esparza, *Decarbonizing industry is difficult but possible*, ENV'TL DEF. FUND (July 10, 2020), https://blogs.edf.org/markets/2020/07/10/why-de carbonizing-heavy-industry-is-difficult-but-also-possible/ [https://perma.cc/4X4R-XYPT]. We are making more progress on cement and steel, but chemicals and plastics especially are likely going to take longer. How long will largely depend on regulation; industry will move as quickly as it is either required to or is economically advantageous, and not faster.

100. *See*, *e.g.*, Sammy Roth, *L.A. is shutting down its largest gas plant – and replacing it with an unproven hydrogen project*, L.A. TIMES (Feb. 8, 2023, 4:54 PM), https://www. latimes.com/business/story/2023-02-08/l-a-is-shutting-down-a-coastal-gas-plant-and-replacing-it-with-hydrogen [https://perma.cc/EW5S-898B]; Clarion Energy Content Directors, *New owner restarts West Virginia coal-fired plant, plans hydrogen conversion*, POWER ENGINEERING (Aug. 31, 2023), https://www.power-eng.com/coal/new-owner-restarts-west-virginia-coal-fired-plant-plans-hydrogen-conversion/ [https://perma.cc/UGZ4-JZUF] (discussing how a shuttered coal-fired power plant is going to be restarted to run on hydrogen).

101. EARTHJUSTICE, *supra* note 94.

102. Thomas Longden et. al., *'Clean' hydrogen?—Comparing the emissions and costs of fossil fuel versus renewable electricity based hydrogen*, 306 APPLIED ENERGY 1 (2022), https://www.sciencedirect.com/science/article/abs/pii/S0306261921014215?via%3Dihub [https://perma.cc/NDH2-THKJ].

103. *Id.*

> of fossil fuels, as many national strategies foresee, may be incompatible with decarbonisation objectives and raise the risk of stranded assets.[104]

There are mixed signals currently on how well regulations are working to ensure that hydrogen will be produced using only zero-carbon resources. In an indication that the hydrogen will not be produced in ways beneficial to the climate, the majority of funding for "hydrogen hubs" selected for government investment focuses on producing hydrogen using fossil fuels.[105] The funding for hydrogen produced with carbon capture and storage ("CCS") is especially problematic from a carbon and climate change perspective; the large tax credits for CCS do not take lifecycle emissions into account and provide a lucrative funding stream for project operators, blunting other regulatory signals and having potentially significant methane leakage.[106] On the other hand, the proposed regulations for obtaining the clean hydrogen tax credit require hour-by-hour matching between the electricity used and new power or recently built renewable electricity production on the same grid.[107] Importantly, that grid requirement also considers transmission constraints.[108]

It is also necessary to acknowledge the environmental justice issues associated with alternative fuels. While burning hydrogen produced with renewable generation may be better for the climate than burning methane, it still requires large amounts of water to produce and creates harmful air pollution when burned.[109] Without careful consideration, simple fuel swapping will continue to cause environmental injustice and harm communities

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104. *Id.*

105. Emma Penrod, *DOE selects 7 hydrogen hubs for $7B funding opportunity*, UTIL. DIVE (Oct. 13, 2023), https://www.utilitydive.com/news/doe-green-blue-hydrogen-hub-7-billion-gas-nuclear-carbon-capture/696569/ [https://perma.cc/7DX3-NK6S]; Jeff St. John*, Biden admin picks 7 'clean hydrogen hubs' for $7 billion federal boost*, CANARY MEDIA (Oct. 13, 2023), https://www.canarymedia.com/articles/hydrogen/biden-admin-picks-7-clean-hydrogen-hubs-for-7-billion-federal-boost [https://perma.cc/Y9QX-7MBJ].

106. St. John, *supra* note 105; Jeff St. John, *The case against the US government's big 'blue hydrogen' bet,* CANARY MEDIA (Oct. 18, 2023), https://www.canarymedia.com/articles/hydrogen/the-case-against-the-us-governments-big-blue-hydrogen-bet [https://perma.cc/88M3-ERRJ]; CLEAN ENERGY GROUP *supra*, note 95.

107. Jeff St. John, *'Green' hydrogen debate heats up ahead of tax-credit decision*, CANARY MEDIA (Dec. 6, 2023), https://www.canarymedia.com/articles/hydrogen/green-hydrogen-debate-heats-up-ahead-of-tax-credit-decision [https://perma.cc/EF2D-A9ND]; Jeff St. John, *New 'clean' hydrogen rules will favor some regions more than others*, CANARY MEDIA (Jan. 4, 2024), https://www.canarymedia.com/articles/hydrogen/new-clean-hydrogen-rules-will-favor-some-regions-more-than-others [https://perma.cc/3FZ6-M5KW].

108. Jesse D. Jenkins, *Biden admin's long-awaited hydrogen rules are here – and on the right track,* CANARY MEDIA (Dec. 22, 2023), https://www.canarymedia.com/articles/hydrogen/the-biden-administration-has-a-chance-to-do-clean-hydrogen-right [https://perma.cc/T7K3-Q9YE].

109. Roth, *supra* note 90; CLEAN ENERGY GROUP, *supra* note 95.

which are already suffering disproportionately.[110] Hydrogen could also further energy injustice if utilities are allowed to rate base hydrogen pipes[111] and pass those costs on to their existing customer base, many of whom will not use hydrogen. This should be avoided; hydrogen pipes should be paid for only by those who use them, not socialized across the entire utility base.

Even if we can produce hydrogen in a planet-friendly way, another challenge is the infrastructure itself. We cannot directly put hydrogen or other low-carbon replacements directly into the existing interstate fossil gas pipeline network,[112] and a large hydrogen pipeline system does not currently exist.[113] Even blends of hydrogen into the existing fossil gas network would "nearly double the volume of leakage,"[114] which is troubling given that methane is a potent greenhouse gas,[115] and hydrogen is a more potent greenhouse gas than carbon dioxide.[116] Any increase in leakage would negate the potential benefit from using hydrogen in place of fossil gas. Therefore, no matter what replacement compounds are put into the current pipelines, the physical pipes will need to be replaced.[117]

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110. Sammy Roth, *Column: Hydrogen is a crucial climate solution. It's also a distraction*, L.A. TIMES (Oct. 19, 2023, 6:00 AM), https://www.latimes.com/environment/newsletter/2023-10-19/column-hydrogen-is-a-crucial-climate-solution-its-also-a-distraction-boiling-point?utm_id=114566&sfmc_id=2600589&skey_id=3493ff18e1b09badd6f0d272c2016ec89c91b9546b4d663d06ad52bf5250ec37 [https://perma.cc/H8XE-3L6B].

111. Roth, *supra* note 90. At least some utilities are hoping to capitalize on hydrogen to increase rate base.

112. Parkes, *supra* note 91; *see also* St. John, *supra* note 97.

113. David Gelles, *The hope and hype of hydrogen*, N.Y. TIMES (Oct. 17, 2023), https://messaging-custom-newsletters.nytimes.com/dynamic/render?campaign_id=54&emc=edit_clim_20231017&instance_id=105436&nl=climate-forward&productCode=CLIM&regi_id=95594363&segment_id=147580&te=1&uri=nyt%3A%2F%2Fnewsletter%2F5bc64646-f1cf-5b34-ad62-72a0415302ad&user_id=f961f9c4b4fb056fceafd24ca83cdc0e [https://perma.cc/WX2V-NVJ3].

114. Parkes, *supra* note 91.

115. *Methane: A crucial opportunity in the climate fight*, ENV'T DEF. FUND, https://www.edf.org/climate/methane-crucial-opportunity-climate-fight [https://perma.cc/WMD5-Y8H5] (last visited Mar. 7, 2024) (noting that "[m]ethane . . . has more than 80 times the warming power of carbon dioxide over the first 20 years after it reaches the atmosphere. Even though CO2 has a longer-lasting effect, methane sets the pace for warming in the near term . . . At least 25% of today's global warming is driven by methane from human actions").

116. EARTHJUSTICE, *supra* note 94.

117. Parkes, *supra* note 91 (noting that interstate fossil gas pipelines are almost all steel, "which is prone to embrittlement when hydrogen is added to the mix. This is because

What these pipelines do have, however, is rights of way. That is not to say that the conversion will be completely free of potential legal challenges. Interstate fossil gas pipelines are developed under the authority of the Natural Gas Act of 1938, which provides a federal power of eminent domain including against states for state-owned land and easements.[118] It is unclear whether challenges would be successful if these pipelines converted to other substances, as those compounds do not enjoy the same right of federal eminent domain.

If the pipelines own the land in fee simple, it is likely that no action could be taken if the pipelines convert; once a property is owned in fee simple, then the owner broadly has the right to do with it as they will.[119] The closer case is where the pipeline only has an easement. In this case, it will depend on the language used in the easement, as well as whether easement language is construed narrowly or broadly in that jurisdiction. Where language is broadly construed, one likely argument is that this is simply an update of what is flowing through the pipeline based on technological advances, similar to the changes for telecommunications technology moving from copper line telephone wire to fiber optic cable.[120] Given advances in climate science regarding the burning of fossil fuels for power production and other household and industrial uses, an argument could be made that we are technologically advancing from fossil gas to carbon-free compounds.

The largest issue if pipelines are on land through easements is if the language is narrow and the easement specifically references fossil gas or the Natural Gas Act of 1938, thus expressly providing that the easement is only for the purpose of transporting fossil gas. In this case, the express easement conditions indicate that the easement will be terminated as soon as fossil gas was not transported through the pipeline, and those routes

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the tiny hydrogen molecule easily permeates metal, where it is absorbed and diffused throughout the structure, making the pipe more prone to cracking").

118. *Divided Court Rejects Eminent Domain Challenge Involving Natural-Gas Pipeline*, CONST. L. REP., https://constitutionallawreporter.com/2021/08/16/eminent-domain-challenge-involving-natural-gas-pipeline-2/ [https://perma.cc/4MKC-XCJ6] (last visited Mar. 8, 2024).

119. *Landowner Basics: Private Property Rights*, REALTORS LAND INSTITUTE (Apr. 17, 2020), https://www.rliland.com/Voices/The-Voices-of-Land-blog/ArticleID/37/Landowner-Basics-Private-Property-Rights [https://perma.cc/PMS5-383Y].

120. Joseph William Singer, *Electricity easement held not to encompass use for fiber-optic cable*, HARV. UNIV. (May 29, 2017), https://scholar.harvard.edu/jsinger/blog/electricity-easement-held-not-encompass-use-fiber-optic-cable [https://perma.cc/WXF8-R9J2]; *see also* Casey Lide & Thomas Lee Magee, *Using Electric Utility Easements for Broadband*, KELLER & HECKMAN: BEYOND TELECOM LAW BLOG (July 6, 2022), https://www.beyondtelecomlawblog.com/using-electric-utility-easements-for-broadband/ [https://perma.cc/XD5W-UHDK].

would have to be abandoned. However, given the number of industries that are finding electrification more feasible and, in many cases, easier than previously expected, it is unlikely that replacement fuels will be needed in the same volumes as is currently transported through the interstate fossil gas distribution system. Therefore, those easements limited to fossil gas distribution could be abandoned with likely little impact on replacement fuel availability.

Additionally, since these updated compounds can be produced in more places than fossil gas—they do not have the same feedstock limitations and are not extracted from the ground[121]—it is also likely that they can be produced closer to where they would be used. This would allow for the interstate pipeline network to provide additional supply to meet peak conditions and act as a hedge against local supply disruptions, but it would not need to do more than that.

It should also be noted that simply replacing natural gas generation with hydrogen for electricity generation will also likely increase emissions and should be avoided, especially if the future hope of green hydrogen is used as the justification for continued building of fossil gas plants.[122] Limited use, of course, may be beneficial, especially for long-term storage.[123] However, wholesale replacement should not be assumed or encouraged.[124] For our fossil infrastructure to be prudently repurposed, we must also recognize when the infrastructure of the past should be fully retired.

121. *Hydrogen Production: Electrolysis*, OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY, https://www.energy.gov/eere/fuelcells/hydrogen-production-electrolysis [https://perma.cc/H7S3-3J5X] (last visited Mar. 8, 2024).

122. St. John, *supra* note 107; Jeff St. John*, The problem with making green hydrogen to fuel power plants*, CANARY MEDIA (Oct. 10, 2023), https://www.canarymedia.com/ articles/hydrogen/the-problem-with-making-green-hydrogen-to-fuel-power-plants [https://perma.cc/6VN7-Q2CX].

123. COPPERLEAF, *supra* note 76. Storage, however, is expensive.

124. St. John, *supra* note 107.

V. CONCLUSION

Our transition to a zero-carbon world will not be smooth. Fossil fuel interests have lied about climate change,[125] captured regulators,[126] and are even working globally to criminalize legitimate peaceful climate protest and vilify climate activists.[127] To maintain the most livable planet possible, we need to completely wean our world as quickly as possible off their use. Determining how to repurpose our fossil infrastructure can help us get there.

125. Christopher M. Matthews & Collin Eaton, *Inside Exxon's Strategy to Downplay Climate Change*, WALL ST. J. (Sept. 14, 2023, 5:30 AM), https://www.wsj.com/business/energy-oil/exxon-climate-change-documents-e2e9e6af?st=4huqlh9sgjknjbz [https://perma.cc/G8CT-FNNH] (discussing how the climate change denial continued through Rex Tillerson's term as CEO).

126. Timothy Fitzgerald, *Regulatory capture in a resource boom*, PUB. CHOICE (2023), https://link.springer.com/article/10.1007/s11127-023-01113-5 [https://perma.cc/9F64-NJ2A].

127. Amy Westervelt & Geoff Dembicki, *Meet the Shadowy Global Network Vilifying Climate Protestors*, THE NEW REPUBLIC (Sept. 12, 2023), https://newrepublic.com/article/175488/meet-shadowy-global-network-vilifying-climate-protesters [https://perma.cc/XH8ESHSF]. The think tanks involved do not disclose their corporate donors, which leads to the illusion of independence.