The Pandemic Legacy: Accounting for Working-from-Home Emissions

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The COVID-19 pandemic has resulted in millions of employees working from home, a development that is challenging public and private standards for reporting and reducing greenhouse gas emissions. Under these standards, corporations disclose the emissions from large buildings and the power plants that supply them with energy, but most do not report other types of emissions. When employees shift from working at an office to working at home, the corporate emissions appear to have decreased even though they have simply shifted beyond the boundary of the reporting requirement. This move creates greenwashing risks—the ability to claim that corporate greenhouse gas emissions have declined when they have just shifted to non-reporting sources—and undermines incentives for corporations to induce employees to reduce emissions. Although the working-from-home transition has been underway for some time, it accelerated dramatically during the COVID-19 pandemic, and it may lead to permanent shifts in the workplace for millions of employees. Using an efficiency and justice lens, this Article examines the standards regarding working-from-home emissions and concludes that undercounting could occur, could unfairly burden workers, and could increase net emissions. The Article proposes changes in emissions reporting standards to address these concerns, including amending or interpreting the standards to require employers to account for employee working-from-home-related emissions in corporate emissions reports. The Article focuses on greenhouse gas emissions, but it has implications for other types of emissions, worker health and safety, taxation, and other fields that have been affected by the working-from-home transition.

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INTRODUCTION

In 2019, only 3.4 percent of the U.S. workforce telecommuted. During the COVID-19 pandemic, this figure increased to at least 25 percent,[1] and some estimates suggest that nearly 50 percent of the workforce telecommuted.[2] The increased percentage of employees working from home (WFH) during the pandemic accelerated trends that were already underway, and these trends may continue for the foreseeable future. For instance, Global Workplace Analytics "estimates that about 60 million employees, or 56 percent of the U.S. workforce,

1. Scott Waldman, *Telecommuting Could Outlive the Pandemic, Lowering Emissions*, SCI. AM: E&E NEWS (Apr. 30, 2020), https://www.scientificamerican.com/article/telecommuting-could-outlive-the-pandemic-lowering-emissions/ (Global Workplace Analytics estimates that by the end of 2021, 25–30 percent of the U.S. workforce will telecommute) [https://perma.cc/E92T-7TJU]; *see also* Matt Curtis, (re)Awakening to the Benefits and Climate Impacts of Telework During COVID-19, at 19 (June 12, 2020) (M.A.S. Capstone Project, Univ. of Cal. San Diego), https://escholarship.org/content/qt7nf8k2q6/qt7nf8k2q6_noSplash_30708910e19831fd3d84c41a96ad5050.pdf?t=qcoyz2 [https://perma.cc/NE2F-UW66].

2. GETABSTRACT, NATIONAL SURVEY: A MAJORITY OF US EMPLOYEES WANT REMOTE WORK ARRANGEMENT TO STAY 3 (2020), https://journal.getabstract.com/wp-content/uploads/2020/04/ga_remote_survey_2020_compressed.pdf [https://perma.cc/JU49-PGG8]. Some of these shifts may be permanent. *See* Press Release, Gartner, Gartner HR Survey Reveals 41% of Employees Likely to Work Remotely at Least Some of the Time Post Coronavirus Pandemic (Apr. 14, 2020), https://www.gartner.com/en/newsroom/press-releases/2020-04-14-gartner-hr-survey-reveals-41—of-employees-likely-to- [https://perma.cc/E7U3-3JZX] (noting that a Gartner survey of HR leaders from 229 companies found that 41 percent of employees will likely work from home at least part time when the quarantine measures end, up from 30 percent prior to the quarantine).

could work from home at least part-time" over the long term and that "25 to 30 percent of the U.S. workforce will be working from home by the end of 2021."[3] The WFH transition has particularly affected lawyers. Within a month after the COVID-19 pandemic emerged in March 2020, 48 percent of all law firms had shifted to a complete WFH policy, 40 percent used a mixed approach, and only 12 percent continued to work exclusively from offices.[4]

The WFH transition may also continue long after the COVID-19 threat recedes. Major employers vary widely in their announcements about their long-term approach to WFH. Employers such as Google, Amazon, and Royal Bank of Scotland initially encouraged at-home work for many employees until at least mid-2021. For the post-COVID-19 period, Amazon plans for employees to return to its office spaces while Google and Apple are planning to provide hybrid options.[5] Employers such as Facebook, Twitter, and Zillow have indicated that the WFH transition will be permanent for many employees.[6] Some corporations, such as the retailer Recreational Equipment Incorporated (known as REI), have responded to the WFH transition by leaving their office buildings permanently.[7] Some law firms have done so as well.[8]

The effects of the WFH transition on climate change mitigation will turn on how the greenhouse gas (GHG) disclosure regime accounts for emissions when employees shift from working at an office to working at home. Major emissions reductions are possible because the WFH transition implicates several GHG-intensive household activities. Before the pandemic, household energy and transportation emissions accounted for roughly a quarter to a third of all GHG emissions in the United States.[9] Transportation is the largest contributor to GHG

3. Curtis, *supra* note 1, at 19.

4. Danielle Braff, *Remote Possibilities Thanks to the COVID-19 Pandemic, Law Firms are Starting to Embrace Virtual Offices—But Will it Last?*, 107 ABA J. 20, 20–21 (2021) (reporting on results of survey by MyCase).

5. *See* Heather Kelly & Rachel Lerman, *As Offices Open Back up, Not All Tech Firms Are Sold on a Remote Future*, WASH. POST (June 4, 2021, 8:00 AM), https://www.washingtonpost.com/technology/2021/06/04/big-tech-office-openings/.

6. Alexis Benveniste, *These Companies Are Working from Home Until 2021—or Forever*, CNN BUS. (Aug. 2, 2020, 2:41 PM), https://www.cnn.com/2020/08/02/business/companies-work-from-home-2021/index.html [https://perma.cc/ZGV9-WWKW]. Similarly, Synchrony Financial, the largest U.S. store credit card company, has announced that employees will not be expected to work in the office five days a week even after the end of the pandemic. *See* Matt Egan, *A Credit Card Giant Says No One Should Work from the Office Five Days a Week*, CNN BUS. (June 30, 2021, 4:46 PM), https://www.cnn.com/2021/06/29/business/back-to-work-wall-street-synchrony/index.html.

7. *See* Leah Asmelash & Alison Kosik, *Outdoor Retailer REI to Sell Sprawling New and Unused Headquarter to Shift to Remote Work*, CNN BUS. (Aug. 14, 2020, 8:29 AM), https://www.cnn.com/2020/08/13/business/rei-sell-campus-coronavirus-trnd/index.html [https://perma.cc/MYC2-5EES].

8. Braff, *supra* note 4, at 21.

9. *See, e.g.*, Michael P. Vandenbergh & Anne C. Steinemann, *The Carbon-Neutral Individual*, 82 N.Y.U. L. REV. 1673, 1694 (2007) (suggesting that U.S. greenhouse gas emissions attributable to households to be over one-third of total emissions); *see generally* Katrina Fischer Kuh, *Personal Environmental Information The Promise and Perils of the Emerging Capacity to Identify Individual Environmental Harms*, 65 VAND. L. REV. 1565 (2012) (identifying household sources and interventions);

emissions in the United States, and when employees shift to WFH, they reduce commuting-related emissions even after accounting for rebound effects.[10] But these employees also shift energy use from their workplaces to their homes. Depending on the relative efficiency of home heating, cooling, and lighting, the relative carbon intensity of the grid, and changes in household behavior, WFH could actually increase GHG emissions.[11] Remote work may also induce people to move away from cities with high wages and high rents to cities with lower costs of living but higher GHG emissions per capita.

The WFH transition thus presents an opportunity to reduce GHG emissions, but public and private GHG reporting standards must be carefully tailored to address these emissions. Public and private governance regimes use informational regulation to induce firms to disclose GHG and other emissions[12] and provide detailed reporting standards to ensure accuracy in emissions calculations.[13] Decades of research demonstrate that informational regulation matters—disclosure of pollutant emissions can induce firms to adopt sustainable practices and lower emissions.[14] Although accurate GHG emissions reporting is crucial for effective informational regulation, estimation methodologies rely on assumptions to save time and accommodate data limitations. The leading public and private GHG disclosure standards developed when WFH was rare. Such reporting systems require corporations to report emissions from their facilities but not from their employees' homes, even if employees are required to work at home. When at-home work represented a small percentage of the workforce, the exclusion of WFH GHG emissions had little effect on the accuracy of corporate

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Gerald T. Gardner & Paul C. Stern, *The Short List The Most Effective Actions U.S. Households Can Take to Curb Climate Change*, 50 ENV'T 12, 18–19 (2008) (identifying steps households can take to reduce emissions); Benjamin Goldstein et al., *The Carbon Footprint of Household Energy Use in the United States*, 27 PROC. NAT'L ACAD. SCIS. 19,122, 19,122 (2020) (suggesting that emissions from U.S. households accounted for roughly 20 percent of all U.S. emissions before the pandemic).

10. Michael P. Vandenbergh & Paul C. Stern, *The Role of Individual and Household Behavior in Decarbonization*, *in* LEGAL PATHWAYS TO DEEP DECARBONIZATION IN THE UNITED STATES 87–110 (John Dernbach & Michael Gerrard eds., 2019).

11. *See* discussion *infra* Part I.

12. *See, e.g.*, Daniel C. Esty, *Environmental Protection in the Information Age*, 79 N.Y.U. L. REV. 115, 115 (2004) (exploring informational regulation and the role of emerging technologies); Cass R. Sunstein, *Informational Regulation and Informational Standing* Akins *and Beyond*, 147 U. PA. L. REV. 613, 614 (1999) (examining statutes requiring private or public disclosure); Mark A. Cohen & W. Kip Viscusi, *The Role of Information Disclosure in Climate Mitigation Policy*, 3 CLIMATE CHANGE ECON. 1, 1 (2012).

13. Michael P. Vandenbergh, *Private Environmental Governance*, 99 CORNELL L. REV. 129, 129 (2013); *see also* Sarah E. Light & Eric W. Orts, *Parallels in Public and Private Environmental Governance*, 5 MICH. J. ENV'T & ADMIN. L. 1, 42–44 (2015); Tracey M. Roberts, *The Rise of Rule Four Institutions Voluntary Standards, Certification and Labeling Schemes*, 40 ECOLOGY L.Q. 107, 154 (2013).

14. Shameek Konar & Mark A. Cohen, *Information as Regulation The Effect of Community Right to Know Laws on Toxic Emissions*, 32 J. ENV'T ECON. & MGMT. 109, 109, 123 (1997); *see also* Wendy E. Wagner, *Imagining Corporate Sustainability as a Public Good Rather than a Corporate Bad*, 46 WAKE FOREST L. REV. 561, 562 (2011) (proposing to stimulate corporate emissions reductions through government disclosure of corporate sustainability data).

carbon footprints. Now, with the vast increase in at-home work, this reporting boundary will allow employers to claim large emissions reductions even if those emissions have simply shifted to employees' homes.

This movement of emissions beyond the employer's reporting boundary can not only enable corporations to engage in greenwashing—to claim phantom emissions reductions that arise from shifting rather than reducing emissions—but can also create perverse incentives regarding emissions reductions.[15] If GHG reporting standards systematically undercount WFH emissions, corporate managers, advocacy groups, and regulators may be unaware of these emissions. In addition, corporate managers may lack incentives to reduce these GHG emissions and may have incentives to push employees into at-home work even if doing so increases net emissions.[16] Allowing WFH emissions to remain outside the corporate reporting boundary could also lead to inequitable shifting of energy costs onto employees, who often lack the information and resources to reduce energy use.

This Article argues that the WFH shift necessitates changes in GHG reporting standards to avoid undermining climate mitigation efforts. The Article focuses on requirements for corporate employers in the United States. But it is relevant to corporations around the world, to other private sector employers (e.g., investment firms, lenders, insurers, colleges and universities, civic and cultural groups, religious organizations, and other nongovernmental organizations (NGOs)), and to public sector employers (e.g., international, national, and subnational governments). The Article highlights the public and private standards driving many employers' emissions reporting: GHG reporting standards managed by the federal Environmental Protection Agency (EPA), the California Air Resources Board (CARB), and the leading private standard, the GHG Protocol Corporate and Accounting Reporting Standard (GHG Protocol Corporate Standard).[17]

The EPA and CARB GHG reporting requirements are largely unaffected by the WFH shift because both include high reporting thresholds (sources with over 25,000 tons per year (tpy) for EPA[18] and 10,000 tpy for CARB[19]) that already exclude many office buildings. Because the emissions from office buildings typically are already outside the EPA and California reporting standards,[20] the

15. *See* Sarah E. Light, *The Law of the Corporation as Environmental Law*, 71 STAN. L. REV. 137, 190 (2019) (discussing "greenwashing" literature).

16. *See* Michael P. Vandenbergh & Mark A. Cohen, *Climate Change Governance Boundaries and Leakage*, 18 N.Y.U. ENV'T L. J. 221, 223–30 (2010) (discussing the effects of reporting boundaries on incentives to reduce emissions).

17. The analysis here is relevant to other reporting standards (e.g., public standards adopted by other states and nations and other private standards), but they are beyond the scope of this Article.

18. 40 C.F.R. § 98.2 (2021).

19. CAL. CODE REGS. tit. 17, § 95101(a)(1)(B) (2021).

20. *See* EPA, 2019 GHGRP OVERVIEW REPORT 3 (2019), https://www.epa.gov/sites/production/files/2020-11/documents/2019_ghgrp_yearly_overview.pdf (noting that the majority of GHG emissions in the commercial sector are accounted for by the reporting of energy suppliers).

risks of greenwashing or creating perverse incentives from the WFH transition are low. Calling for greater attention to household emissions could improve these government standards, however. As such, this Article supports the development of an Individual Carbon Release Inventory (ICRI) based on periodic surveys of household GHG emissions.[21]

The private standard presents a greater challenge. The GHG Protocol Corporate Standard has emerged as the dominant global standard for corporate GHG accounting and reporting in the last decade. More than 90 percent of the Fortune 500 companies that reported emissions to CDP (formerly the Carbon Disclosure Project) in 2016 used some form of the GHG Protocol Corporate Standard.[22] Many universities, NGOs, and governments also use the GHG Protocol Corporate Standard for emissions reporting.[23] The GHG Protocol Corporate Standard is the product of the Greenhouse Gas Protocol Initiative (GHG Protocol Initiative), an NGO formed in 1998 by a partnership of businesses, other NGOs, and governments convened by the World Resources Institute and the World Business Council on Sustainable Development.[24] The GHG Protocol Corporate Standard is the most widely adopted global standard for GHG reporting and an important component of climate mitigation efforts. For instance, a recent CDP report maintains that investors with over $100 trillion in assets recently induced roughly 10,000 corporations to report their emissions using the GHG Protocol Corporate Standard.[25] The CDP uses this reporting to push for corporate emissions reductions.[26]

The risk that the WFH transition will shift emissions outside the reporting boundary of most corporations arises because WFH emissions largely fall outside the most widely used reporting categories. The GHG Protocol Corporate Standard divides corporations' emissions into three categories: Scope 1 emissions arise from sources owned or controlled by the corporation; Scope 2 emissions arise from the generation of purchased energy (for example, electricity generated offsite) consumed by the corporation in its facilities; and Scope 3 emissions include all other indirect emissions.[27] Although Scope 3 emissions

21. *See* Vandenbergh & Steinemann, *supra* note 9, at 1679 (proposing an Individual Carbon Release Inventory).

22. *See About Us*, GREENHOUSE GAS PROTOCOL, https://ghgprotocol.org/about-us (last visited Feb. 11, 2021) [https://perma.cc/W7YE-FPTQ].

23. *See What We Do*, CDP, https://www.cdp.net/en/info/about-us/what-we-do (last visited Feb. 11, 2021).

24. *See* GREENHOUSE GAS PROTOCOL, A CORPORATE ACCOUNTING AND REPORTING STANDARD: REVISED EDITION 2 (2004), https://ghgprotocol.org/corporate-standard [https://perma.cc/DB44-ZS4Y] (describing the GHG Protocol Initiative as "a multi-stakeholder partnership of businesses, non-governmental organizations (NGOs), governments, and others").

25. *See* BusinessGreen Staff, *CDP Reporting Record Almost 10,000 Companies Disclose Environmental Data in 2020*, GREENBIZ (Nov. 18, 2020), https://www.greenbiz.com/article/cdp-reporting-record-almost-10000-companies-disclose-environmental-data-2020 [https://perma.cc/K3K4-37MY].

26. *See id.*

27. *See* discussion *infra* Subpart I.B.

arise from the activities of the corporation, the emissions come from sources not owned or controlled by the company, such as the supply chain and WFH activities. Firms that track GHG emissions typically report Scope 1 and Scope 2 emissions, but not Scope 3 emissions, and only a handful of those that report Scope 3 emissions include WFH emissions.[28] WFH emissions can be difficult for the employer to assess and might have been trivial compared to Scope 1 and 2 emissions when the GHG Protocol was drafted. But with the WFH transition, allowing firms not to report WFH emissions because they fall outside the reporting boundaries used by most firms is no longer a defensible approach.

The Article explores modifications to the GHG Protocol Corporate Standard to account for the WFH transition. To facilitate efficient and equitable emissions reductions, the Article argues that WFH emissions reporting should seek to induce employers to report WFH emissions when they are the least cost avoider, avoid double counting, reduce the transaction costs associated with reporting, and ensure that the actor best able to pay for emissions reductions is assigned the reporting obligation. Default or benchmark assumptions are commonly used to reduce GHG accounting costs and can enable employers to calculate emissions based on mean or median employee WFH emissions.

Part I assesses the GHG implications of the WFH shift and presents an economic model that examines the implications of at-home work for GHG emissions. Part II provides an overview of public and private GHG reporting standards, takes a deep dive into how these standards apply to WFH-related emissions, and recommends modifications to account for the WFH transition. Part III examines how two other regulatory regimes, worker safety and taxation, address WFH reporting issues and argues that the attribution of WFH emissions to employers is consistent with the approach taken in these areas. The Article concludes by arguing that the modifications suggested in the Article are feasible, address the perverse incentives created by the current reporting regime, and will yield large, cost-effective, and equitable GHG emissions reductions.

I. GHG EMISSIONS AND OPTIMAL EMISSIONS REPORTING

A. GHG Emissions from Working-from-Home

1. Elements of WFH Emissions

The GHG emissions from households[29] and corporations[30] have been studied extensively, but the emissions arising from the WFH shift and the

28. *See* discussion *infra* Part III.

29. *See generally* Vandenbergh & Steinemann, *supra* note 9; Thomas Dietz et al., *Household Actions Can Provide a Behavioral Wedge to Rapidly Reduce US Carbon Emissions*, 106 PROC. NAT'L ACAD. SCIS. 18,452 (2009); Goldstein et al., *supra* note 9.

30. *See, e.g.*, Waldman, *supra* note 1; Andrew Hook et al., *A Systematic Review of the Energy and Climate Impacts of Teleworking*, 15 ENV'T RSCH. LETTERS 1 (2020) (examining the energy and climate effects of telework).

implications for reporting standards have not. At the outset, the quantity of emissions that may be affected by the shift is substantial. The U.S. workforce in 2020 included roughly 135 million people,[31] and the United States currently includes more than 100 million households.[32] Even minor shifts in GHG emissions between office work and at-home work could thus have important effects on GHG emissions.[33] Research in 2003 suggested that at-home work decreases carbon dioxide (CO_2) emissions, although the range of possible emissions reductions was very wide—between 2 and 80 percent.[34] This early research also suggested that telework may increase emissions of other GHGs like nitrous oxide and methane, however, and it did not assess the effects of changes in home location by employees.[35]

To assess the current state of knowledge regarding the WFH transition, we divide WFH impacts into three categories: commuting, corporate buildings, and WFH location. Table 1 presents many of the emissions impacts of switching to at-home work in a table form, with an eye toward summarizing the expected energy and carbon impacts.

Our first category is commuting. Transportation accounts for roughly 40 percent of total GHG emissions in the United States,[36] and commuting accounts for a substantial share of U.S. transportation emissions.[37] If 25 to 50 percent of employees stop commuting, the reductions in net GHG emissions could be substantial.[38] Given this opportunity, researchers have suggested that government policies requiring eligible employees to telework could reduce corporate emissions.[39] Recent responses to COVID-19 have led to a 300 percent increase in walking and over 200 percent increasing in biking according to

31. *See* Waldman, *supra* note 1.

32. *Id.*

33. *Id.*

34. Erasmia Kitou & Arpad Horvath, *Energy-Related Emissions from Telework*, 37 ENV'T SCI. & TECH. 3467, 3470–71 (2003).

35. *Id.*

36. EPA, EPA 430-R-20-002, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2018, at ES-13 (2020).

37. Approximately 28 percent of GHG emissions come from public transport, and 59 percent of that is from light duty vehicles. *See Fast Facts on Transportation Greenhouse Gas Emissions*, EPA, https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions (last visited Feb. 11, 2021) [https://perma.cc/2Y7X-U2WL]. In 2017, commuting to and from work accounted for about a quarter of total vehicle trips, and about 30 percent of vehicle-miles traveled. *See* Nikos Tsafos, *The Slowly Changing U.S. Commute*, CTR. FOR STRATEGIC & INT'L STUD. (June 12, 2019), https://www.csis.org/blogs/energy-headlines-versus-trendlines/slowly-changing-us-commute#:~:text=In%202017%2C%20commuting%20to%20and,it%20is%20a%20big%20one [https://perma.cc/Q4WY-KEP4].

38. *See Work-at-Home After Covid-19—Our Forecast*, GLOB. WORKPLACE ANALYTICS, https://globalworkplaceanalytics.com/work-at-home-after-covid-19-our-forecast (last visited Feb. 11, 2020) [https://perma.cc/FEW9-WQX4] ("[T]here is no easier, quicker, and cheaper way to reduce your carbon footprint than by reducing commuter travel."); *see also Fast Facts on Transportation Greenhouse Gas Emissions*, *supra* note 37; Tsafos, *supra* note 37.

39. Matt Butner & Jayni Hein, *Remote Work is a Huge Opportunity for High-Impact Climate Policy*, QUARTZ AT WORK (May 5, 2020), https://qz.com/work/1851226/remote-work-is-a-form-of-high-impact-climate-policy/ [https://perma.cc/QY87-VEBY].

transportation surveys in Washington State,[40] as well as unprecedented demand for bicycles,[41] all of which could lead to long-term changes in commuting habits.

But the WFH shift can also lead to a rebound effect in which employees use the time savings from reduced commuting to drive more for errands or recreational travel. The net impact is still likely to be a reduction in vehicle miles traveled,[42] but this rebound effect may reduce the GHG emissions savings from the WFH transition. Another rebound effect can result from the added consumption that may arise from lower commuting costs and other work-related costs arising from the WFH transition. These money and time savings may result in more frequent leisure trips or other purchases that increase carbon emissions. The net impact on emissions will depend on the carbon cost of the replacement expenditures, a topic that will require additional research.[43]

Our second category is corporate buildings. Building construction and operation account for 39 percent of global energy-related GHG emissions.[44] If WFH affects building-related energy use, it could have an appreciable effect on United States and global GHG emissions.[45] A switch to WFH can result in less energy used at the office through reduced heating and cooling, lighting, and equipment use, and perhaps a net decrease in commercial space needed. These savings may be small if the space is still heated, cooled, and illuminated or if the existing commercial space has other uses. WFH also may result in a long-term decrease in commercial space,[46] as demonstrated by the REI decision to close its headquarters, but the net effects on GHG emissions are still unknown.

Our third category is the WFH location. At-home work-related GHG emissions vary depending on several factors: efficiency of the workspace; energy-related behavior of the worker; emissions intensity of the electricity and fuels used to light, heat, cool, and run the space; and long-run effects such as new building additions or accessory dwelling units used as offices where employees

40. Wash. State Dep't of Transp., *Roads Less Travelled How the COVID-19 Pandemic is Affecting Transportation in Washington,* 77 GRAY NOTEBOOK 1, 3 (2020), https://wsdot.wa.gov/publications/fulltext/graynotebook/gray-notebook-Mar20.pdf [https://perma.cc/3QZQ-498W] (comparisons for April 9 and April 17).

41. Christina Goldbaum, *Thinking of Buying a Bike? Get Ready for a Very Long Wait*, N.Y. TIMES (May 18, 2020), https://www.nytimes.com/2020/05/18/nyregion/bike-shortage-coronavirus.html [https://perma.cc/XX7W-5KGG].

42. Sangho Choo et al., *Does Telecommuting Reduce Vehicle-miles Traveled? An Aggregate Time Series Analysis for the U.S.*, 32 TRANSP. 37, 60 (2005); Prashant B. Balepur et al., *Transportation Impacts of Center-Based Telecommuting Interim Finding from the Neighborhood Telecenters Project*, 25 TRANSP. 287, 287 (1998).

43. For a discussion of the costs implications of telecommuting, *see Telecommuting Could Save U.S. Over $700 Billion a Year and Much More*, GLOB. WORKPLACE ANALYTICS, https://globalworkplaceanalytics.com/cut-oil (last visited Dec. 7, 2020) [https://perma.cc/382P-B6Y7].

44. GLOB. ALL. FOR BLDGS. & CONSTR., 2018 GLOBAL STATUS REPORT: TOWARDS A ZERO-EMISSION, EFFICIENT AND RESILIENT BUILDINGS AND CONSTRUCTION SECTOR 14 (2018), https://www.worldgbc.org/sites/default/files/2018%20GlobalABC%20Global%20Status%20Report.pdf [https://perma.cc/223G-KSJ6].

45. *See id*.

46. *See* Asmelash & Kosik, *supra* note 7.

can work. Indeed, many who work from home have a dedicated room, garage, or multiple rooms for work,[47] so a WFH shift could result in a demand for larger homes.[48] If these spaces connect to the main living area, they may need to be heated and cooled—even during nonworking hours. In addition, some companies may scale up their information technology center infrastructure to accommodate increased internet use associated with the WFH shift, leading to further increases in energy use and GHG emissions.[49]

The WFH shift may also affect GHG emissions by changing the timing of energy use. For instance, eliminating the evening peak-period for electricity usage can change the GHG emissions intensity of energy. Evening peak-periods vary by region and by season but are generally between 4–8 pm, when offices are still being heated and cooled and workers are arriving home and turning on household appliances.[50] The WFH shift could reduce evening peaks, making it easier to incorporate renewables. Teleworking thus could reduce emissions if renewables replace the peak energy source or if the peak source simply has a higher carbon intensity than the baseload.[51]

Furthermore, the WFH shift could affect emissions by facilitating employee relocations. The transition to at-home work has allowed many workers to move farther from urban centers and into more affordable housing,[52] to different

47. Matthew Zenkteler et al., *Home-Based Work in Cities In Search of an Appropriate Urban Planning Response*, FUTURES (2019), https://doi.org/10.1016/j.futures.2019.102494. [https://perma.cc/7PYF-P4FQ] (reporting that a survey in Australia found 81 percent of teleworkers intend to continue working from home).

48. Matthew J. Delventhal et al., How Do Cities Change When We Work from Home? 10 (Dec. 4, 2020) (unpublished manuscript), http://www.andrii-parkhomenko.net/files/DKP_Covid_Urban.pdf [https://perma.cc/8YQA-9JCY] (noting that the average house size was 2,430 square feet in 2010, with home-based teleworkers having, on average, an additional 500 square feet, suggesting that telecommuters' homes are approximately 20 percent larger than the national average).

49. Marlese Lessing, *Rapidly Scaling IT Infrastructure for Remote Workers*, SDXCENTRAL (Apr. 11, 2020, 2:48 PM) https://www.sdxcentral.com/security/definitions/it-infrastructure-scaling-for-remote-workers/ [https://perma.cc/RK6A-XWFH].

50. *Hourly Electricity Consumption Varies Throughout the Day and Across Seasons*, U.S. ENERGY INFO. ADMIN.: TODAY IN ENERGY (Feb. 21, 2020), https://www.eia.gov/todayinenergy/detail.php?id=42915 [https://perma.cc/7X88-66WS].

51. *See* Jonathan Susser, *Why Is Peak Demand a Concern for Utilities?*, ADVANCED ENERGY (Mar. 13, 2018), https://www.advancedenergy.org/2018/03/13/why-is-peak-demand-a-concern-for-utilities/ ("In the past, utilities have been able to generally predict the pattern of electricity demand, with spikes in the morning and early evening surrounded by gradual increases and decreases; there was rarely a large jump or dip in demand. With increasing amounts of solar and wind energy, however, this pattern is becoming less reliable, particularly when considering when these energy sources are most readily available and how quickly they go online or offline.").

52. *See* Delventhal et al., *supra* note 48, at 2.

regions with lower living costs[53] or higher amenities,[54] and possibly even to relocate abroad.[55] These effects can increase if the WFH transition continues for an extended period and have mixed implications for GHG emissions. For instance, moving farther away can reduce travel savings from teleworking if employees still commute to the office a few days a week.[56] Perhaps most important, as demonstrated by Table 2, the WFH shift could have profound effects on emissions if workers move from high cost, low per capita emissions states such as California, to low cost, high per capita emissions states such as Texas. Figure 1 plots the per capita GHG emissions and cost of living of each state and the District of Columbia. Although some states, such as Wyoming and North Dakota, shown in Figure 1, have high per capita emissions due to fossil fuel extraction industries, generally, states with a higher cost of living have lower per capita emissions.[57] Moving from states with higher housing costs will likely result in the employee living in a location with higher average per capita emissions. The differences can have large effects on GHG emissions: a move from the District of Columbia, the most expensive state, to Louisiana, the 18th most expensive state, would result in four times the GHG emissions per capita.[58]

Any electricity used by a transplant from Washington, D.C. to Louisiana (or California to Texas or New York to Montana), whether the electricity is used directly or indirectly from the grid, will likely be higher in GHG emissions. The urban environment in higher per capita emission states may be less conducive to lower carbon transportation without the same vehicle charging network, public transit, and bike/pedestrian infrastructure. At the same time, these new residents may also bring a different view of the importance of climate action and may change the political representation of their new home. Lower home prices will

53. Cat Zakrzewski & Tonya Riley, *The Technology 202 The Tech Industry's Shift to Remote Work Will Forever Change Silicon Valley*, WASH. POST (May 22, 2020, 9:05 AM), https://www.washingtonpost.com/news/powerpost/paloma/the-technology-202/2020/05/22/the-technology-202-the-tech-industry-s-shift-to-remote-work-will-forever-change-silicon-valley/5ec6aa41602ff165d3e3e892/ [https://perma.cc/6MYH-5QEE]; Meghan McCarty Carino, *More Remote Work Could Send Techies out of Tech Hubs . . . to a Point*, MARKETPLACE (May 18, 2020), https://www.marketplace.org/2020/05/18/more-remote-work-could-send-techies-out-of-tech-hubs/ [https://perma.cc/3H8F-KHTM].

54. Justin Fox, *The Rise of Work-From-Home Towns*, BLOOMBERG: OP. (Aug. 27, 2020, 9:35 AM), https://www.bloomberg.com/opinion/articles/2020-08-27/scenic-towns-enjoy-boom-as-work-from-home-becomes-pandemic-norm?sref=aGTrSb9U [https://perma.cc/VP8R-BL9Q].

55. Charu Suri, *Why Work from Home When You Can Work from Barbados, Bermuda or . . . Estonia?*, N.Y. TIMES (Aug. 19, 2020), https://www.nytimes.com/2020/08/19/travel/remote-worker-visa.html [https://perma.cc/4L2Z-8DTT].

56. Rolf Moeckel, *Working from Home Modeling the Impact of Telework on Transportation and Land Use*, 26 TRANSP. RSCH. PROCEDIA 207, 208 (2017).

57. *See* Figure 1.

58. U.S. ENERGY INFO. ADMIN., ENERGY-RELATED CARBON DIOXIDE EMISSIONS BY STATE, 2005-2016, at 16 (2019), https://www.eia.gov/environment/emissions/state/analysis/ [https://perma.cc/24A3-7Z35] (assumes no increase in Louisiana's industrial emissions, which are 58 percent of the state's emissions).

result in larger homes,[59] which will require more energy to heat, cool, and maintain. Workers who relocate to other states or foreign countries may start flying more for work,[60] and they may change the number or distance of flights they take to see family and friends, depending on where they moved. The WFH shift may also have important effects on productivity, but these effects are difficult to assess and beyond the scope of this Article.[61]

A shift to WFH will likely have consequences for equity as well, although the direction of these effects is difficult to predict. During the pandemic, 37 percent of Asian employees and 29.9 percent of White employees worked from home, but only 19.7 percent of Black or African American and 16.2 percent of Hispanic or Latino families worked from home.[62] If WFH reduces the need to commute, workers will move farther from work. And as a result, commuting and housing patterns will change, which will raise environmental justice concerns around traffic congestion, air quality, and the housing market. Many of these impacts will depend on local conditions and will require location-specific analysis.[63]

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59. ARTHUR O'SULLIVAN, URBAN ECONOMICS 177–80 (9th ed. 2019).

60. It is also possible that WFH employees will fly more often because they will not need to be near their office to work. Air travel is one of the highest impact sources of carbon emissions today. According to the Institute of Physics carbon footprint calculator, one transatlantic flight produces more greenhouse gas emissions than the average person in seventy-four countries (with the lowest per-capita emissions) does in an entire year. Seth Wynes & Kimberly A. Nicholas, *The Climate Mitigation Gap Education and Government Recommendations Miss the Most Effective Individual Actions*, 12 ENV'T RSCH. LETTERS 1, 4 (2017).

61. The effects of the WFH shift on productivity also could have important effects on GHG emissions. For instance, if WFH is more productive, employees may be able to spend less time at work, thus reducing the costs for the employer, the net amount of time spent working, and the GHG emissions associated with WFH. Research suggests that WFH can increase productivity for some jobs in the short-term although there may be long-term productivity losses from a decrease in innovation. *See* Edward Glaeser & David Cutler, *You May Get More Work Done at Home. But You'd Have Better Ideas at the Office*, WASH. POST (Sept. 24, 2021, 4:14 PM), https://www.washingtonpost.com/outlook/2021/09/24/working-home-productivity-pandemic-remote/. Studies suggest that businesses would save about $500 billion a year in real estate, electricity, turnover, productivity, and absenteeism through increased WFH, and employees would save between $2,000–7,000 in transportation and work-related costs. *See Telecommuting Could Save U.S. Over $700 Billion a Year and Much More*, *supra* note 43. Employees also may benefit by reducing the time spent on their daily commute. *See* Courtney Connley, *Why Many Employees are Hoping to Work from Home Even After the Pandemic Is Over*, CNBC: MAKE IT, (May 4, 2020, 9:50 AM), https://www.cnbc.com/2020/05/04/why-many-employees-are-hoping-to-work-from-home-even-after-the-pandemic-is-over.html [https://perma.cc/95BV-7QXU]. Several factors suggest that the WFH shift may not lead to greater productivity, however, and the WFH effects on productivity are beyond the scope of this Article.

62. Elise Gould & Heidi Shierholz, *Not Everybody Can Work from Home Black and Hispanic Workers Are Much Less Likely to Be Able to Telework*, ECON. POL'Y INST.: WORKING ECON. BLOG (Mar. 19, 2020, 1:15 PM), https://www.epi.org/blog/black-and-hispanic-workers-are-much-less-likely-to-be-able-to-work-from-home/.

63. *See* Tackling the Climate Crisis at Home and Abroad, Exec. Order No. 14,008, §§ 219–23, 86 Fed. Reg. 7,619, 7,629–32 (Jan. 27, 2021) (requiring consideration of environmental justice in federal climate actions); *see also* Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Communities, Exec. Order No. 12,898, 59 Fed. Reg. 7629, 7629 (Feb. 11, 1994) (requiring assessments of environmental justice effects of federal agency actions).

2. Economic Model

As the discussion above suggests, multiple factors affect how increases in at-home work will influence energy demand and GHG emissions, and these factors may interact in complex ways. To provide additional clarity that can assist with the design of improved reporting standards, we develop a theoretical model of utility maximization subject to budget and time constraints.

The model starts with a utility function that workers maximize by choosing their housing, the amount of labor they supply, and the amount of consumption they enjoy, as measured by a composite good. Workers make these decisions based on the cost of housing in various locations, the commuting cost of living in that location, their wage, and whether their employer allows them to work from home. Emissions are a function of the employees' choices, and the question addressed by the model is whether WFH increases emissions. Employees do not pay the external costs of their carbon emissions, but employers pay a reputational cost for their reported carbon emissions. This means excluding WFH emissions in the employer's reported emissions will create a perverse incentive for employers to encourage workers to work from home at a more than optimal level.

Workers maximize utility:

$$U(H, L, X) = H^{\alpha} L^{\beta} X^{\gamma} \quad (1)$$

Where U is utility, H is a measure of housing which includes housing quality and size, L is the hours of leisure time, and X is a composite good whose price is normalized to 1.

The budget constraint is:

$$P_{H,l} H + X \leq wE \quad (2)$$

Where $P_{H,l}$ is the price of housing in location l, w is the wage and E is the amount of time the employee is working per week as measured in hours.

The weekly time constraint is:

$$L + E + C_l(5 - WAH) \leq T \quad (3)$$

Where C_l is the time in hours needed to commute round trip to the office from location l, WAH is the number of days the employee is able to WFH, and T is the total number of hours available to the employee in a week.

Using (1), (2) and (3), we can derive demand curves for housing, leisure and the composite good for a particular location:

$$\begin{aligned} &H(P_{H,l}, w, C_l | WAH) \\ &L(P_{H,l}, w, C_l | WAH) \\ &X(P_{H,l}, w, C_l | WAH) \end{aligned} \quad (4)$$

The functions in (4) can be used to create a value function for each location l, and the consumer's location decision is picking the l with the highest value function.

$$V_l(P_{H,l}, w, C_l|WAH) \quad (5)$$

Using (4) and (5) we can calculate total emissions for the value function with the highest utility which is a function of a vector of housing prices at all locations, $\boldsymbol{P_H}$, *w,* and a vector of commuting time costs at all locations $\boldsymbol{C}$:

$$S(\boldsymbol{P_H}, w, \boldsymbol{C}|WAH) \quad (6)$$

The employee is unable to control the number of days they can work from home, *WAH,* but is able to pick the housing, hours worked, location and amount of composite good subject to the employer's decision around WAH.

If $\partial S(\boldsymbol{P_H}, w, \boldsymbol{C}|WAH)/\partial WAH > 0$, that would imply that increased flexibility around WFH increases emissions. There is likely a large discontinuity at $WAH = 5$ where the employee is no longer tethered to the employer's location and can move further than a day's drive from the worksite.

Employers maximize profits with production function:

$$P_y Y(E, WAH, \mathrm{S}) - w(WAH)\mathrm{E} - \phi S(\widetilde{WAH}) \quad (7)$$

Where Y is output, P_y is the price of the output and ϕ is the shadow price of GHG emissions, often an internal carbon price or the reputational cost of additional GHG emissions, and $S(\widetilde{WAH})$ is reported emissions which may be systematically different from actual emissions.

In a competitive labor market, we would assume that higher levels of WFH mean employees are willing to do the job for a lower wage, hence the wage is assumed to be a function of *WAH*, *w*(*WAH*) with $w(WAH)/\partial WAH < 0$ and the impact of WFH on total emissions, $S(WAH)/\partial WAH$, having an ambiguous sign. If we exclude emissions related to home offices, then $S(\widetilde{WAH})$ will be lower than *S*(*WAH*) and $S(\widetilde{WAH})/\partial WAH$ will be negative even if actual emissions rise with increased WFH.

In short, the model suggests that if emissions reporting standards systematically underreport WFH emissions, employers may overinvest in WFH-related activities. And perhaps more likely, emissions reporting standards that systematically underreport emissions will induce employers to miss valuable opportunities to achieve emissions reductions related to home office use.

3. Opportunities for Reducing Emissions

The model suggests that if reporting standards fail to attribute WFH emissions to employers, the employers may not have incentives to reduce WFH GHG emissions. But are employers better situated than employees to reduce WFH emissions? If so, can employers achieve substantial emissions reductions at low cost? Although both employers and employees may have the capacity and desire to reduce GHG emissions, employers tend to be better situated to gather, assess, and report GHG emissions and generally have greater resources to devote to data gathering and analysis than their employees. Numerous studies demonstrate that individuals have little information about household GHG emissions and have serious misperceptions about which household activities have the greatest emissions.[64]

Governments and NGOs can try lowering household emissions by supplying individuals with accurate information, but these interventions are difficult to scale.[65] In contrast, employers can affect household GHG emissions on a large scale.[66] Thus, from an efficiency perspective, employers are often better situated to report and reduce WFH GHG emissions than employees.[67] Employer emissions reduction efforts may face constraints arising from employee equity and privacy concerns; thus, any assignment of WFH GHG reporting to employers will need to account for equitable distribution of employee subsidies and limits on data gathering.[68]

As to the feasibility of achieving GHG emissions reductions at the household level, well-designed initiatives could substantially reduce household GHG emissions, but efforts to target household energy use and GHG emissions have had mixed success.[69] Direct government regulation of household energy use, GHG emissions, and behavior are often unpopular.[70] No major environmental advocacy group has focused principally on the household sector,

64. *See, e.g.*, Shahzeen Z. Attari et al., *Public Perceptions of Energy Consumption and Savings*, 107 PROC. NAT'L ACAD. SCIS. 16,054, 16,055 (2010) (identifying energy myths about household actions).

65. *See* Michael P. Vandenbergh et al., *Regulation in the Behavioral Era*, 95 MINN. L. REV. 715, 763 (2011).

66. For instance, General Electric had 205,000 employees in 2019. *See Total Number of Employees at General Electric from 2006 to 2019*, STATISTA (Feb. 2020), https://www.statista.com/statistics/220718/number-of-employees-at-general-electric/ [https://perma.cc/R5WW-FRPK].

67. Of course, for climate policy generally, an important question is whether the marginal cost of reducing WFH emissions is lower than the other available climate mitigation opportunities.

68. *See generally* Katrina Fisher Kuh, *When Government Intrudes Regulating Individual Behaviors that Harm the Environment*, 61 DUKE L.J. 1111 (2012).

69. *See, e.g.*, Dietz et al., *supra* note 29, at 18,455 (identifying successful household energy and climate interventions).

70. *See* Michael P. Vandenbergh, *From Smokestack to SUV The Individual as Regulated Entity in the New Era of Environmental Law*, 57 VAND. L. REV. 515, 610–28 (2004) (noting resistance to federal regulatory measures directed at household environmental behavior).

and some advocates for government climate action worry that individual behavior-focused efforts undermine support for government action.[71]

Nevertheless, government, NGO, and corporate employer initiatives have achieved important successes in reducing household GHG emissions in the United States. For instance, government lightbulb efficiency standards combined with private sector initiatives to increase uptake of LED lightbulbs have produced annual emissions reductions of roughly 127 million metric tons of GHGs.[72] This amount alone exceeds the total emissions from several large industrial sectors.[73] In fact, research suggests that uptake of LED and compact fluorescent lightbulbs may be responsible for the first sustained reduction in per capita household electricity use in the United States over the last decade.[74] Similarly, government and private initiatives that provide consumers with clear, simple efficiency information regarding appliances and comparative energy use information on electric power bills have resulted in large, persistent reductions in energy use and GHG emissions.[75]

Studies suggest that well-designed programs that target households could increase rather than decrease support for government action[76] and yield annual emissions reductions equal to all of the emissions from the country of France.[77] But as noted above, efforts to shift individual behavior face problems of scale: more than 100 million households exist in the United States and reaching them with information or incentives is not easy.[78] Initiatives by large corporate employers could bypass problems of scale by reaching hundreds of thousands of employees.

Public and private climate initiatives that target corporations often focus on direct emissions from corporate facilities rather than inducing corporations to

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71. *See, e.g.*, Michael E. Mann, *Lifestyle Changes Aren't Enough to Save the Planet. Here's What Could*, TIME (Sept. 12, 2019, 7:14 AM), https://time.com/5669071/lifestyle-changes-climate-change/ [https://perma.cc/RWS9-5ERS]; Michael E. Mann & Jonathan Brockopp, *You Can't Save the Climate by Going Vegan. Corporate Polluters Must Be Held Accountable.*, USA TODAY (June 3, 2019), https://www.usatoday.com/story/opinion/2019/06/03/climate-change-requires-collective-action-more-than-single-acts-column/1275965001/ [https://perma.cc/SR8E-J3V4].

72. Jonathan M. Gilligan & Michael P. Vandenbergh, *A Framework for Assessing the Impact of Private Climate Governance*, 60 ENERGY RSCH. & SOC. SCI. 1, 2 (2020) (expressing the reductions carbon dioxide equivalents or CO_2e).

73. *Id*.

74. *See* Lucas W. Davis, *Evidence of a Decline in Electricity Use by U.S. Households*, 37 ECON. BULL. 1098, 1103–04 (2017); *see also* Gilligan & Vandenbergh, *supra* note 72 (discussing role of Walmart and estimating GHG reductions).

75. For an overview, see MICHAEL P. VANDENBERGH & JONATHAN M. GILLIGAN, BEYOND POLITICS: THE PRIVATE GOVERNANCE RESPONSE TO CLIMATE CHANGE 245–312 (2017).

76. *See* Heather Barnes Truelove et al., *Positive and Negative Spillover of Pro-Environmental Behavior An Integrative Review and Theoretical Framework*, 29 GLOB. ENV'T CHANGE 127, 131 (2014); *see also, generally*, Amanda R. Carrico et al., *Does Learning About Climate Change Adaptation Change Support for Mitigation?*, 41 J. ENV'T PSYCH. 19 (2015).

77. Dietz et al., *supra* note 29, at 18,452–53, 18,455 (evaluating technical potential and behavioral plasticity of seventeen action types).

78. Vandenbergh & Stern, *supra* note 10, at 87.

reduce WFH GHG emissions.[79] Federal climate policy has varied widely over the last eight years. It has focused principally on regulating electric utilities and motor vehicle manufacturers, however, rather than on reducing WFH emissions.[80] Although several states have developed more consistent climate policies than the federal government, none has focused explicitly on WFH emissions.[81] Firms respond not only to regulatory pressures, but also to nonregulatory social and economic pressures,[82] and they have been described as needing both a legal and a social license to operate.[83] Not surprisingly, private initiatives have used social license pressure to induce corporate emissions reductions,[84] but these initiatives typically focus on direct (Scope 1) and power plant (Scope 2) emissions.[85] Surveys indicate that most of the firms that disclose GHG emissions report Scope 1 and 2 emissions but not Scope 3 emissions.[86] Of the firms reporting Scope 3 emissions, most of the focus is on supply chains, and

79. For a discussion of initiatives that have targeted corporations and households, see VANDENBERGH & GILLIGAN, *supra* note 75, at 177–312.

80. *See, e.g.*, Tackling the Climate Crisis at Home and Abroad, Exec. Order No. 14,008, 86 Fed. Reg. 7619, 7624 (Jan. 27, 2021) (addressing large stationary sources by including the goal of a "carbon pollution-free electricity sector" by 2035); Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis, Exec. Order No. 13,990, 86 Fed. Reg. 7037, 7037 (Jan. 30, 2021) (addressing transportation emissions instructs the heads of relevant agencies to "consider publishing for notice and comment a proposed rule suspending, revising, or rescinding the agency action within the time frame specified," including "The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program" by April 2021, and "The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks" by July 2021); *see also* Jennifer Dlouhy & Stephen Lee, *Biden's EPA Chief Vows Tougher Tailpipe Rules by July, Unwinding Trump Regs*, AUTO. NEWS (Apr. 6, 2021, 1:51 PM), https://www.autonews.com/regulation-safety/bidens-epa-chief-vows-tougher-tailpipe-rules-july-unwinding-trump-regs (noting the shifting regulatory direction regarding automobile GHG emissions regulations among recent presidential administrations).

81. *See* Global Warming Solutions Act of 2006, A.B. 32, 2005–2006 Leg., Reg. Sess. (Cal. 2006). For an overview, see *Climate Change*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/topics/climate-change (last visited Dec. 12, 2020) [https://perma.cc/P5HQ-A47D].

82. *See, e.g.*, Neil Gunningham et al., *Social License and Environmental Protection Why Businesses Go Beyond Compliance*, 29 L. & SOC. INQUIRY 307, 308–10 (2004) (noting that firms need a social license to operate as well as a legal license).

83. *Id.*

84. *See* U.N. ENV'T PROGRAMME, EMISSIONS GAP REPORT 2019, at 35 (2019), https://wedocs.unep.org/bitstream/handle/20.500.11822/30797/EGR2019.pdf [https://perma.cc/W9BU-BY9S].

85. For instance, the CDP reporting regime requires Scope 1 and Scope 2 emissions reporting and encourages, but does not require, Scope 3 reporting. *See* CARBON TRUST, CDP, CASCADING COMMITMENTS: DRIVING AMBITIOUS ACTION THROUGH SUPPLY CHAIN ENGAGEMENT 16 (2019), https://www.cdp.net/en/research/global-reports/global-supply-chain-report-2019 [https://perma.cc/WQR5-YCV3].

86. *See* Florence Depoers et al., *Voluntary Disclosure of Greenhouse Gas Emissions Contrasting the Carbon Disclosure Project and Corporate Reports*, 134 J. BUS. ETHICS 445 (2016); Samuel Tang & David Demeritt, *Climate Change and Mandatory Carbon Reporting Impacts on Business Process and Performance*, 27 BUS. STRATEGY & ENV'T 437, 446 (2018).

the limited anecdotal evidence suggests that very few of the firms reporting Scope 3 emissions include WFH emissions.[87]

Still, advocacy groups and corporations are beginning to respond to the WFH transition by targeting employee emissions. For instance, CDP and other NGOs are escalating pressure on corporations to report many types of Scope 3 emissions, including employee commuting emissions.[88] Attributing employee WFH-related emissions to employers may create a variety of incentives to lower these emissions.[89] Of course, assigning the emissions to employees could increase pressure on employees to reduce household emissions. This reduction will only occur, though, if their household emissions are transparent, if they are subject to regulatory or social pressure, and if they have the financial and human resources necessary to respond, all of which are unlikely.[90] In contrast, assigning WFH-related emissions to employers would likely increase regulatory and informal social license pressure on the employers.

Including WFH-related GHG emissions in corporate reporting can incentivize companies to provide energy-saving resources and information to employees who work at home. In fact, some corporations have already begun providing employee energy benefits, which range from providing employees with information regarding home energy efficiency to subsidies for home energy audits, weatherization, energy-efficient equipment, and solar panels.[91] The growth in employee energy benefits has also spawned a new type of business that offers employers the ability to provide employee energy benefit programs with low transaction costs.[92] Employers who offer employee energy benefits are particularly well positioned to conduct large-scale efforts to assist employees in reducing household GHG emissions.[93]

Equitable considerations also favor assigning firms some level of responsibility for reducing energy use and emissions from at-home work.[94] For many individuals, the costs of household energy use are a substantial energy

87. *See Measuring Environmental Impact Carbon Footprint Calculations*, IBM KNOWLEDGE CTR., https://www.ibm.com/support/knowledgecenter/SSFCZ3_10.7/com.ibm.tri.doc/tre_measure/c_carbon_ftpt_calcs.html (last visited Feb. 12, 2021) [https://perma.cc/KC9E-W6HM].

88. *See, e.g.*, Christine Uri & Emma Stewart, *How Coronavirus Could Have a Lasting Effect on Carbon Reduction*, ENGIE IMPACT, https://www.engieimpact.com/insights/coronavirus-carbon-reduction (last visited Dec. 10, 2020) [https://perma.cc/VXF9-QG8M].

89. *See id.*

90. Butner & Hein, *supra* note 39.

91. Alexander Maki et al., *Employee Energy Benefits What Are They and What Effect Do They Have on Employees?*, 12 ENERGY EFFICIENCY 1065, 1065 (2018). For an example of a new firm that is assisting corporations with employee energy benefits, see SUSTAIN6, https://sustain6.com/ (last visited Feb. 11, 2021) [https://perma.cc/TYZ2-GRXR].

92. *See, e.g.*, SUSTAIN6, *supra* note 91.

93. *See, e.g.*, Uri & Stewart, *supra* note 88.

94. For a discussion of climate change justice and equity issues regarding individual behavior, see generally Michael P. Vandenbergh et al., *Micro-Offsets and Macro-Transformation An Inconvenient View of Climate Change Justice*, 33 HARV. ENV'T L. REV. 303 (2009) and Michael P. Vandenbergh & Brooke A. Ackerly, *Climate Change The Equity Problem*, 26 VA. ENV'T L.J. 55 (2008).

burden.[95] Firms typically have greater expertise and resources than employees. They also profit from the WFH transition by reducing overhead costs and in some cases require employees to work at home. Although a firm's higher-paid employees may be well situated to obtain the equipment and knowledge necessary to reduce WFH GHG emissions, most employees will likely have far less money and information than their employers. Employer-sponsored information and subsidy programs may go a long way toward addressing these concerns.

B. Optimal Reporting of Working-from-Home GHG Emissions

The fact that firms are well positioned to assist employees with household GHG emissions reductions suggests that reporting standards that motivate firms to reduce WFH emissions could be cost-effective. The costs of WFH emissions reduction measures and the need to protect employee autonomy at home suggest the need to create incentives for an optimal balance of actions by firms and employees. The model and discussion presented above suggest several insights about the optimal reporting of GHG emissions from at-home work.

Assigning WFH emissions to employers can be expected to increase regulatory and informal social license pressure on firms to reduce their emissions and to provide resources and information that reduce WFH-related emissions. In contrast, assigning those emissions to employees can be expected to relieve employers of this pressure and encourage firms to shift additional employees to WFH settings even if doing so increases emissions. Although assigning the emissions to employees could also increase pressure on employees to reduce household emissions, this pressure will only arise if emissions from households are transparent and subject to regulatory or social pressure. And these reductions are only likely to occur if employees have the financial and human resources necessary to respond.

Requiring firms to report employees' WFH GHG emissions would result in an increase in emissions reported, which could increase costs for firms that are subject to high reputational or other pressures from investors, lenders, insurers, employees, or local communities. As a result, the placement of the reporting boundary matters—if firms are required to report WFH emissions, they will likely reduce them either because of public or private governance-based motivations. And to minimize total costs of compliance, firms can be expected to make the least-cost abatements first. They can do so by leveraging better access to capital and economies of scale, such as staff expertise in reducing emissions in WFH settings. Initiatives that pressure firms to disclose employee-

95. *See, e.g.*, Agya K. Aning, *Why the Poor in Baltimore Face Such Crushing Energy Burdens*,' INSIDE CLIMATE NEWS (Feb. 12, 2021), https://insideclimatenews.org/news/12022021/energy-burdens-low-income-baltimore/ (exploring disproportionately high spending on natural gas and electric costs among lower-income families in Baltimore).

based WFH emissions thus could induce those firms to reduce emissions and are a potentially valuable tool for public and private policymakers.[96]

Firms may respond to the pressure arising from reporting WFH emissions by taking a range of steps. As discussed above, one is offering employees additional employee energy benefits, such as energy efficiency information or subsidies for home energy audits, weatherization, energy-efficient equipment, or home solar systems.[97] Firms could also respond with direct financial incentives, such as bonuses or salary adjustments based on employees' energy use and GHG emissions, by mandating efficient practices, or even differentiating salary based on the expected emissions if an employee changes location. Programs that provide employees with incentives to calculate their carbon footprint, along with nudges and incentives to reduce their footprint, could be effective as well. Employers might also respond by offering remote work during seasons with the lowest demand for heating or air-conditioning.

Employers will need to be careful, however, to account for the effects on transportation emissions and congestion.[98] As with the timing of electricity use, reducing congestion can play an important role in GHG emissions.[99] In addition, firms may have financial incentives to induce people to drive less during certain parts of the year in bad air quality areas. For instance, regulatory programs under the Clean Air Act incentivize employers to reduce driving in the summer months.[100]

Finally, if WFH increases a firm's reported emissions, the costs associated with WFH employees will increase relative to the costs of on-site employees. This cost increase may result in a decline in the firm's demand for WFH employees. In turn, this decline in firm demand for WFH employees will result in relatively more on-site employees. These effects may vary among different sectors of the workforce and may raise equity concerns. Overall, the attribution of WFH emissions to employers or employees can have important and complex effects on corporate incentives to reduce WFH-related GHG emissions and the distribution of costs and benefits of employment. It is therefore important to understand how the leading public and private GHG standards account for these emissions.

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96. *See* Attari et al., *supra* note 64 (identifying energy myths about household actions).

97. *See* Maki et al., *supra* note 91 (discussing employee energy benefits).

98. For instance, many utilities calculate degree days for every month of the year, which allows researchers to predict which months will have the lowest demand for heating or cooling. This information suggests that heating and cooling demands would be lowest from March to May and September to November in many areas of the United States, making these times more suitable for remote work. In contrast, the summer and winter months would be more suitable for office work. *See Units and Calculators Explained Degree Days*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/energyexplained/units-and-calculators/degree-days.php (last updated June 23, 2021).

99. *See generally* Matthew Barth & Kanok Boriboonsomsin, *Real-World Carbon Dioxide Impacts of Traffic Congestion*, 2058 TRANSP. RSCH. REC. 163 (2008).

100. *See* Craig N. Oren*, Detail and Implementation The Example of Employee Trip Reduction*, 17 VA. ENV'T L.J. 123, 155 (1998). Regulatory programs create similar incentives in the winter months in areas where inversion layers can contribute to poor air quality. *Id.*

II. GHG REPORTING STANDARDS

Part II examines how the principal reporting standards account for WFH-related emissions and then proposes several changes. The analysis of public standards focuses on the federal and California requirements. The analysis of private standards focuses on the GHG Protocol Corporate Standard, the dominant private reporting standard in the United States and around the world.[101]

A. Public Standards

1. Federal Requirements: EPA Greenhouse Gas Reporting Program (GHGRP).

On October 30, 2009, EPA published a GHG reporting rule, and it has developed the Greenhouse Gas Reporting Program (GHGRP) to implement the rule.[102] We refer to the rule and EPA's interpretations collectively as the GHGRP. The GHGRP requires approximately 8,000 facilities in forty-one industrial categories across the United States to report GHG emissions annually.[103] The GHGRP has limited relevance to WFH emissions, however, because it only requires reporting of GHG emissions from facilities that emit 25,000 metric tons of GHGs per year ("direct emitters"), suppliers of certain fossil fuels and industrial gases, and facilities that inject CO_2 underground.[104] If subject to the mandate, facilities that emit GHGs are required to submit data reports annually to EPA.[105] Firms submit data for emissions from the previous calendar year, and each October, the reported data are made publicly available

101. Another widely used private pollution reporting regime is the Global Reporting Initiative. *See About GRI*, GLOBAL REPORTING INITIATIVE, https://www.globalreporting.org/about-gri/.

102. *See* 40 C.F.R. § 98 (2021) (codifying the GHGRP). For preamble information, see Mandatory Reporting of Greenhouse Gases, 75 Fed. Reg. 66,433 (Oct. 28, 2010) (to be codified at 40 C.F.R. pt. 86, 98). The GHGRP derives its statutory authority from sections 114 and 208 of the Clean Air Act, 42 U.S.C. §§ 7414, 7542, and from the fiscal year 2008 Consolidated Appropriations Act, H.R. 2764, Pub. L. No. 110-161. Clean Air Act section 114 authorizes EPA to require emissions sources and entities subject to the Clean Air Act to monitor and report information on GHG emissions. Section 208 grants EPA similar authority to monitor emissions from the manufacturers of new vehicles and other entities subject to the requirements of parts A and C of Title II of the Clean Air Act.

103. *See Greenhouse Gas Reporting Program (GHGRP)*, EPA, https://www.epa.gov/ghgreporting (last visited Jan. 2, 2022).

104. The GHGRP requires reporting of GHGs in the form of carbon dioxide equivalents, or CO_2e. *See* EPA, FACT SHEET: GREENHOUSE GASES REPORTING PROGRAM IMPLEMENTATION 1 (2013) [hereinafter GHGRP IMPLEMENTATION FACT SHEET], https://www.epa.gov/sites/production/files/2014-09/documents/ghgrp-overview-factsheet.pdf [https://perma.cc/8ZVM-SVBB]; EPA, GREENHOUSE GAS REPORTING PROGRAM: EMISSION CALCULATION METHODOLOGIES 1, https://www.epa.gov/sites/production/files/2017-12/documents/ghgrp_methodology_factsheet.pdf (last visited Dec. 16, 2020) [https://perma.cc/4NAX-MEU4].

105. *FAQ What Is the Definition of a "Facility"?*, EPA: FREQUENTLY ASKED QUESTIONS (last updated Aug. 21, 2019, 3:23 PM), https://ccdsupport.com/confluence/pages/viewpage.action?pageId=91750549 [https://perma.cc/HRC8-YXFX] (The rule defines facility as "any physical property, plant, building, structure, source, or stationary equipment.").

after verification by EPA.[106] Emissions from agriculture, land use, and direct emissions from sources with annual emissions of less than 25,000 metric tons of CO_2 equivalent are not required to report.[107]

In theory, firms could reduce their reportable emissions at facilities that exceed the reporting threshold by permitting or requiring employees to work remotely. Headquarters or other office facilities are potentially subject to the GHGRP. They are commercial buildings and considered direct emitters for which GHG reporting must occur at the facility level if the facility exceeds the 25,000-metric ton threshold.[108] As a result, under the GHGRP, remote work that leads to less on-site emissions will decrease the quantity of reportable GHG emissions. Many headquarter facilities will fall under the 25,000-metric ton threshold,[109] but small reductions arising from the WFH transition could have important effects at the margin. For instance, if a factory with just over 25,000 tpy emissions includes office workers or others who can shift from working at the facility to working at home, the facility's emissions could drop—and possibly even fall below the reporting threshold. Further research is needed on whether many factories and other facilities now subject to the EPA GHGRP also include substantial numbers of employers who are or could be part of the WFH shift.

With a reporting threshold of 25,000 metric tons, the GHGRP does not apply to American households, [110] which on average emit less than 100 tpy GHG emissions.[111] Nor does the GHGRP include specific obligations for employers to report WFH emissions. But its reporting requirements do apply to electric power plants and fossil fuel suppliers. Household and WFH GHG emissions therefore do not fall completely outside of the reporting regime. Such emissions simply are not required to be reported by the two types of actors who might have the greatest incentives to reduce them: employers and employees.[112]

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106. *Greenhouse Gas Reporting Program (GHGRP)*, EPA, https://www.epa.gov/ghgreporting (last visited Dec. 16, 2020) [https://perma.cc/ES5Z-8UVB].

107. *See* 40 C.F.R. § 98.2 (2021) (establishing federal GHG reporting requirements).

108. *See* GHGRP IMPLEMENTATION FACT SHEET, *supra* note 104.

109. *See, e.g.*, EPA, *supra* note 20, at 12 (stating that reporting by energy suppliers, as opposed to office building owners or operators, accounts for the majority of GHG emissions in the commercial sector).

110. Direct emissions from sources producing annual emissions of less than 25,000 metric tons of carbon dioxide equivalent, such as those produced by employees working remotely at their homes, are excluded from the GHGRP. *See* GHGRP IMPLEMENTATION FACT SHEET, *supra* note 104. The Clean Air Act authorizes EPA to take non-regulatory steps and promote technologies for preventing and reducing air pollution, see Clean Air Act of 1970 § 103(g), 42 U.S.C. § 7403 and Mandatory Reporting of Greenhouse Gases, 75 Fed. Reg. 66,433 (Oct. 28, 2010) (to be codified at 40 C.F.R. pt. 86, 98), but EPA has not sought to regulate household or office GHG emissions.

111. The 100 tpy CO_2-e figure is based on several very rough assumptions, including twenty tpy emissions per individual and four individuals per household, which yields a total of eighty tpy CO_2-e. According to a recent study, residential energy use in the United States produces 2.83 ± 1.0 t of CO_2-equivalents per capita (t CO_2-e/cap), a figure that is roughly consistent with national energy statistics, which estimate 3.19 t CO_2-e/cap. *See* Goldstein et al., *supra* note 9, at 19,124.

112. *See* Vandenbergh & Steinemann, *supra* note 9, at 1679 (proposing Individual Carbon Release Inventory); VANDENBERGH & GILLIGAN, *supra* note 75.

Similarly, most commercial buildings do not reach the emissions reporting threshold under the GHGRP. Over 75 percent of commercial buildings have combustion equipment that consumes less than 1 MMBtu/hr;[113] for commercial buildings boiling water for heat, about 80 percent have boilers that consume less than 10 MMBtu/hr. These are well below the threshold for reporting.[114] In addition, our analysis of the most recent EPA list of reporting facilities did not identify GHG reporting by any corporate offices or headquarters.[115]

The fact that households and offices are not required to report emissions does not suggest that the GHGRP does not account for emissions from these sources. As discussed above, the GHGRP requires suppliers of electricity, natural gas, and other energy sources to report the amount of GHGs that would be released if the fuels and industrial GHGs that they supply annually are used and emitted. This supplier data allows for the inclusion of GHGs from low-emitting sources that are not required to report emissions under the GHGRP, such as mobile and residential sources.[116] When coupled with the data submitted by direct emitters, which comprise about half of total United States emissions, this broadens the GHGRP emissions coverage to 85–90 percent of United States' total emissions.[117]

The EPA GHGRP requirements thus provide an adequate snapshot of total emissions, but they obscure the source of those emissions when many employees work remotely. The requirements attribute WFH-related emissions to energy suppliers such as electric power plants, not to employers or households. This allocation makes it difficult for regulators and advocacy groups to assess the implications of the WFH shift and develop public and private governance responses. It also reduces the pressure on employers to reduce emissions.[118]

Although forcing firms to calculate every employee's WFH emissions could be costly and beyond EPA's regulatory authority, Congress could expand EPA's authority to address WFH emissions reporting, and other alternatives are possible even without new legislation. For instance, EPA could use existing data or collect survey data to estimate the mean or median household GHG emissions in the United States each year. This estimation could include an assessment of the WFH-related emissions attributable to employers. The data could be

113. Defined as millions of British thermal units of energy per hour.

114. *See FAQ Are Owners of Commercial Buildings Required to Report?*, EPA: FREQUENTLY ASKED QUESTIONS, https://ccdsupport.com/confluence/pages/viewpage.action?pageId=91553979 (last visited Dec. 14, 2020) [https://perma.cc/643U-WPXQ].

115. A review of the EPA Greenhouse Gas Inventory on December 11, 2020, focusing on large cities such as New York, Chicago, and San Francisco, did not reveal any reports of offices. *See Facility Level Information on Greenhouse Gases Tool (FLIGHT)*, EPA, https://ghgdata.epa.gov/ghgp/main.do?site_preference=normal# (last visited Feb. 11, 2021) [https://perma.cc/945R-ZR8J].

116. *See Greenhouse Gas Reporting Program GHGRP Reported Data*, EPA, https://www.epa.gov/ghgreporting/ghgrp-reported-data (last visited Dec. 16, 2020) [https://perma.cc/B7W6-CJVU].

117. *See id.*

118. *See* Vandenbergh & Steinemann, *supra* note 9, at 1730 (proposing annual EPA assessment and disclosure of GHG emissions from the average individual to focus attention on the importance of household emissions).

published annually in an ICRI modeled on the Toxic Release Inventory data that EPA releases under the Emergency Planning and Community Right-to-Know Act.[119] Rules of thumb could also be used to attribute some of these emissions to corporate facilities. If EPA is unable to release the data in a useful format, environmental advocacy groups could assemble and release the information, just as the Environmental Defense Fund has done with the Toxic Release Inventory data.[120] If used in this way, the ICRI data could facilitate federal, state, local, and private pressure on firms to calculate and disclose WFH emissions.

2. State Requirements: California Air Resources Board (CARB) Mandatory GHG Reporting Regulation.

CARB has adopted a Mandatory GHG Reporting Regulation based on its statutory authority granted by the California Global Warming Solutions Act of 2006 (often referred to as "AB 32").[121] The CARB requirement has a lower threshold (10,000 metric tons of GHGs per year) than the EPA GHGRP, but even this lower threshold only covers emissions from major sources.[122] CARB publishes a list of the sources exceeding the 10,000-ton threshold, and our review of the list suggests that it does not include typical office buildings or other buildings that may be most affected by the WFH shift.[123] It certainly does not include households or even apartment buildings.[124] As with the EPA GHGRP, the CARB reporting requirement does not include specific obligations for employers to report emissions from employees' remote work.

WFH-related emissions thus are not subject to the CARB source-specific reporting requirements unless they involve office workers at factories or similar facilities that exceed the emissions threshold. The reporting requirements of electric power plants and fuel suppliers, however, do account for WFH-related emissions.[125] As with the federal rule, the possible responses include expanding California state regulatory authority, or requiring CARB to prepare a state-focused ICRI each year and attribute some employees' emissions to their employers' facilities.

119. *See Toxics Release Inventory (TRI) Program*, EPA, https://www.epa.gov/toxics-release-inventory-tri-program (last visited Dec. 16, 2020) [https://perma.cc/V4CN-LABT]. For a discussion of the ICRI concept, see Vandenbergh & Steinemann, *supra* note 9, at 1730.

120. *See Toxics Release Inventory (TRI) Data*, ENV'T DEF. FUND (Aug. 19, 2014), https://www.edf.org/health/toxics-across-america/TRI-table [https://perma.cc/9QUF-Z6CM].

121. *See Mandatory Greenhouse Gas Emissions Reporting*, CAL. AIR RES. BD., https://ww2.arb.ca.gov/our-work/programs/mandatory-greenhouse-gas-emissions-reporting/about (last visited Dec. 16, 2020) [https://perma.cc/J6LL-QRRP].

122. CAL. CODE REGS. tit. 17, § 95101(a)(1)(B) (2021).

123. *See generally* CAL. AIR RES. BD., 2019 GHG FACILITY AND ENTITY EMISSIONS (2020).

124. *See generally id.*

125. *See* CAL. CODE REGS. tit. 17, § 95101(a)(1)(B) (2021).

B. Private Standards

The GHG Protocol Corporate Standard applies to a greater range of emissions than the federal and state standards and is widely adopted around the world.[126] Although it is a private standard and thus not subject to government enforcement, the GHG Protocol Corporate Standard is more than just "soft" law. Legal risks for noncompliance may arise if a national or subnational government requires corporations to use the standard when reporting corporate or facility emissions to the government or when selling goods and services to the government. Legal risks may also arise if a corporation has entered into a private supply chain contract that requires compliance with the standard. Legal risks may also arise if corporate disclosures based on the standard run afoul of securities disclosure requirements or create tort liability.[127] Even in the absence of formal legal risks, however, social license pressures from investors, lenders, insurers, employees, and advocacy groups may encourage firms to comply with the GHG Protocol Corporate Standard, and may rival the pressures from the risk of government enforcement of a regulatory standard.[128]

CDP and other NGOs rely on the GHG Protocol Corporate Standard and more detailed requirements to provide a consistent methodology for reporting

126. *See* Benedikt Downar et al., *The Impact of Carbon Disclosure Mandates on Emissions and Financial Operating Performance* 2–3 (Stan. Graduate Sch. of Bus., Working Paper No. 3873, 2020) (noting 14–18 percent increase in reductions in United Kingdom versus a control group), https://www.gsb.stanford.edu/faculty-research/working-papers/impact-carbon-disclosure-mandates-emissions-financial-operating; Tang & Demeritt, *supra* note 86, at 438–39 (concluding that findings in United Kingdom suggest reasons for caution about hopes for nudging firms); David C. Broadstock et al., *Voluntary Disclosure, Greenhouse Gas Emissions and Business Performance Assessing the First Decade of Reporting*, 50 BRIT. ACCT. REV. 48, 48 (2018) (finding a non-linear relationship).

127. For a discussion of the limits of soft law, see generally Cary Coglianese, *Environmental Soft Law as a Governance Strategy*, 61 JURIMETRICS 19 (2020). Private environmental supply chain contracting requirements are widespread, often exceed government environmental law requirements, and are legally enforceable. *See* Michael P. Vandenbergh, *The New Wal-Mart Effect The Role of Private Contracting in Global Governance*, 54 UCLA L. REV. 913, 916–17 (2007); Michael P. Vandenbergh, *The Private Life of Public Law,* 105 COLUM. L. REV. 2029, 2029–76 (2005). For recent efforts to expand supply chain contracting requirements regarding climate mitigation, see CARBON TRUST, *supra* note 85, at 32, 37; *Private Environmental Governance*, ENV'T L. INST., https://www.eli.org/private-environmental-governance (last visited Dec. 16, 2020) [https://perma.cc/K2AP-2789] (describing an initiative to develop model environmental supply chain contracting provisions).

128. For a recent discussion of lender pressure, see Sarah E. Light & Christina P. Skinner*, Banks and Climate Governance*, COLUM. L. REV. (forthcoming 2021). For a review of incentives to comply with private environmental standards by the former head of energy and climate programs at the World Wildlife Fund, see generally Louis G. Leonard III, *Under the Radar A Coherent System of Climate Governance, Driven by Business*, 50 Envtl. L. Rep. (Envtl. Law Inst.) 10,546 (2020). As discussed at the outset, CDP uses the support of investment firms with over $100 trillion in assets under management to induce roughly 10,000 corporations to disclose and reduce their carbon emissions. *See* BusinessGreen Staff, *supra* note 26; *see also* CDP ET AL., POWER FORWARD 3.0: HOW THE LARGEST U.S. COMPANIES ARE CAPTURING BUSINESS VALUE WHILE ADDRESSING CLIMATE CHANGE 38 (2017), http://assets.worldwildlife.org/publications/1049/files/original/Power_Forward_3.0_-_April_2017_-_Digital_Second_Final.pdf [https://perma.cc/8MPG-BUWR]; Leslie Kaufman, *Emissions Disclosure as a Virtue*, N.Y. TIMES (Dec. 28, 2009), http://www.nytimes.com/2009/12/29/business/energy-environment/29degrees.html [https://perma.cc/USF9-4T2F].

GHG emissions. As explained at the outset, the GHG Protocol Corporate Standard was conceived of by the GHG Protocol Initiative, a partnership of businesses, NGOs, and governments convened by the World Resources Institute and World Business Council on Sustainable Development.[129] The two organizations convened a core steering group to guide the standard development process, with members from several environmental groups—including the World Wildlife Fund, the Pew Center on Global Climate Change, and the Energy Research Institute—as well as industry representatives like Norsk Hydro, Tokyo Electric, and Shell.[130] This broad stakeholder involvement likely contributed to the GHG Protocol becoming the dominant global industry standard for emissions reporting, used by over 90 percent of Fortune 500 companies.[131]

The GHG Protocol Corporate Standard is one of seven standards issued by the GHG Protocol Initiative, each designed for different organizations and activities.[132] The GHG Protocol Initiative serves as the secretariat for the GHG Protocol Corporate Standard and other standards. It establishes and amends the reporting standards, generates detailed guidance and tools for applying the requirements, and provides expert advice and training.[133] The GHG Protocol Corporate Standard includes several specific standards, which are requirements for GHG reporting for companies that prepare a GHG emissions inventory (e.g., a standard on setting organizational boundaries), and more detailed guidance and examples to steer the application of each standard. The GHG Protocol Initiative issued the first edition of the GHG Protocol Corporate Standard in 2001, issued a revised edition in 2004, and has issued more recent updates to guidance documents and tools.[134]

To develop an emissions reporting program according to the GHG Protocol Corporate Standard, a corporation must set organizational and operational boundaries. The corporation sets organizational boundaries by choosing an

129. *See* GREENHOUSE GAS PROTOCOL, *supra* note 24, at 2 (describing the GHG Protocol Initiative as "a multi-stakeholder partnership of businesses, non-governmental organizations (NGOs), governments, and others convened by the World Resources Institute (WRI), a U.S.-based environmental NGO, and the World Business Council for Sustainable Development (WBCSD), a Geneva-based coalition of 170 international companies").

130. *See id.* at 104.

131. *See id.* at 3; MARY SOTOS, GREENHOUSE GAS PROTOCOL, GHG PROTOCOL SCOPE 2 GUIDANCE: AN AMENDMENT TO THE GHG PROTOCOL CORPORATE STANDARD 101 (2013), https://ghgprotocol.org/sites/default/files/standards/Scope%202%20Guidance_Final_Sept26.pdf (last visited Dec. 16, 2020) [https://perma.cc/5BVC-U3EL] (defining a company as "the entity developing a GHG inventory, which may include any organization or institution, either public or private, such as businesses, corporations, government agencies, nonprofit organizations, assurers and verifiers, universities, etc.").

132. *See Standards*, GREENHOUSE GAS PROTOCOL, https://ghgprotocol.org/standards (last visited Dec. 16, 2020).

133. *See About Us*, *supra* note 22.

134. *See generally* GREENHOUSE GAS PROTOCOL, *supra* note 24. Understanding the various documents produced by the GHG Protocol Initiative is not for the faint of heart: the GHG Protocol Initiative website provides corporate reporting materials that include a standard, a guidance, a calculating guidance, and calculation tools, and the calculation tools in turn include documents called guidance and worksheets. *See* GREENHOUSE GAS PROTOCOL, https://ghgprotocol.org (last visited Nov. 19, 2021).

approach to consolidate GHG emissions and define its operations for reporting purposes.[135] It sets operational boundaries by "identifying emissions associated with its operations, categorizing them as direct and indirect emissions, and choosing the scope of accounting and reporting for indirect emissions."[136] Together, the organizational and operational boundaries constitute a corporation's inventory boundary.[137] Unlike the EPA and CARB standards, the GHG Protocol Corporate Standard lacks a reporting threshold, so in theory even very small facilities could be subject to GHG reporting. As discussed below, however, corporations are required to determine and disclose a "significance threshold." Small sources may escape reporting if they fall below this threshold,[138] although some changes can trigger a base year emissions recalculation.[139]

The GHG Protocol Corporate Standard differentiates between direct and indirect emissions, and it further differentiates among three scopes of emissions in defining inventory categories.[140] As discussed at the outset, Scope 1 emissions are direct GHG emissions that occur from sources owned or controlled by the corporation. They include emissions from combustion in company-owned boilers, furnaces, and vehicles. In contrast, indirect GHG emissions result from the corporation's activities but occur at sources owned or controlled by another company. Indirect emissions include Scope 2 emissions, which occur from the electricity generated off-site but consumed by the corporation in its owned or controlled operations. All other indirect emissions are considered Scope 3—those that result from the corporation's activities but come from sources that it does not own or control, like suppliers and WFH activities.

The GHG Protocol Corporate Standard requires corporations to report Scope 1 and 2 emissions, but Scope 3 reporting is optional.[141] The vast majority of corporations that follow the standard do not report Scope 3 emissions, including those from WFH-related emissions, although there is a trend toward increased Scope 3 reporting.[142] Employees who work on-site ordinarily generate emissions under Scope 1 and 2, whereas employees who work remotely generate emissions under Scope 3. Consequently, under the GHG Protocol Corporate Standard, reductions in on-site emissions arising from a WFH shift enable most corporations to report lower GHG emissions even though their total emissions

135. *See* GREENHOUSE GAS PROTOCOL, *supra* note 24, at 16.

136. *See id*. at 24.

137. By inventory boundary, we mean the boundary between the emissions that are identified with the corporation and those that are not.

138. *See* GREENHOUSE GAS PROTOCOL, *supra* note 24, at 35.

139. *See id.*

140. *See id.* at 24.

141. *See id.* at 25.

142. *See* CDP, TRANSPARENCY TO TRANSFORMATION: A CHAIN REACTION: CDP GLOBAL SUPPLY CHAIN REPORT 2020, at 4–5, 13 (2021), https://6fefcbb86e61af1b2fc4-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/005/554/original/CDP_SC_Report_2020.pdf?1613048129.

remain the same. The source of emissions simply shifts from Scope 1 and 2 activities, which are within the corporate reporting boundary, to Scope 3 WFH activities, which are not.

Some companies exceed the GHG Protocol Corporate Standard and report emissions according to the Corporate Value Chain (Scope 3) Standard (hereinafter the GHG Protocol Scope 3 Standard). The GHG Protocol Scope 3 Standard supplements the GHG Protocol Corporate Reporting Standard and provides a comprehensive assessment of value chain emissions.[143] In the GHG Protocol Scope 3 Standard, emissions from remote work, or "teleworking," are categorized as "employee commuting" (Category 7) and are designated as "optional" for inclusion within the reporting boundary.[144] The discussion of teleworking appears only several times in the 152-page document, however. The discussion also lacks additional information that can help users interpret the standard in a post-COVID world. The GHG Protocol Technical Guidance for Calculating Scope 3 Emissions is a 182-page document that provides more fine-grained directions on assessing Scope 3 emissions.[145] Although it provides guidance on calculating employee commuting, it provides limited information on calculating telework emissions and just reiterates that reporting telework emissions is "optional."[146] The GHG Protocol Initiative has not issued specific guidance about how corporations should address the WFH shift and how they should integrate employees' WFH emissions into their Scope 3 calculations.[147]

In addition to standards such as the GHG Protocol Corporate Standard and the GHG Protocol Scope 3 Standard, the GHG Protocol Initiative has issued guidance documents and calculation tools regarding Scope 2 emissions. The

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143. GREENHOUSE GAS PROTOCOL, CORPORATE VALUE CHAIN (SCOPE 3) ACCOUNTING AND REPORTING STANDARD 4 (2011), https://ghgprotocol.org/standards/scope-3-standard [https://perma.cc/Y6TV-JZVK].

144. *Id.* at 35. As stated in the employee commuting category description, "[c]ompanies *may* include emissions from teleworking (i.e., employees working remotely) in this category." *Id*. at 57 (emphasis added); *see also* GREENHOUSE GAS PROTOCOL, TECHNICAL GUIDANCE FOR CALCULATING SCOPE 3 EMISSIONS: SUPPLEMENT TO THE CORPORATE VALUE CHAIN (SCOPE 3) ACCOUNTING & REPORTING STANDARD 87–93 (2013), https://ghgprotocol.org/sites/default/files/standards_supporting/Chapter7.pdf [https://perma.cc/78J8-9Q65].

145. *See generally* GREENHOUSE GAS PROTOCOL, *supra* note 144. https://ghgprotocol.org/sites/default/files/standards/Scope3_Calculation_Guidance_0.pdf [https://perma.cc/9NAM-2ULD].

146. *See id*. at 8, 87, 89–90, 172 (the term "teleworking" appears five times throughout the document, and it is listed as "optional" at 8). The document provides limited guidance on how to calculate telework emissions. For instance, it states that the calculations should include, "[i]f applicable, the amount of energy used from teleworking (e.g., kWh of gas, electricity consumed)." *Id.* at 89. It also states that

> [c]ompanies may optionally calculate the emissions of teleworking from home. To calculate these emissions, a baseline emissions scenario should first be established. Baseline emissions occur regardless of whether or not the employee was at home (e.g., energy consumed by the refrigerator). The reporting company should only account for the additional emissions resulting from working from home, for example the electricity usage as a result of running the air conditioner to stay cool.

Id. at 90.

147. *See* GREENHOUSE GAS PROTOCOL, *supra* note 143, at 35.

GHG Protocol Scope 2 Guidance (hereinafter the Scope 2 Guidance) states that "[a]ny energy consumption not covered by contractual arrangements with owned/operated generation units should be treated as grid-consumed energy in scope 2, reported according to both the location-based and market-based method emission factor hierarchies."[148] Because the Scope 2 Guidance calls for companies to report net electricity consumption within their inventory boundaries, companies that exclude at-home workplaces from their reporting boundaries will not report WFH-related emissions. Some companies provide their WFH employees with what they describe as "satellite offices," which may include items such as an office chair, a full-service printer, a monitor, and a wireless internet router.[149] These satellite offices could be treated as corporate offices or facilities and included in a company's Scope 2 reporting.

Much like the Scope 3 WFH calculation, accounting for WFH-related emissions within the Scope 2 boundary would require a company to determine employees' baseline and work-related emissions (e.g., emissions stemming from increased WFH computer and other energy use). This would not be a simple assessment, but firms such as Dell have conducted in-depth analyses of their remote work initiatives and have demonstrated that it is possible to account for WFH emissions.[150] Firms lacking the resources of Dell could use default assumptions for different regions based on the carbon intensity of the electric grid and other factors. In short, assessing WFH emissions on a per-employee basis appears to be resource intensive but feasible. The GHG Protocol Corporate Standard, GHG Protocol Scope 3 Standard, and related guidance are sufficiently capacious to allow WFH emissions to be attributed to the employer or the employee.

The GHG Protocol Initiative has also developed guidance to account for new developments. The guidance indicates that changes in emissions can trigger requirements for recalculation of emissions, and that Scope 1 emissions may change if a change affects company-owned electricity production.[151] For example, operational changes may include decreased need for office air conditioning supplied by company generators or changes in travel in company-owned vehicles.[152] Scope 2 indirect emissions[153] may change if remote work alters the amount of office space or type of equipment in ways that affect the

148. *See* SOTOS, *supra* note 131, at 41.

149. *See, e.g.*, Dror Poleg, *The Future of Offices When Workers Have a Choice*, N.Y. TIMES (Jan. 4, 2021), https://www.nytimes.com/2021/01/04/upshot/work-office-from-home.html.

150. *See generally* JOHN PFLUEGER ET AL., DELL, THE SUSTAINABILITY BENEFITS OF THE CONNECTED WORKPLACE (2016), https://i.dell.com/sites/doccontent/corporate/corp-comm/en/Documents/telecommute-study.pdf [https://perma.cc/2D7M-AZHS].

151. *See* SOTOS, *supra* note 131, at 101 (defining "[d]irect emissions" as emissions from corporate facilities, corporate vehicles, and sources "owned or controlled by the reporting entity").

152. *See id*.

153. *See id.* at 35 (Scope 2 accounts for emissions from the generation of energy that is "purchased [or acquired] or otherwise brought into the organizational boundary of the company.").

amount of energy use. Scope 3 indirect emissions[154] may be affected by reductions in employee business travel or employee commuting.[155] Depending on the magnitude, these changes may require the company to perform a base year recalculation. Whether a recalculation is necessary can be determined using a company's previously disclosed data. A company must set a base year recalculation policy that includes the basis and context for any recalculations.[156]

As noted above, companies must determine and disclose the "significance threshold" that triggers base year emissions recalculation. A significance threshold is a qualitative or quantitative criterion used to define any significant changes to the data, inventory boundary, methods, or any other relevant factors.[157] A party that is engaged to verify the reporting has the responsibility to "confirm the company's adherence to its threshold policy."[158]

According to the GHG Protocol Corporate Standard, developments that "shall trigger recalculation of base year emissions [include] . . . [c]hanges in calculation methodology or improvements in the accuracy of emission factors or activity data that result in a significant impact on the base year emissions data."[159] The Corporate Standard also provides that:

> [B]ase year emissions shall be retroactively recalculated to reflect changes in the company that would otherwise compromise the consistency and relevance of the reported GHG emissions information. Once a company has determined its policy on how it will recalculate base year emissions, it shall apply this policy in a consistent manner. For example, it shall recalculate for both GHG emissions increases and decreases.[160]

Depending on the size of the changes in GHG emissions, the Corporate Standard suggests that changes in company structure may require a baseline recalculation (defined as a "[r]ecalculation of emissions in the base year to reflect a change in the structure of the company or a change in the accounting methodology used, to ensure data consistency over time").[161] Whether base year emissions need recalculation depends on the significance of the changes.[162] Other GHG programs specify numerical rather than qualitative significance thresholds. For example, the California Climate Action Registry utilizes a change threshold of 10 percent of the base year emissions, determined on a cumulative basis from the time the base year is established.[163]

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154. *See id.* at 106 (Scope 3 emissions are "[a]ll indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions.").
155. *Id.*
156. *See id.* at 99.
157. *Id.* at 75.
158. *See* GREENHOUSE GAS PROTOCOL, *supra* note 24, at 35.
159. *Id.*
160. GREENHOUSE GAS PROTOCOL, *supra* note 24, at 37.
161. *See* SOTOS, *supra* note 131, at 99.
162. *See id.* at 75.
163. *See* GREENHOUSE GAS PROTOCOL, *supra* note 24, at 38.

The GHG Protocol Corporate Standard and related guidance suggest, however, that structural changes do not trigger base year emissions recalculation if the company is still reporting its indirect emissions from relevant activities.[164] Based on these statements in the GHG Protocol Corporate Standard and guidance, it appears that when a company relocates its workforce from offices within its inventory boundary to at-home work, thus moving its emissions-generating activities from Scope 1 to Scope 3, the change may trigger a recalculation.[165] This move may not require the company to completely recalculate its emissions, though, if it continues to report the energy usage of the workforce. As an example, the guidance included with the GHG Protocol Corporate Standard provides that "outsourcing production of electricity, heat, or steam does not trigger base year emissions recalculation, since the GHG Protocol Corporate Standard requires Scope 2 reporting."[166] Nevertheless, outsourcing that shifts significant emissions from Scope 1 to Scope 3 when Scope 3 is unreported does trigger a base year emissions recalculation.[167] Thus, if a company continues to report its workforce's emissions through Scope 2 reporting, the company can avoid a potentially costly base year recalculation even as a percentage of it moves to WFH. The best arguments for including WFH emissions within a company's Scope 2 emissions are that changes in employee workplaces may be permanent, that categorizing these emissions as Scope 2 will increase the likelihood that corporations will report them, and that reporting will create incentives for corporations to reduce their employees' WFH emissions.

In addition, employee WFH emissions could fall within a new category of company operations. The GHG Protocol Corporate Standard points to its five core principles to guide implementation "[w]hen application of the guidance in specific situations proves ambiguous."[168] It states:

> The GHG accounting and reporting shall be based on the following principles:
>
> - Relevance. Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users—both internal and external to the company.
> - Completeness. Account for and report on all GHG emission sources and activities within the inventory boundary. Disclose and justify any specific exclusion.
> - Consistency. Use consistent methodologies to allow for meaningful performance tracking of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.

164. *See id.*

165. *See id*. An important issue is the relative cost of a base year recalculation and whether the recalculation costs would discourage corporations from including their employees' emissions data.

166. *See id.* at 38.

167. *See id.* at 40. This may occur when a company outsources the transportation of products.

168. *See* SOTOS, *supra* note 131, at 21; *see also* GREENHOUSE GAS PROTOCOL, *supra* note 24, at 10.

- Transparency. Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.
- Accuracy. Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable confidence as to the integrity of the reported information.[169]

These principles are intended to "underpin all aspects of GHG accounting and reporting" so that a company's GHG inventory constitutes a true and fair representation of the company's GHG emissions.[170] The relevance, completeness, and accuracy principles all argue in favor of reporting WFH emissions either as Scope 2 emissions or as Scope 3 emissions, but they argue against treating them as Scope 3 emissions for companies that do not report Scope 3 emissions. If many employees have made the WFH shift in a post-COVID world, particularly if the shift is permanent, and if a company does not report Scope 3 emissions, the result will be incomplete, inaccurate reporting that is inconsistent with GHG accounting principles. For companies that do not report Scope 3 emissions, allowing employee WFH emissions to be reported only as Scope 3 emissions would allow corporate reports to undercount the emissions arising from company operations. This result would be inconsistent with the GHG accounting principles of completeness and accuracy.

Moreover, these reports would no longer include the most relevant information about a company's inventory boundary.[171] By 2020, many companies no longer considered WFH optional.[172] Thus, the traditional workspace is no longer housed in one place. Accordingly, a company's inventory boundary may include offices where the baseline data no longer reflect the current organizational structure of that company. The company's workforce is still using energy to do work—that energy is just reflected in the employee's utility bills, not the employer's bills.

Facebook's GHG Protocol inventory boundary provides an example: the boundary includes operational GHG emissions (Scope 1 and 2 emissions) for data centers, offices, and "other data center-related facilities," which Facebook identifies as "facilities where Facebook used less than 100,000 MWh of

169. *See* GREENHOUSE GAS PROTOCOL, *supra* note 24, at 8.

170. *See id.*

171. *See id.* ("An important aspect of relevance is the selection of an appropriate inventory boundary that reflects the substance and economic reality of the company's business relationships, not merely its legal form.").

172. *See, e.g.*, Benveniste, *supra* note 6 (noting that some employers do not plan to have employees work in the office).

electricity in the reporting year, such as warehouses or colocation facilities."[173] Any reported reductions in Scope 2 emissions for these spaces would not accurately reflect Facebook's reductions in emissions since the employees would simply have shifted their energy consumption from Facebook facilities to their homes. Facebook arguably should still be responsible for these emissions, as Facebook, or the employee acting as its agent, generated the demand for power, and that power was used in furtherance of the company's goals.[174]

Exceptions exist to the pattern of not reporting WFH emissions, but they also reflect the limitations of the flexibility inherent in the GHG Protocol Corporate Standard.[175] For instance, a team of developers at IBM drafted a carbon emissions proposal which included the indirect emissions from an employee's WFH computer in the employee's carbon footprint.[176] However, even this proposed model does not specify whether it attributes and reports WFH emissions under Scope 1, 2, or 3, nor does it appear to account for other aspects of remote work.[177] The developers assumed that the "home is not being heated or cooled or has any special lighting that is necessary for the employee to perform their job functions."[178] Their proposal further states that it does not include a telecommuting employee's other WFH emissions when measuring employee carbon footprints "for simplicity's sake."[179] IBM declined to implement this proposal at a global level. Although IBM accounts for emissions reductions in 2020 from reduced need for employee travel[180] and building heating and cooling,[181] the firm did not include WFH emissions in its emissions calculations.[182]

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173. FACEBOOK, FACEBOOK SUSTAINABILITY DATA 2019, at 1 (2020), https://sustainability.fb.com/wp-content/uploads/2020/12/FB_Sustainability-Data-Disclosure-2019.pdf [https://perma.cc/8YVA-P4EM].

174. SAMANTHA PUTT DEL PINO & PANKAJ BHATIA, WORLD RES. INST., WORKING 9 TO 5 ON CLIMATE CHANGE: AN OFFICE GUIDE 31–42 (2002), https://ghgprotocol.org/sites/default/files/standards_supporting/Working%209%20to%205%20on%20Climate%20Change.pdf [https://perma.cc/83BN-X9GT].

175. *See* Lister, *supra* note 38.

176. HICHAM BADAWI, HOW TO MEASURE EMPLOYEE CARBON FOOTPRINTS: PART 1: SAMPLE SOA IMPLEMENTATION ARCHITECTURE 2, IBM: DEVELOPERWORKS (Apr. 8, 2009), https://perma.cc/G52W-NPYA ("This avoids solving the complex problem of having to determine how much of the employee's monthly electric bill is actually attributed to the person having to work from home.").

177. *See id.*

178. *Id.*

179. *Id.*

180. *GHG Emissions Inventory*, IBM, https://www.ibm.com/ibm/environment/climate/ghg.shtml (last visited Jan. 11, 2022).

181. IBM, 2020 CORPORATE RESPONSIBILITY REPORT 28 (2020), https://ibmorg-public.s3.us-east.cloud-object-storage.appdomain.cloud/responsibility/cr/pdfs/IBM-2020-CRR.pdf. *See generally* IBM, 2020 IBM AND THE ENVIRONMENT REPORT, https://www.ibm.com/ibm/environment/annual/IBMEnvReport_2020.pdf (last visited Jan. 11, 2022).

182. 2020 IBM AND THE ENVIRONMENT REPORT, *supra* note 181, at 26; *Position on Scope 3 GHG Emissions*, IBM, https://www.ibm.com/ibm/environment/climate/scope3.shtml (last visited Jan. 11, 2022).

Including actual employee emission data may raise privacy concerns and require using data from hundreds of employees' utility bills. This could result in unintended consequences for members of marginalized communities, multigenerational housing units, or those with nontraditional living situations. The GHG Protocol Corporate Standard and guidance discuss these kinds of tradeoffs, though, and favor completeness,[183] as demonstrated by a case study on The Body Shop.[184] As a disaggregated retailer with almost 2,000 locations, the two-tiered approach The Body Shop used to calculate Scope 2 emission data could serve as a rough model for accounting for employee remote work:

> First, stores were encouraged to actively pursue direct consumption data through disaggregated data or direct monitoring. Second, if unable to obtain direct consumption data, stores were given standardized guidelines for estimating emissions based on factors such as square footage, equipment type, and usage hours. This system replaced the prior fragmentary approach, provided greater accuracy, and provided a more complete account of emissions by including facilities that previously were unable to calculate emissions. If such limitations in the measurement processes are made transparent, users of the information will understand the basis of the data and the tradeoff that has taken place.[185]

Plain language from the Scope 2 Guidance also indicates an intent to include the largest possible scope of GHG emissions that a company generates through its demand for electricity.[186] A company that exercises significant operational control over its employees should arguably include its employees' WFH emissions in the company's Scope 2 emissions. The guidance defines control as "[t]he ability of a company to direct the policies of another operation [or activity]."[187] This can be (1) operational control, which occurs when "the organization or one of its subsidiaries has the full authority to introduce and implement its operating policies at the operation;" or (2) financial control, which occurs when "the organization has the ability to direct the financial and operating policies of the operation with a view to gaining economic benefits from its activities."[188]

Similarly, the inclusion of WFH emissions in Scope 3 is appropriate if a company uses the operational control method to define its operational boundaries and inventory. When companies hire employees exclusively for remote work, those companies typically use contracts to delineate corporate expectations.[189]

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183. *See* GREENHOUSE GAS PROTOCOL, *supra* note 24, at 9.

184. *Id.*

185. *Id.*

186. SOTOS, *supra* note 131, at 41 ("In some leased building arrangements, tenants do not pay for electricity individually. However, this should not exempt tenants from reporting the emissions from that energy use . . . [because] Scope 2 includes energy that is acquired and consumed.").

187. *Id*. at 101.

188. *Id.*

189. *See* U.S. DEP'T OF ENERGY, ENABLING A MOBILE WORKFORCE: HOW TO IMPLEMENT EFFECTIVE TELEWORKING AT U.S. DEPARTMENT OF ENERGY NATIONAL LABORATORIES 28–40 (2017),

These can include detailed descriptions of when an employee is expected to be available for work and even dictate requirements for home office safety.[190] This level of operational control likely indicates that an employer is responsible for an employee's actions during the workday while working from home.[191]

Several potential objections can be raised to the inclusion of WFH-related emissions in corporate GHG emissions reports. Employers can double count the GHG emissions arising from the electric generation used for WFH activities if electric generating stations or households are already reporting those emissions. Employers may have inadequate information to report employee-based emissions or may be tempted to misreport information. They may be unable to control employee behavior at home, or it may be too intrusive for employers to inspect employee behavior at home. Yet, the greater risks are that corporations reporting GHG emissions under the GHG Protocol Corporate Standard and others will avoid disclosing their activities' full climate implications and lack incentives to lower their employees' energy use and GHG emissions, even if they are best positioned to achieve large, low-cost emissions.

In sum, reporting WFH emissions as Scope 2 emissions is within the scope of the relevant standards, may result in the most widespread reporting, and may induce firms to engage in cost-effective emissions reduction activities. Still, a combination of Scope 3 reporting with major new NGO initiatives to motivate firms to report Scope 3 emissions also may be valuable. The advantage of relying on NGO pressure to induce employers to report Scope 3 WFH emissions is that amendments to the GHG Protocol Corporate Standard or guidance documents would not be required. Unfortunately, advocacy groups have had limited success inducing firms to report WFH and other types of Scope 3 emissions and have only achieved substantial success in recent years with supply chain contracting emissions. There is reason for optimism, however. Public awareness of the shift toward WFH is rising. Employee engagement around climate change at firms like Facebook, Google, and Amazon is increasing. Investors are becoming increasingly focused on the adequacy of corporate GHG emissions reporting. Together, these developments may lighten the load of advocacy groups campaigning for corporations to report Scope 3 WFH emissions.

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https://info.ornl.gov/sites/publications/Files/Pub74811.pdf [https://perma.cc/M5BT-2BXC] (the guides on pages 28–36, sample home office safety guidelines on page 37, and contracts on pages 38–40 exemplify the high level of specificity in these contracts).

190. *Id.* at 38–40.

191. Alternatively, large companies could be expected to report the emissions associated with their ICT technologies. For further research, see, for example, CARBON TRUST & GLOB. E-SUSTAINABILITY INITIATIVE, ICT SECTOR GUIDANCE BUILT ON THE GHG PROTOCOL PRODUCT LIFE CYCLE ACCOUNTING AND REPORTING STANDARD (2017), https://ghgprotocol.org/sites/default/files/GHGP-ICTSG%20-%20ALL%20Chapters.pdf [https://perma.cc/R7MK-WZEF].

III. OTHER WFH REGULATORY REGIMES

Whether under public or private reporting standards, the inclusion of WFH GHG emissions in corporate reporting will create incentives for employers—the parties most likely to have the capability and resources to reduce emissions—to act. In Part III, we examine other regulatory regimes that address WFH activities and find that attribution of WFH emissions to employers is consistent with the approach taken in these other regulatory regimes. Although we focus on the worker safety and tax areas, the WFH transition also may have implications for the regulation of indoor air quality, drinking water, home loans, household fire and liability insurance, and other areas.

A. Worker Safety Standards

The regulations promulgated by the Occupational Safety and Health Administration (OSHA) under the Occupational Safety and Health Act define the standards for reporting work-related injuries, fatalities, or illnesses.[192] OSHA defines an injury to be work-related if it occurred in the work environment.[193] The work environment is defined as "the establishment and other locations where one or more employees are working or are present as a condition of their employment," and includes the equipment employees use for work.[194] OSHA also identifies how employers decide if an injury is work-related when employees work from home. According to section 1904.5(b)(7), employers are required to report an injury or illness if "the employee is performing work for pay or compensation in the home," but only if the injury or illness "is directly related to the performance of work rather than to the general home environment."[195]

For many companies, WFH emissions will be "directly related to the performance of [the] work."[196] These emissions arise from the energy use associated with home office equipment, lighting, heating, and cooling. And therefore, treating WFH emissions as within the firm's boundary for GHG emissions reporting purposes is consistent with OSHA's treatment of workplace injuries arising from WFH activities.

B. Tax Standards

Taxation issues associated with home offices are also relevant in how WFH emissions under public and private GHG disclosure standards are treated. According to the Internal Revenue Service (IRS), to qualify to deduct expenses for business use of a home, the taxpayer must use the home exclusively and

192. *See* 29 C.F.R. § 1904 (2021).
193. *See id.* § 1904.5(a).
194. *Id.* § 1904.5(b).
195. *Id.* § 1904.5(b)(7).
196. *Id*.

regularly as the primary place of business or as the place where the taxpayer meets or deals with patients, clients, or customers.[197] The home office deduction was eliminated for employees by the Tax Cuts and Jobs Act of 2017, although it is still available for self-employed individuals.[198] Prior to the 2018 tax year, however, remote work employees could deduct home office expenses from their gross income if the home office was a condition of employment, necessary for the employer's activities, or necessary for the employee to perform their duties properly.[199] That is, the home office must have been for the convenience of the employer, not the employee, in addition to its exclusive use for business-related activities. The deductions could include the prorated costs of "utilities and services" which might include the costs of internet, phone, electricity, water, and gas attributable to the home office.[200]

As with other WFH regulatory regimes, the tax treatment of home offices could raise equity concerns. For instance, if higher-income workers tend to have a room dedicated to their work, but lower-income workers do not, higher-income workers may better meet any exclusivity requirements. In addition, as with the worker safety requirements, the treatment of home office deductions by the IRS is consistent with the inclusion of WFH emissions in corporate GHG disclosures.[201] The historical treatment of home offices suggests that Congress and the IRS have not drawn bright lines between working at the office and working at home, instead treating them similarly when WFH is functionally similar to office work. The treatment of WFH under the tax code is particularly important because the WFH transition may result in substantial increases in home offices and may create pressure on Congress and the IRS to revisit the home office deduction.

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197. INTERNAL REVENUE SERV., PUBLICATION 587, BUSINESS USE OF YOUR HOME (INCLUDING USE BY DAYCARE PROVIDERS) 2–3 (2021). The 2021 IRS document states that:

> To deduct expenses for business use of your home, you must use part of your home:
>
> Exclusively and regularly as your principal place of business;
>
> Exclusively and regularly as a place where you meet or deal with patients, clients, or customers in the normal course of your trade or business;
>
> In the case of a separate structure which is not attached to your home, in connection with your trade or business;
>
> On a regular basis for certain storage use;
>
> For rental use; or
>
> As a daycare facility.

198. Tax Cuts and Jobs Act, Pub. L. No. 115-97, 131 Stat. 2054 (2017); Kimberly Lankford, *Can You Take the Home Office Tax Deduction*?, U.S. NEWS (Mar. 9, 2021, 11:37 AM), https://money.usnews.com/money/personal-finance/taxes/articles/guide-to-home-office-tax-deduction.

199. *See* Lankford, *supra* note 198.

200. *See* INTERNAL REVENUE SERV., *supra* note 197, at 7.

201. As to commuting, the firm would have some ability to exercise control by subsidizing commute mode, or housing prices close to work, or lowering wages if the employee lives in an area that is not walkable.

CONCLUSION

Current GHG reporting standards risk systematically undercounting WFH GHG emissions and missing important opportunities to reduce net GHG emissions. Based on the analysis above, it is reasonable to conclude that it is more efficient and more equitable for an employer to assist an employee in reducing WFH emissions than for an employee to reduce emissions alone. It is also reasonable to conclude that cuts in GHG emissions will be deeper if employers have incentives to reduce their employees' WFH emissions.[202] If WFH results in lower, more efficient, and more equitable net GHG emissions than performing the same work at an office, and if reporting emissions creates incentives to reduce emissions, then reporting standards should require employers to report WFH emissions. The modifications suggested in this Article will achieve that end and, in doing so, will address the perverse incentives created by the current reporting regime and yield large, cost-effective, and equitable GHG emissions reductions.

The suggested modifications are also feasible. As to the GHG Protocol Corporate Standard, increased WFH reporting could be achieved by amendments or interpretations that require inclusion of WFH emissions in Scope 1 or 2 emissions, or by increased pressure on employers to report Scope 3 emissions and to include WFH emissions in their Scope 3 reporting. Calculating WFH emissions for each employee can be expensive, but the use of benchmarks or default assumptions is already common in GHG reporting. These benchmarks can enable assessments based on considerations such as the regional mean or median WFH emissions and the number of employees who work at home. In addition, both public and private disclosure regimes would benefit from increased awareness of WFH emissions. This increased awareness could be achieved through periodic government or private sector development and publication of data regarding the average individual or household emissions by state or region—an ICRI.

Roughly half of the U.S. population telecommuted during the COVID-19 pandemic, and at least a third may continue to telecommute after the pandemic. Attributing at-home emissions to employers could thus have substantial effects on GHG emissions if it motivates companies to induce employees to reduce their energy use and ultimately, emissions. Firms that help install energy-saving home office equipment and efficient HVAC systems also may ease the energy burden on households and yield benefits that may continue during nonwork hours. From

202. *See* OFF. OF FED., STATE & LOC. GOV'TS, INTERNAL REVENUE SERV., PUBLICATION 5137, FRINGE BENEFIT GUIDE 45, 51 (2020) (noting that employers may deduct awards to employees as well as education assistance, implying that initiatives like employee energy benefits or educational emissions reduction training might be written off by employers as a business expense with a few exceptions (e.g., highly paid employees and the owners of the firm)).

an efficiency and justice perspective, the time is ripe for revising reporting boundaries to account for the WFH transition.

Table 1: Changes in Emissions as a Result of Increased WFH

	Carbon Impact		Captured in GHG Protocol?
Commuting	⇓	Fewer trips between work and home	Scope 3
	⇑	Workers may make more discretionary trips and run more errands	No
	⇑ ?	Increased cross-country travel for business purposes for employees who chose to WFH in more distant locations.	Scope 2
	⇓	WFH and COVID-19 has led to an up to 300% increase in biking and walking, which could lead to a long-term change in commuting habits.	No
	?	Rebound effects from time saved not commuting being spent on other activities (increases in reading and cleaning activities at home would be low emissions activities, increased use of off-road vehicles may be high)	No
Electricity Usage	⇓	Fewer workspaces to heat, cool and light when workers are at home	Scope 2
	⇑	Home offices may have less efficient heating, cooling and lighting spaces than more modern commercial buildings and many workers may still need an office even if they mostly work from home	Scope 3
	?	Peak loads could be reduced; depending on the peak energy source this could increase or decrease emissions	?
	⇑ ?	Moving from smaller homes in urban areas and relatively low carbon electricity to larger homes in growing sunbelt cities with a dirtier grid.	Maybe Scope 3
Location Choice	⇑?	Households may decide to locate farther from work, including moving to regions where housing prices are lower. Relocating to lower-cost regions would likely result in larger houses, and many lower-cost regions are likely to have higher per capita carbon footprints than higher-cost regions.	Maybe Scope 3
	?	Changing long-distance travel behavior. Increasing work-related flights. Potential for a decrease in flights to see family and friends if location choice is closer to those groups.	

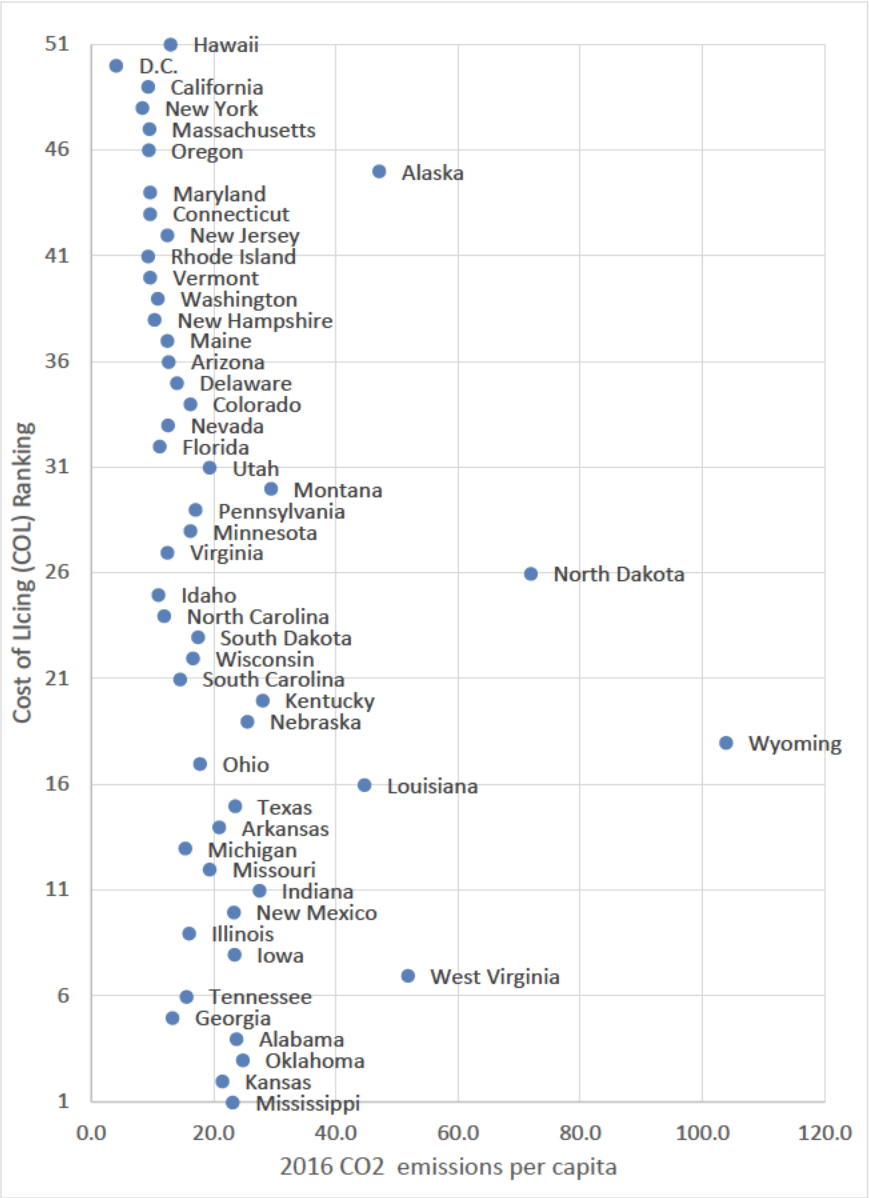
Table 2: 2016 CO_2 Emissions Per Capita by State[204] and Ranking of Cost of Living (COL) using the Third Quarter 2021 Council for Community and Economic Research Cost of Living Calculator[205]

	2016 CO_2 emissions per capita	COL
States with the lowest emissions per capita		
District of Columbia	4.0	50
New York	8.3	48
California	9.2	49
Rhode Island	9.2	41
Oregon	9.3	46
Massachusetts	9.4	47
Maryland	9.6	44
Vermont	9.6	40
Connecticut	9.6	43
New Hampshire	10.3	38
States with the highest emissions per capita		
Texas	23.4	15
Alabama	23.7	4
Oklahoma	24.7	3
Nebraska	25.4	19
Indiana	27.4	11
Kentucky	27.9	20
Montana	29.3	30
Louisiana	44.6	16
Alaska	47.0	45
West Virginia	51.7	7
North Dakota	71.8	26
Wyoming	103.7	18

204 U.S. ENERGY INFO. ADMIN., *supra* note 58, at 22–23.

205 *Cost of Living Data Series*, MO. ECON. RSCH. AND INFO. CTR., https://meric.mo.gov/data/cost-living-data-series (last visited Jan. 4, 2022).

Figure 1: Emissions Per Capita and State Ranking in Cost of Living



Scatter plot of CO_2 emissions per capita and ranking of cost of living (COL) index. Same data sources as Table 2.