Check the Box: Does Information on the Existence of Public Climate Disclosure Reduce Federal Suppliers' Emissions?

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Abstract

We examine whether suppliers reduce emissions when their federal customers start requesting information on the existence of suppliers' public climate disclosure. We explore a change in U.S. federal government procurement that requires certain suppliers to represent *whether* and *where* they have public disclosure on their greenhouse gas emissions and reduction goals. Using data on actual representations, we find that suppliers who made the representation decreased emissions more than suppliers who did not. This relation is robust to using a plausibly exogenous threshold in the representation requirement as an instrument to actual representations. Further analyses reveal that suppliers are motivated by economic incentives to reduce emissions, and the reductions are greater when the contracting officers can better process suppliers' climate disclosure using information obtained by the representation. Our evidence highlights how reducing customers' information processing costs can have real effects on suppliers' polluting activities – economically reliant suppliers respond to current and anticipated actions from customers who can more easily process their climate disclosure.

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Introduction

Fighting climate change is a societal problem, as profit-maximizing private actors do not fully internalize the social costs of their greenhouse gas (GHG) emissions (Stern 2006). While governments are expected to play a key role, many have questioned the repeated failures of laws and regulations and a lack of political will to impose penalties, taxes, and subsidies (Bénabou and Tirole, 2010; De Bettignies and Robinson, 2018; Christensen, 2022). Yet, another way the government can potentially reduce corporate emissions without imposing punitive policies is through its procurement process. In the U.S. corporate sector, federal agencies are the largest buyer of goods and services (Sahadi 2012). At the same time, bureaucracies and resource constraints could lead to substantial frictions in the procurement process that prevent the government from greening its supply chain (Wilson, 2019). In this paper, we examine whether a reduction in the U.S. federal government's processing costs of climate disclosure reduces their suppliers' greenhouse gas emissions.

In response to President Obama's Executive Order 13693, the U.S. federal government, through its Federal Acquisition Regulations (FAR), implemented FAR 52.223-22 (the GHG representation) in 2016. FAR 52.223-22 is a simple check-the-box representation—it requires certain bidders for federal contracts to declare whether (and, if so, where) they publicly disclose GHG emissions and their reduction goals. This setting offers several features that help to examine how a change in federal agencies' information processing frictions alters their suppliers' polluting activities. First, the federal government is a large customer with high bargaining power (Sahadi 2012). Second, FAR 52.223-22 only elicits information on the existence (and the location, if applicable) of suppliers' public GHG disclosure without imposing a requirement to disclose. Therefore, it isolates the effect of the awareness and acquisition costs of processing GHG and arguably does not alter suppliers' disclosure

behavior.[1] Third, FAR 52.223-22 introduces plausibly exogenous variations among otherwise similar suppliers—it is mandatory for those who have received more than $7.5 million in federal contracts aggregated over the previous federal fiscal year.

While the U.S. federal government has shown to express environmental preferences in procurement (Even-Tov et al., 2022; Huang, 2022; Yu, 2022), it is not obvious whether the GHG representation can meaningfully reduce suppliers' emissions. On the one hand, FAR 52.223-22 does not require non-disclosing suppliers to start making disclosures or bind suppliers to specific reduction targets. As the GHG information of disclosing suppliers is already publicly available, the representation might have little impact on how federal agencies process suppliers' GHG information. On the other hand, information processing frictions could be substantial in the government procurement setting. Government agencies do not have profit-maximizing objectives, and substantial frictions can exist, including bureaucracies and ideology misalignment (Yoder, 2018; Wilson, 2019; Spenkuch et al., 2023). This is exacerbated as individual contracting officers often face capacity constraints when handling many suppliers (Warren, 2004). Second, wide heterogeneity exists in where and how firms disclose GHG emissions, and the information elicited by FAR 52.223-22 is otherwise costly for contracting officers to acquire (i.e., learn whether GHG information is disclosed, locate it, and access it). Finally, FAR 52.223-22 is the *first* time, in a federal-wide move, that the government requested GHG information in the procurement process, marking a concrete step in its effort to reduce supply chain emissions. Suppliers, anticipating the government to take further actions with the now available GHG information, may start reducing current pollution (Christensen et al., 2021).

[1] [Appendix E] analyses the content of the GHG representation made by firms in our sample and show that there is plausibly no change in the availability and the content of their GHG disclosure around the first time a supplier made the GHG representation.

We gather government contracts from the official open data source of federal spending information (USAspending.gov), GHG emissions from Trucost, and merge with the Compustat universe. Our sample period spans from 2013 and 2020, three years before and after the implementation of the GHG representation in 2016. This procedure yields 390 unique government suppliers and 2,046 firm-year observations, with 10.5 million federal contracts and a total contract value of $212 billion. For the suppliers in our sample, we gather a novel dataset on their GHG representations. Specifically, we collect each supplier's responses to FAR 52.223-22 on The System for Award Management (SAM.gov) to determine whether and when they make the GHG representation and the associated content. Employing a generalized difference-in-differences design, we document a greater reduction in combined Scopes 1 and 2 GHG emissions for suppliers after making the GHG representation (1st difference) and relative to suppliers who did not represent (2nd difference). Throughout our analyses, we include firm and year fixed effects to hold constant time-invariant firm characteristics and time trends.[2]

Typical in a setting involving new regulations, the actual representation is not completely random – there exist firms below the $7.5 million threshold and voluntarily represented and firms above the $7.5 million threshold and yet did not represent. This discretion could pose two validity threats to our design. First, an omitted time-varying firm characteristic (e.g., shareholder environmental pressure) could be correlated with the likelihood of both making the GHG representation and reducing emissions. Second, concerns over reverse causality exist – firms expecting to reduce emissions are more likely to make the GHG representation. We address these concerns using a battery of archival evidence, further supplemented with institutional knowledge from interviewing two federal procurement officials. First, we use "mandatory requirement" – firms with estimated total contract values

[2] In Section 4.1, we exploit alternative designs to address the recent concerns over potential biases from two-way fixed effects models (Cengiz et al., 2019; Goodman-Bacon 2021; Baker et al., 2022; Breuer and de Haan, 2023).

above the threshold – as an instrument for actual GHG representation. Notably, the assignment of suppliers into mandatory requirements is based on the aggregate contract value realized during the previous fiscal year, making it difficult to manipulate this threshold ex-ante. Our results remain unchanged. Second, we examine the emissions of firms who voluntarily made the GHG representation. If reverse causality drives our results, we expect the strongest emission reductions among firms who voluntarily make the representation. Yet, we do not document significant emission reductions among voluntary firms. Third, we examine changes in emissions in the [-2, +2] year window around the first time firms started to represent and find no evidence that emission reduction begins in years before making the GHG representation. In addition, once firms start making the GHG representation, they will continue doing so in later years, inconsistent with managers discretionarily making the representation only in years when they reduce emissions. Fourth, we use entropy balancing to control for observable differences between firms that made and did not make the GHG representation, and our results remain unchanged. We also show that changes in shareholder pressure do not drive our results. Finally, based on our interviews with several federal procurement officials, we believe that it is unlikely that suppliers strategically misrepresent. The cost of intentional misrepresentation is high – it could result in a federal offense and a loss of all future contracts. Instead, it is likely a result of unintentional miscalculations. The GHG representation is the only representation that uses the $ 7.5 million as a threshold. Further, the frequent contract modifications (Broggard et al., 2022) make it difficult for suppliers to precisely determine the value of aggregate contract awards at the time of the representation.

Next, we investigate the mechanisms through which the GHG representation can motivate suppliers to reduce emissions. Our cross-sectional analyses exploit variations at the firm, contract, and contracting officer levels, yielding the following insights. First, suppliers are motivated by economic incentives to reduce emissions. We document greater emission

reductions among suppliers with greater reliance on the U.S. government as a customer (proxied by the percentage of revenue from federal contracts and the voluntary disclosure of the U.S. federal government as a major customer) and suppliers who face greater competition and uncertainty in securing future contracts (measured using the degree of competitive bidding and the variability of historical revenue from federal contracts). Second, we show that emission abatement is predictably stronger when the contracting officers can better process suppliers' GHG disclosure with the information obtained in the representation. We gather information on the identity of individual contracting officers approving the contracts. We measure the usefulness of the information provided in FAR 52.223-22 (whether firms provided a valid link to their public GHG disclosure and reduction goals) and the ability of contracting officers to compare emissions between suppliers they work with. As expected, we find greater emission abatement when the information provided to them is more useful and when contracting officers can benchmark emissions among suppliers. Finally, we exploit variations in contracting officers' capacity to monitor each procurement contract and document greater reductions when contracting officers are less capacity-constrained.

Finally, we investigate the operational feasibility of emission reductions and the associated financial impacts. Emission abatements might seem to entail costly operational adjustments and upfront investments. However, in its well-known report, McKinsey (2009) points out that many low-cost abatement opportunities exist currently (e.g., LED lighting, insulation retrofit, and motor systems efficiency), enabling firms to achieve meaningful reductions without adverse financial impacts. Consistently, we document higher reductions in Scope 2 emissions, which can be achieved by switching to sustainable energy sources and energy-saving campaigns. At the same time, we do not find that firms scale back productions, increase production costs, experience a drop in margins or accounting returns, or increase capital expenditure. Second, we document that emission reductions are associated with a

greater likelihood of receiving future contracts and receiving larger future contracts, consistent with tangible economic benefits motivating treated suppliers to reduce missions.

Our study contributes to several streams of literature. First, we contribute to the literature on disclosure processing costs to the decision context of supplier-customer contracts in general, and government procurement contracts in particular. Specifically, we examine how a reduction in information processing frictions can affect the actions of contractual parties. While earlier work focused on the implications of processing costs for users of financial information in the capital markets (see Blankespoor et al., 2020 for a review), we know relatively little about how it affects other decision-makers. Information processing frictions can be pervasive in a government setting (Even-Tov et al., 2023; Duguay et al., 2023). It could be material since the force of arbitrage is not as powerful as equity markets, which is further exacerbated by a lack of profit-maximizing incentives, resource constraints, and bureaucracies (Wilson, 2019). By documenting the role of information processing costs among contracting officers, we answer the call by Blankespoor et al. (2020) to study the effects of disclosure processing friction beyond the capital markets.

Next, our paper contributes to the emerging literature on how CSR information (Christensen et al., 2017; Chen et al., 2018; Rauter, 2020; Fiechter et al., 2022) and particularly carbon disclosure (Jouvenot and Krueger, 2020; Downar et al., 2021; Darendeli et al., 2022; Tomar, 2023) can induce firms to change their real behaviors. Firms alter their real activities when a change in the availability, presentation, or certification of CSR information makes it easier for environmentally inclined (investors or other) stakeholders to process; firms, in turn, respond to anticipated or actual stakeholder actions (see Christensen et al., (2021) for a review). Our study demonstrates that firms are motivated to pollute less when GHG information becomes easier to process for an important customer (i.e., the federal government) who are expected to act upon this information. Relatedly, we highlight the benefit of readily accessible

public GHG disclosure in reducing emissions, which has policy implications as financial reporting regulators worldwide start to implement mandatory GHG disclosure.

Finally, our paper contributes to the growing literature on how emission reductions can be transmitted along the supply chain (Schiller, 2018; Dai et al., 2021; Cho et al., 2022; Dai et al., 2022; Darendeli et al., 2022; Lu et al., 2022). In the specific case of the federal government as a customer, recent studies show that federal agencies' overall environmental preferences are associated with suppliers' environmental disclosures and pollution abatements (Even-Tov et al., 2022; Huang, 2022; Yu, 2022). Our study further illuminates the role of GHG information processing costs in federal green procurement. In addition, studies on CSR activities along the supply chain usually rely on broad changes in overall CSR incentives driven by market-wide regulations (Schiller, 2018; Lu et al., 2022), state regulations (She, 2022), or firm initiatives (Dai et al., 2021), which increase a firm's CSR activities along a broad set of dimensions. In contrast, our setting focuses on a single yet salient element of CSR – GHG emissions – and identifies a tight link between contractual arrangements and real CSR outcomes.

2. Institutional Background and Literature

2.1 The federal procurement process and FAR 52.223-22

The Federal Acquisition Regulations (FAR) codify the U.S. federal government procurement procedures. When an agency decides to purchase a good or service, a contracting officer (CO) will post a public request for proposals, and prospective contractors can submit offers. A government contract is often contested, with an average of 16 bidders competing for the same bid and only 13% of contracts with single bids. The FAR set out various guidelines to conduct diligence on the potential vendors, including technical expertise, financial capabilities, and accounting and operational controls. The CO is the main person in charge of managing the procurement process, including posting the initial request for proposal,

evaluating bids received, selecting the final supplier, and monitoring the contractor to ensure that all requirements and standards are met (Spenkuch et al., 2023; FAR Section 1.620-1).

On March 19, 2015, President Obama issued Executive Order (EO) 13693, titled Planning for Federal Sustainability in the Next Decade, which required federal agencies to submit a plan to reduce procurement emissions. Subsequently, the Department of Defense (DoD), General Service Administration (GSA), and National Aeronautics and Space Administration (NASA) proposed to request information on vendors' GHG emissions and reduction goals on May 25, 2016. On November 18, 2016, FAR 52.223-22, titled Public Disclosure of Greenhouse Gas Emissions and Reduction Goals-Representation, was announced, and it was subsequently implemented on December 19, 2016. This was the *first* time in a *federal-wide* move that the FAR included mandatory provisions related to public GHG emission disclosure.[3]

FAR 52.223-22 consists of a two-part question list. In the first part (FAR 52.223-22 (a)), *all* entities must check a box on whether they received $7.5 million or more in federal contracts during the previous federal fiscal year or received less than $7.5 million but still want to make a representation on climate disclosure. If an entity checks "Yes," SAM.gov will direct the entity to answer two follow-up questions (FAR 52.223-22 (b)): whether the entity itself or through its immediate owner or highest-level owner, publicly discloses GHG emissions or emission reduction goals. If an entity answers "Yes," the system further asks for an available URL of its GHG disclosure ((FAR 52.223-22 (c)). Appendix [B] provides more details and Figure [1] provides a diagrammatic illustration.

[3] President Trump's announcement to exit from the Paris Agreement in June 2017 created some uncertainty over the federal government's future enforcement incentives. However, the impact of Trump's announcement was limited in our setting. Federal procurement agencies continued their efforts to reduce direct GHG emissions from 2018 to 2021. Empirical evidence suggests that the U.S. government procurement continues to promote corporate social responsibilities among its suppliers under President Trump (Even-Tov et al., 2022; Huang, 2022; Yu, 2022).

A few details of FAR 52.223-22 are worth noting. First, it is not a disclosure mandate (i.e., it does not require entities to disclose their emissions, publicly or privately), nor does it bind entities to specific reduction targets. Instead, the GHG representation made it easier for contracting officers to locate, access, and process suppliers' GHG information. Such a check-the-box mechanism is not costly to implement. At the same time, the penalty for lying is high since a violation could result in fines, penalties, and mischarging costs (FAR 31.205-15). Second, the representation specifies a threshold: entities who have received $7.5 million or more in federal contract awards in the prior Federal fiscal year must make this disclosure representation. The $7.5 million threshold is difficult to manipulate for the following reasons. First, the value awarded for each contract often involves external factors (e.g., the extent of competition at bidding and the types of contracts). Second, federal suppliers usually receive multiple contracts in a year, making it difficult for them to precisely manipulate the realized total award value. Third, both the federal government and the contractors could exercise options, as specified in the initial contract, to alter the value and the scope of the contract during the life of the project. Therefore, the frequent modifications mean that the realized value of a contract is often beyond the bidder's control.[4] Finally, FAR 52.223-22 was announced on November 18, 2016, and took effect on December 19, 2016. The quick implementation window suggests there is little room for pre-emption among suppliers.

2.2 External stakeholder's processing of CSR information and real effects

CSR information can alter firms' real polluting activities. This is because external stakeholders (e.g., investors, creditors, suppliers, customers, and employees) could use public CSR information to exert pressure on managers in the form of active voice (e.g., sending environmental shareholder proposals) or the threat of exit (e.g., terminating businesses,

[4] Internet Appendix [A] shows that there is an increase in the proportion of entities exceeding the $ 7.5 million after 2016, inconcistent with strategic manipulation.

reducing consumptions, divesting holdings). Firms, in turn, are induced to alter their polluting activities in response to *actual* or *anticipated* stakeholder pressures (Christensen et al., 2021).

Recent empirical evidence shows that there are real effects associated with how CSR information is aggregated for, disseminated to, and accessed by stakeholders (Christensen et al., 2021). When regulations make existing CSR information more available and accessible to external stakeholders, firms may alter their CSR activities. For example, Christensen et al. (2017) examine the Dodd-Frank mine-safety disclosure provisions. They find that including existing mine-safety disclosure in SEC filings, which increased public awareness of such information, improved mine safety.

In the realm of GHG emissions, several studies analyzed disclosure mandates that improved the dissemination of GHG information to a broad audience. Information processing frictions are likely substantial as wide heterogeneity exists in where and how firms disclose GHG information. They can include a section in their financial reports, have dedicated sustainability, or report to external platforms. It is often costly for external stakeholders to 1) learn that the disclosure exists (awareness), 2) obtain the relevant report and extract the pertinent information (acquisition), and 3) analyze the implications (integration) (Blankespoor et al., 2020). As a result, reducing the costs of processing GHG information can meaningfully alter how stakeholders (and how firms perceive stakeholders) use this information. Yang, Muller, and Liang (2021) studied the effect of the US Greenhouse Gas Reporting Program on electric power plants. Presenting already available information on a centrally accessible platform resulted in a 10% reduction in emission intensity for treated plants. Similarly, Jouvenot and Krueger (2020) and Downar et al. (2021) examine a setting where listed companies in the U.K. are required to include Scope 1 and 2 GHG emissions in annual financial reports since 2013. Both studies focus on firms that disclosed GHG information before the regulation and document reductions in emissions ranging from 8% to 21%, depending on

different designs and control groups. Our study extends this literature by examining changes in suppliers' emissions when their GHG information is made more available to one important stakeholder, i.e., an environmentally inclined large customer.

2.3 CSR information processing among contracting officers at federal agencies

Recent empirical evidence shows that regulators often rely on public disclosures in monitoring firms' activities (Armstrong et al., 2010; Bozanic et al., 2017; Li and Wang, 2022). Compared to requesting information privately, public disclosure is subject to greater scrutiny by other stakeholders, including institutional investors (Dyck et al., 2019; Cohen et al., 2022; van Benthem et al., 2022), lenders (Choy et al., 2023; Houston and Shan, 2022; Wang 2023), employees (Greening and Turban, 2000), and nongovernmental organizations (Rodríguez et al. 2016). However, in the specific setting of government procurement, contracting officers often face substantial costs in processing their counterparties' public disclosures, particularly as capacity and resources are constrained (when contracting officers face multiple counterparties) and when bureaucracies often prevent the elimination of (information) frictions (Wilson, 2019).

The GHG representation required that suppliers indicate the availability of public emission disclosures that followed a consistently applied standard and that the reduction goals be quantitative. The specificity of the requirement may reduce contracting officers' cost of searching for (i.e., the existence of disclosure), acquiring (i.e., the location of disclosure), and integrating suppliers' GHG information. As a result, contracting officers may better use emission information in either selecting cleaner suppliers or pressuring suppliers to pollute less. Furthermore, the GHG representation that we study is the *first* time the government, in a federal-wide movement, requested climate information during procurement solicitations. It, therefore, marks a salient step taken by the federal government towards reducing procurement emissions. Suppliers who made the GHG representation are aware that their contracting officers have information on their public climate disclosure, can access them, and can compare

these disclosures with that of other disclosing suppliers. Suppliers with more at stake, i.e., those that are economically reliant on federal contracts and have greater uncertainty in securing future contracts, are more motivated to reduce emissions in anticipation of future government actions, including screening based on GHG emissions.

3. Sample and Main Variables

3.1. Greenhouse gas emissions

We obtain carbon emissions data from Trucost, which collects, standardizes, and validates GHG emissions data from various company disclosures. When emissions data is unavailable, Trucost estimates GHG emissions based on global fuel use or a proprietary input-output model based on government census and survey data, industry data, and statistics and national economic accounts (S&P Global, 2020). Since Trucost significantly expanded its coverage in 2016 to include many medium- and small-cap firms, we use firms that have been covered by Trucost before 2016 as the main sample to mitigate concerns that Trucost's data expansion explains our results.[5] We measure the total GHG emissions related to a firm's production process as the natural logarithm of the sum of Scopes 1 and 2 emissions (Log(*GHGEmission*)) (Lewandowski, 2017; Jouvenot and Krueger, 2021).[6] Scope 1 emissions are direct emissions from sources owned by the firm. Scope 2 emissions are indirect emissions generated off-site, such as purchased energy or heat.

3.2. Government contracts and the main firm-year sample

We download all federal procurement contracts from USAspending.gov, which is the official source of spending data for the U.S. government, between federal fiscal years 2012 and 2021, resulting in 47,054,292 contracts. The federal fiscal year runs from October 1 through

[5] We show that our results are not sensitive to this choice in [XXX]. We also address concerns that Trucost estimates GHG emissions for some companies where reported data is not available.
[6] Since no firms in our sample report zero combined Scopes 1 and 2 emissions, we avoid performing a Log (1+) transformation given the econometric issues documented in Cohen et al. (2022) and Chen and Roth (2023).

September 30. We merge the contract data with the Compustat universe by matching the name of a contractor's parent company with company names recorded in Compustat (variable *CONM*). Specifically, we first use a Python fuzzy name-matching package that removes punctuation and legal business suffixes and replaces non-ASCII characters.[7] We retain observations with a matching score greater than 90 (out of 100) and manually verify each match. This procedure results in 11,730,122 Compustat-merged contracts.

From the Compustat-merged contracts, we construct the following firm-year measures of government contracts. For a given firm-year observation, *GovContractValue* is the total contract award value, and *GovContractN* is the total number of contracts received during the year. We focus on government suppliers by only keeping firm-year observations with a positive *GovContractValue*. The sample starts in 2013 and ends in 2020 because we retain observations in the three years before and after the implementation of the GHG representation.[8] After merging with GHG emissions from Trucost and requiring data on controls and at least two observations per firm, our main sample consists of 2,046 firm-year observations, corresponding to 390 unique firms for 10,478,466 contracts from the federal years 2012 to 2021. We winsorize all continuous variables at the top and bottom percentile.

Table 1 presents the descriptive statistics of contract-level data for the firms in our sample. On average, a government contract is worth $20,269 and has a maturity of 136 days. Each contract receives an average of 16 offers; only 13% of contract awards receive only one bid. As shown in the Internet Appendix Table A1, the Department of Defense (DOD) is the

[7] We obtain the name_matching package from https://github.com/DeNederlandscheBank/name_matching.
[8] Throughout the document, year refers to each firm's respective fiscal year, unless otherwise stated. The federal fiscal year ends on September 30 while many firms' fiscal years end in a different month. Therefore, for firms ending their fiscal years in December or any month from January to May, our sample period starts from 2013 and ends in 2019, with year 2016 being the FAR implementation year. For firms ending their fiscal years from June to November, the sample period starts from 2014 and ends in 2020, with the year 2017 being the FAR implementation year.

largest agency, with a 79% share in contract value, followed by the Department of Veterans (VA) (5%) and the General Services Administration (GSA) (4%).

3.3. GHG representation

We collect data on GHG representation from the System for Award Management (SAM.gov). SAM.gov is an official website of the U.S. Government that processes and stores entity registration information for any entities that wish to do business with the U.S. federal government. Registered entities on SAM.gov are required to complete electronic annual representations and update the representations as necessary or at least annually (FAR 4.12). After December 19, 2016, FAR 52.223-22 has been included in the list of representations.

It is important to note that the GHG representation is made by entities. SAM.gov defines a unique entity based on "a separate legal entity associated with a separate physical address" and subsequently assigns it a unique entity identifier (UEI).[9] Consequently, many firms contract with federal agencies under multiple entities. The 390 firms in our main sample have 3,558 UEIs from the federal years 2017 to 2021. Because manually collecting all current and historical GHG representations these entities make is time-consuming, we proceed in two steps. First, we select a sample of 598 UEIs and instruct our research assistants to manually collect all current and historical GHG representations made by them.[10] We verify that once an entity starts to make the GHG representation, it will continue making it in subsequent years.[11] Based on this observation, we proceed to the second step. We gather the current representation made by the remaining UEIs using SAM.gov Get Opportunities public API.[12] For UEIs who

[9] Throughout this document, we use the terms "company," "firm," and "supplier" interchangeably to refer to a unique Compustat GVKEY and "entity" to refer to a unique UEI.
[10] For each unique firm (i.e., GVKEY) in our sample, we choose the UEI with the largest contract value so that we can manually verify the entity that the firm most frequently contracts with the federal agencies. In addition, we select up to three randomly selected UEIs for each firm. Appendix [XXX] provides more details.
[11] It is possible that some UEIs that do not provide GHG representation in their most recent representation have made GHG representation in the past. However, we observe that this is the case for only 0.31% of UEIs (among the 598 UEIs that we manually verified). Further, at the firm-year level, no firms stop making the GHG representation once it has started doing so. Additionally, omitting such cases biases against our findings.
[12] We thank SAM.gov for providing us with public access.

have made the GHG representation in the current period, we instruct our research assistants to collect all of the historical representation data to determine the precise time the entity starts to represent. Appendix [C] provides step-by-step documentation of the collection procedure.

We construct the following variables based on the collected GHG representations. *GHGRep* equals one if any of a firm's UEIs made the GHG representation in a given year, and zero otherwise. Next, we determine if the GHG representation made by a UEI is mandatory or voluntary in nature. We estimate the total contract value for each UEI in a given federal year by summing up the value of all contract awards. A UEI is considered to be mandatory if its total contract value in the previous federal fiscal year before the representation submission date is 7.5 million or more, and voluntary otherwise. At the firm-year level, *GHGRep(Mandatory)* indicates if any of a firm's UEI provides a mandatory GHG representation.[13] In addition, we exploit variations in the *content* of the information provided by firms conditioned on having made the GHG representations. A UEI could either state "Yes" or "No" when asked about whether it, through itself or its immediate owner or highest-level owner, discloses GHG emission information and/or reduction goals (FAR 52.223-22(b)). *GHGRepDiscl* is an indicator variable that takes the value of one if a firm, through any of its UEIs, has provided a link to its public disclosure of emissions or reduction goals. Finally, we examine the *quality* of the information provided, conditioning on having provided website links. The system on SAM.gov is designed such that all UEIs will have to enter non-missing information on a website link should they have entered "Yes" in the previous question (i.e., FAR 52.223-22(b)). However, the system cannot verify whether the website link provided is a valid and accessible web address. To verify the validity of the link provided at the time of the representation, we

[13] In Internet Appendix [IA], we discuss the extent to which entites comply with the requirement to make the GHG representation. 68.5% of the UEIs exceeding the mandatory representation requirements made the GHG representation. In addition, as shown in Internet Appendix Table [IA2] we find that the proportion of entities exceed or just exceed the $ 7.5 million threshold exhibit a general upward trendsafter 2016, inconsistent with firms strategically allocating the total contract values among entities to stay below the threshold and avoid making the GHG representation.

use the Wayback machine to determine whether the link was accessible in the past year before the representation date (*GHGRepDisclValid*). Appendix [B] provides more details, and Figure [1] provides a diagrammatic illustration.

3.4. Contracting officer identity

Contracting officers (CO) are the individuals who can use information elicited by the GHG representation to process suppliers' climate disclosure. To identify individual COs, we obtain the email addresses of officers who approve the federal contracts from SAM.gov (Spenkuch et al., 2023). We merge it with the initial universe of contracts from USAspending.gov. This results in 43,778,071 unique contracts and 63,704 unique email addresses. Similar to the data collection process in Spenkuch et al. (2023), we observe that some email addresses are likely admin accounts that do not belong to an individual officer (e.g., ebs.sysadmin.dla.mil). We further require an email address to contain an "@" and a name that can be found in the top 5000 most prevalent first names or last names according to the U.S. Census and the Social Security Account. We identified 47,629 individual officers responsible for 9,636,339 contracts from 256,749 UEIs. Appendix [D] provides detailed documentation.

Using information on the identity of contracting officers, we compute two measures relating to their costs for processing suppliers' GHG emissions. First, we calculate the number of UEIs that each CO is responsible for in a given federal year as a measure of the CO's capacity constraints (*NUEICO*). On average, a CO manages 56 contracts from 21 UEIs each year, with a total contract value $14 million (Internet Appendix Table [IA3]). Second, we estimate the extent to which the GHG representation helps a CO to compare GHG emissions among suppliers that he/she manages. Specifically, we calculate the percentage of UEIs with the GHG

representation, out of all UEIs that a CO manages in a given year and have available records on SAM.gov (*PctUEIGHGRep*).[14]

4. Research Design and Main Results

4.1 The GHG representation and government suppliers' GHG emissions

We estimate the following OLS model at the firm-year level to examine the effect of the GHG representation on federal suppliers' GHG emissions:

$$Log(GHGEmission)_{i,t} = \beta_0 + \beta_1 GHGRep_{i,t} \text{ or } GHGRep(Mandatory)_{i,t} + \beta_2 GovContractValue/Sales + \beta_3 Log(Total\ Asset)_{i,t} + \beta_4 Log(1+Age)_{i,t} + \beta_5 ROA_{i,t} + \beta_6 Leverage_{i,t} + \beta_7 AssetGrowth_{i,t} + \beta_8 Tangibility_{i,t} + \beta_9 Log(1+AnalystN)_{i,t} + \beta_{10} Log(1+InstN)_{i,t} + \beta_{11} Log(1+SRIProposalN)_{i,t} + \beta_{12} GRIReport_{i,t} + \beta_{13} PriorGHGPubDiscl_{i,t} + Firm\ FE + Year\ FE + \varepsilon_{i,t}, \quad (1)$$

The dependent variable is log-transformed combined Scope 1 and 2 GHG emissions. The independent variable of interest is *GHGRep* and *GHGRep(Mandatory)*. *GHGRep* estimates the average effects of the GHG representation on emissions. *GHGRep(Mandatory)* focuses on suppliers who have exceeded the mandatory threshold of $7.5 million and have made the representation. These suppliers are more likely to be under the spotlight in sustainable procurement and face higher pressure to reduce emissions.[15] We control for time-varying firm characteristics, including firm size, age, ROA, leverage, asset growth, tangibility, and analyst coverage. *ContractValue/Sales* is included to mitigate concerns that federal agencies exert more pressure on larger contractors to reduce emissions, regardless of whether there is a GHG representation. We include several control variables to mitigate the concern that other external stakeholder pressures might drive emission reductions. First, we control for shareholder pressure by including institutional ownership (*InstN*) and the number of social responsibility

[14] Appendix D provides further details on how we collect the GHG representation for the UEIs that the contracting officers identified in our sample manage.

[15] Since the GHG representation, the $ 7.5 million threshold has been applied in subsequent proposals related to green procurement. For instance, a recent FAR proposal (FAR Case 2021-015, Disclosure of Greenhouse Gas Emissions and Climate-Related Financial Risk), proposed after our sample period on November 14, 2022, required entities receiving more than $7.5 million contract awards to disclose Scopes 1 and 2 GHG emissions.

shareholder proposals (*SRIPropsoalN*). We include an indicator for whether a firm publishes sustainability reports in accordance with the Global Reporting Initiative (GRI) to mitigate concerns that firms might adopt sustainability reporting frameworks during the sample period, resulting in greater external monitoring of the firm's environmental activities.[16] Finally, we include an indicator for the availability of public disclosure prior to making the GHG representation, measured by whether Trucost obtained the firm's emission information in the previous fiscal year from a public source instead of making an estimation (*PriorGHGPubDis*).

Throughout the remainder of our empirical analyses, we include firm and year fixed effects to control for time-invariant firm characteristics and time trends, therefore employing a within-firm model. The coefficient of interest, β_1, is the generalized difference-in-differences estimator. It captures the changes in emissions for suppliers after making the GHG representation (1st difference) and relative to suppliers who did not represent (2nd difference). To the extent that suppliers expect that federal agencies will take actions (either in the form of monitoring in the current period or screening in the future) as the GHG representation makes it easier for contracting officers to access and process suppliers' climate disclosure, we expect to find a negative and significant β_1. In the main specification, we measure both emission outcomes and GHG representation variables contemporaneously to align with the contract duration observed in our sample, which is usually completed within a year (the mean duration is 136 days). In other words, we expect that suppliers will respond to current or anticipated pressures from the government actions in the year that they make GHG representation. Later analyses ([Section 4.2]) show that emission reductions persist in the two years after making the GHG representation. We cluster standard errors by firms.

[16] We thank the referee for this suggestion. In the Internet Appendix Table [IA7], we further show that our results are robust in the subsample without social responsibility shareholder proposals or without GRI reports.

In Table 2 Panel A, we present the distribution of GHG representation (*GHGRep)* at the firm-year level. There was no *GHGRep* in the pre-period from 2013 to 2015 and 0.9% in 2016 (as FAR 52.223-22 was implemented in December 2016). We observe that 22.2% of firms made the GHG representation in 2017, with 21.2% making it for the first time (*FirstGHGRep*). The percentage of firms making the GHG representation increases gradually. In addition, in each year from 2017 and 2021, there are around 3% to 8% of firms start to make the GHG representation for the first time. This suggests that the "treatment" in our sample, i.e., *GHGRep*, is staggered over time, mitigating concerns over concurrent trends. We further find that among the firm-years with the GHG representation, 62% provide the GHG representation as mandated by FAR 52.223-22, and 81% state that they have public disclosure of GHG emissions or reduction goals. Panel B of Table 2 presents the descriptive statistics of the main variables and the Internet Appendix Table [IA4] provides additional descriptive statistics. The average firm has $34,569 million in total assets. They receive $232 million in contract awards on average, about 1.6% of their total sales. The average yearly emissions of Scopes 1 and 2 are 3.46 million tonnes. 37.8% of firms report GRI-standard sustainability reports.

Table 3 Panel A presents the OLS regression results of Equation (1). Columns 1 and 3 do not include any controls, and columns 2 and 4 include the full vector of control variables. Firm and year-fixed effects are included in all columns. Across all specifications, we find a negative and significant β_1, significant under the 5% or 1% significance levels, suggesting that suppliers reduce emissions when they provide GHG representations. The effect of making GHG presentations on emission reduction is economically significant, resulting in a reduction of absolute emissions by 12.9% ($1- e^{-0.138}$). The effect is larger among mandatory suppliers, with a 13.8% reduction in emissions ($1- e^{-0.148}$).[17] This finding supports our prediction that

[17] The economic magnitude is in line with prior studies examining the effect of dissemination and aggregation of existing GHG information. Both Jouvenot and Krueger (2021) and Downar et al. (2021) examine the effect of

suppliers are motivated to reduce emissions as they expect the federal government to use the GHG representations to take action (now or in the future).

In Table 3 Panel B, we re-estimate Equation (1) with several alternative measures of firms' GHG emissions. In our main specification, we log-transform absolute emissions, which is right-skewed.[18] In columns 1 and 2, we replace *Log(GHGEmission)* with a count-like transformation using decile-ranked emissions and use Poisson pseudo maximum likelihood regressions (Cohn et al., 2022). In columns 3-6, we use emission intensity measures by scaling absolute emissions with sales or costs of goods sold. Our results remain unchanged.

We also report several alternative specifications in the Internet Appendix Table [IA5]. First, one might be concerned that Trucost's emissions estimates for firms without public information are systematically biased. We re-estimate Equation (1) using a subsample of firms whose emission data is obtained directly from company reports by Trucost. In addition, we use alternative sources of emissions from the Carbon Disclosure Project (CDP), which surveys firms' emissions information. We continue to find that suppliers with GHG representation reduce emissions.[19] Second, while we do not have any singletons in the main regression, 303 (331) control firms in our sample have never made the GHG representation and, therefore, have no variations in *GHGRep* (*GHGRep(Mandatory)*). To address the concern that these observations may bias our estimation (Breuer and de Haan, 2023), we drop them in estimating Equation (1) and find similar results. Third, recent literature suggests that heterogenous treatment effects may bias the estimates from staggered DiD regressions (Goodman-Bacon 2021; Baker et al., 2022). We thus conduct stacked regressions by stacking suppliers making the (mandatory) GHG representation for the first time in the same year with suppliers never

The Companies Act 2013 in the United Kingdom on firms who already disclose GHG information. They document a reduction in GHG emissions in the range of 8% to 16%, and in GHG emission intensity between 10% to 21%.

[18] In our sample, the mean value is 3.46 million tCO2e and the median is 282,266 tCO2e.

[19] Results are also robust when we further control for whether firms prepare climate disclosures in accordance with TCFD (Task Force on Climate-Related Financial Disclosures) guidelines, according to CDP reports.

making the GHG representation in our sample period (Cengiz et al., 2019). We continue to find that suppliers reduce emissions after they make (mandatory) GHG representation for the first time. Lastly, we present two alternative samples. First, we exclude the year during which FAR 52.223-22 was implemented, making it difficult to separate the period before or after its effective date cleanly. Second, we include all firms with Trucost coverage, including those with incomplete coverage that did not span the entire same period (i.e., full Trucost sample). Our results remain unchanged in both cases.

4.2 Endogeneity concerns and mitigating strategies

The actual representation made by firms is not completely random. Firms below the $7.5 million threshold can make a voluntary GHG representation; there are also firms above the $7.5 million threshold and yet do not represent. This gives rise to two potential endogeneity concerns in our within-firm design. First, an omitted time-varying firm characteristic may explain both the decision to represent and emission reductions. For example, firms facing increasing social responsibility pressure from other stakeholders may start making the GHG representation and reduce emissions simultaneously. Second, concern about reverse causality exists. It is possible that firms are more likely to provide the GHG representation when they expect to reduce emissions. Reverse causality should be more pronounced among voluntary suppliers and suppliers who do not provide GHG presentations despite being subject to mandatory requirements (i.e., with contract value above the $ 7.5 million threshold).

In this section, we outline [four] sets of analyses to mitigate these concerns, and in the [Internet Appendix A], we provide further discussions on possible reasons for failing to make the GHG representation, which is unlikely to be strategic. First, we use *Mandatory*– firms with entities that exceeded the $7.5 million threshold – as an instrument for the actual GHG representation. The premise is that the total contracting value received in the previous federal year is not completely within the suppliers' control – it could also be affected by external factors

such as allocated federal budgets, competitive bidding, and the extent of contract modifications (Broggard et al., 2022). As a result, it is unlikely that whether a supplier's total contract value in the previous federal year was above or below the $7.5 million threshold is correlated with its GHG emissions (i.e., the exclusion criteria).[20] Using *Mandatory* as an instrument essentially estimates a local average treatment effect on the subset of firms who would only have made the GHG representation because of the mandatory requirement (Jiang 2017). We modify Equation (1) using the following two-stage least-squared (2SLS) estimation:

$$GHGRep_{i,t} \text{ or } GHGRep(Mandatory)_{i,t} = \beta_0 + \beta_1 Mandatory_{i,t} + Controls + Firm\ FE + Year\ FE + \varepsilon_{i,t}, \quad (2a)$$

$$Log(GHGEmission)_{i,t} = \beta_0 + \beta_1 Predicted\ GHGRep_{i,t} \text{ or } Predicted\ GHGRep(Mandaotry)_{i,t} + Controls + Firm\ FE + Year\ FE + \varepsilon_{i,t}, \quad (2b)$$

Control variables follow those defined in Equation (1). β_1 in Equation (2b) identifies the local average treatment effect. The first-stage regression results (Table 4 Panel A columns 1 and 2) show that *Mandatory* is associated with a 36.9 (43.9) percentage point increase in having GHG representations (significant at the 1% level), supporting that it is a strong instrument for both *GHGRep* and *GHGRep(Mandatory)*. Columns 3 and 4 present the second-stage regression results of Equation (2b). We find that both *Predicted GHGRep* and *Predicted GHGRep(Mandatory)* are negative and significant under 5% levels, alleviating concerns over omitted variables and reverse causality.

Second, we compare the emission reductions among (1) firms that exceeded the $ 7.5 million threshold and made the GHG representation (*GHGRep(Mandatory)*), (2) firms who did not exceed the threshold and voluntarily represented (*GHGRep(Voluntary)*), as well as (3) firms who did not make the GHG representation despite being subject to the mandatory requirement

[20] Another possible concern is that firms receiving larger contracts (and thus exceeding the $ 7.5 million threshold) have more financial resources available to reduce emissions. *Mandatory* only captures a discontinuity in contract value at a specific threshold. We control for contract value throughout our analyses to mitigate the concerns that our results are driven by the size of federal contracts.

(*NoGHGRep(Mandatory)*). If the concerns of reverse causality are true, we expect that suppliers who reduce emissions to a greater extent are more likely to represent voluntarily, suggesting a more negative coefficient on *GHGRep (Voluntary)*. Table 4 Panel B presents the result. Inconsistent with the alternative explanation, the coefficient on *GHGRep(Voluntary)* is of a much smaller magnitude than that on *GHGRep(Mandatory)* and is not significant (p-value is 0.113). The coefficient on *GHGRep(Mandatory)* remains negative and significant at the 1% level. This finding further corroborates our prediction that mandatory suppliers feel more pressure to reduce emissions as they are more "under the radar" of the federal government. In addition, we do not observe significant changes in emissions among suppliers exceeding the threshold and yet did not make the GHG representation (*NoGHGRep(Mandatory)*), highlighting that it is the GHG representation but not the mandatory requirements (or total contract size) per se that drives the observed emission reductions.

Third, we test for any pre-trend in emissions before suppliers start providing the GHG representation. We replace *GHGRep* in Equation (1) with indicators for the two years before, during, and two years after firms' first GHG representation. As shown in Table 4 Panel C, none of the pre-first GHG presentation variables are significant at the 10% level. This suggests that firms did not change their emissions before making the GHG representation. Results are similar when we examine the emission trends before the first mandatory GHG representation. These results are inconsistent with both alternative explanations. It is unlikely that firms make the GHG representation because they have been reducing emissions regardless (i.e., reverse causality). In addition, if the firms' decision is strategic, we will expect them to make the GHG representation during the years that they anticipate greater reductions in emissions and withhold in other years. However, we do not observe such cases. For all firms in our sample, once they start making the GHG representation, they will continue doing so in later years.

Lastly, we perform entropy-balancing matching for firms with the GHG representation and those without, thus controlling for observable differences between the two groups. We use entropy balancing to reweight firms without the GHG representation based on variables that likely affect the decision of GHG representation, including contract value, firm size, institutional ownership, shareholder proposals, GRI reporting, and prior public GHG disclosure. We observe a similar distribution of these control variables between the two groups after entropy balancing matching (Internet Appendix Table [IA6]). Notably, we include contract size as a covariate to mitigate the concern that our results might be driven by suppliers with larger contract size, regardless of whether they made the GHG representation. Similarly, we reweight firms without mandatory GHG representation. Table 4 Panel D presents the regression results of Equation (1) in the entropy-balanced sample. We continue to find that both *GHGRep* and *GHGRep(Mandatory)* have a negative and significant effect on emissions, and our interpretation remains unchanged.

5. Cross-sectional Results and Additional Analyses

5.1 Cross-sectional analyses based on suppliers' economic incentives

We predict that suppliers making the GHG representation are motivated by economic incentives to reduce emissions. Specifically, suppliers that 1) rely more on the federal government as a customer and 2) face greater uncertainty in securing contracts are more concerned about losing federal contracts. Therefore, they respond more to the GHG representation by altering their polluting activities, as they have more at stake when federal agencies take action using climate disclosure. We develop two measures to capture the extent of reliance on the federal government as a customer. First, a supplier will have a high reliance if its government contract value accounts for a higher percentage of total sales than the sample median (*HighGovContractValue/Sale*). Second, we identify firms that disclose the federal government as a major customer (*MajorGovCustomer*) in corporate communications. We

collect disclosed customer information from Factset Revere, which gathers customer data from various company disclosures, including 10-K filings, conference calls, investor presentations, and company websites (Wang et al., 2021). A customer relationship is disclosed either because it crosses the 10% of total revenue threshold for mandatory segment disclosure as specified in SFAS 131 or because the company discretionarily reveals a relationship as a business decision.

Next, we develop two measures for the extent of uncertainty in securing future federal contracts based on bidding competition and past contract variability. First, we calculate contract competition as the number of competing offers per bid and define that a supplier faces high contract uncertainty if less than 50% of its contract value in a given year are single-offer bids (*LowSingleBid*). We use the standard deviation of contract value divided by sales over the past five years as a proxy for contract variability and define suppliers in the highest quartile of the sample as those facing high uncertainty (*HighVariability*).

Panel A of Table 5 presents cross-sectional results based on government reliance. We re-estimate Equation (1) by replacing *GHGRep* with two separate indicators, essentially partitioning the treatment firms into those with high reliance (*GHGRep-HighReliance*) and low reliance (*GHGRep-LowReliance*) based on the cross-sectional variables defined above, respectively. We create similar partitions for firms making mandatory GHG representation: *GHGRep(Mandatory)-HighReliance* versus *GHGRep(Mandatory)-LowReliance*. In column 1, we find that the effect of the GHG representation in reducing emissions is concentrated (muted) among suppliers with a higher (lower) percentage of sales from federal contracts. In column 3, we observe that the effect of the GHG representation on emission reductions is negative and significant in both suppliers with major federal customers and those without, but the coefficient estimates on suppliers with major federal customers have a much larger magnitude (p-value on coefficient difference is 0.019). We observe similar results among firms making mandatory GHG representation in columns 2 and 4. These results suggest that suppliers with greater

reliance on federal contracts are more inclined to respond to current or anticipated government actions in greening supply chains.

Panel B of Table 5 presents cross-sectional analyses by dividing firms with the GHG representation into high and low uncertainty of securing future contracts: *GHGRep-HighUncertainty* and *GHGRep-LowUncertainty.* Consistent with our expectation, we find a stronger effect among firms that face more competition in bidding and those with greater value variability in federal contracts received. The coefficient estimates are consistently negative and significant among suppliers with high uncertainty and are of much larger magnitude (around two times greater) than those of low uncertainty firms (with one-sided *p*-values of difference in coefficients significant at the 10% level in all columns). Overall, our results support that economic incentives are important mechanisms that motivate suppliers to reduce emissions.

5.2 Cross-sectional analyses based on contracting officers' information processing

The GHG representation helps the contracting officer managing the federal procurement process to access, retrieve, and compare emissions levels and reduction targets among suppliers. We expect the effects of the GHG representation in inducing suppliers to alter their polluting activities to be stronger when the contracting officer can better use the information obtained. To examine the CO's ability to process the information elicited by the GHG representation, we present two sets of tests based on 1) the usefulness of the information provided by firms in the GHG representation and 2) the variations in the individual CO's capacity constraints in processing this information as well as their ability to benchmark emissions. First, we examine the content of the information. A GHG representation is considered to provide more useful information to the CO in accessing suppliers' environmental activities if it states the location of a firm's public disclosure of emissions and/or reduction goals. On the contrary, a representation stating no disclosure has little effect in reducing the CO's information processing costs. Accordingly, we partition firms into those who provides

disclosure (*GHGRepDiscl*). Second, we verify if the website location provided stated by firms in FAR 52.223-22 is an accessible website location, a proxy for the quality of information provided. We use the WayBack Machine to evaluate whether a website link has been accessible historically in the past year before the representation date (*GHGRepDisclValid*).

Next, we exploit heterogeneities in how individual contracting officers may process GHG information provided by firms. We posit that GHG representation is more useful to an individual officer who has a lower capacity constraint such that he or she can utilize the information collected. This is measured by the number of unique entities an officer handles each year (*NUEICO*). We also predict that GHG information is more useful if a contracting officer can benchmark it with other suppliers in his or her portfolio because more firms under his or her portfolio make the GHG representation. We construct a CO-level measure of the percentage of UEIs providing GHG representation (*PctUEIGHGRep*). Based on the two CO-level measures, we create two firm-level indicators on whether a supplier's COs have capacity constraints below the sample median (*LowNUEICO*) and a benchmarking ability above the sample median (*HighPctUEIGHGRep*).

Table 6 Panel A shows cross-sectional results based on the usefulness of information elicited by the GHG representation. We find that the effect of GHG representation is concentrated in suppliers providing the location of their public GHG disclosure and those providing accessible disclosure links. The coefficient estimates on *GHGRep* are only significant among firms when the information provided is more useful, and are larger than those with less useful representation (*p*-values comparing coefficient differences are significant under 5% in three out of four specifications). This finding suggests that the disclosure content included in the GHG representation plays a role in inducing suppliers to reduce emissions, mitigating the concern that our results are driven by other concurrent changes in the federal acquisition regulations. We present the results of contracting officers' information processing

in Table 6 Panel B. Consistent with the GHG representation being more useful to officers with lower capacity constraints, we find that suppliers reduce more emissions when the CO contract with fewer entities compared to the sample median and when the CO has a higher percentage of suppliers under their portfolio making the GHG presentation (*p*-values comparing coefficient differences are significant under 5% in three out of four specifications). Overall, the results in Table 6 show that GHG representation reduces suppliers' emissions when it helps contracting officers better process suppliers' public GHG disclosure.

5.3 Additional Analyses

5.3.1 Operational feasibility on emission reduction

We further investigate the potential channels through which suppliers reduce their emissions. On the one hand, suppliers may shift their Scopes 1 and 2 emissions to more opaque Scope 3 emissions, as the latter is harder to measure and monitor. On the other hand, suppliers may invest in costly environmental reduction infrastructures to support Scope 1 emission reduction. Alternatively, suppliers may exploit low-cost abatement opportunities, such as promoting energy efficiencies through insulation retrofit and LED lighting, to reduce energy consumption (McKinsey 2009). Suppliers can also switch to renewable energy, such as solar and wind power, whose costs have declined significantly in recent years with the development in technology.[21] Such actions can be effective in reducing Scope 2 emissions. Table 7 presents the regression results of Equation (1) by replacing the dependent variable with Scope 1, Scope 2, and Scope 3 emissions. We find the strongest reductions among Scope 2 emissions, with a coefficient estimate of -0.129 on *GHGRep*, significant under 5% levels. While we continue to find that suppliers reduce Scope 1 emissions, the coefficient estimates are of a smaller magnitude and with a *p*-value of 0.252. Results on *GHGRep(Mandatory)* are similar. This finding is consistent with the fact that Scope 2 emissions can be reduced relatively quickly by

[21] https://ourworldindata.org/cheap-renewables-growth

adopting clean energy and energy efficiency policies. We do not observe an increase in Scope 3 emissions either, inconsistent with suppliers hiding their emissions along the supply chain.

In Table 8, we provide additional evidence of GHG representations' overall impact on suppliers' financial performance. Suppliers may experience worse financial outcomes if they make costly abatement investments or are forced to reduce production. However, their financial performance may not be negatively affected when exploiting low-cost abatement opportunities. We find evidence supporting the latter. Suppliers with GHG representation do not report a lower ROA or gross margin, consistent with no adverse financial impact. In addition, we find little change in revenues or costs of goods sold, inconsistent with suppliers reducing their production. We do not observe a change in capital expenditures or R&D investments. Our results are consistent with prior literature that emission reductions can be achieved without significant capital investments or sacrificing financial performance (Downar 2021).

5.3.2 Suppliers' future contractual benefits

To better understand suppliers' cost-benefit trade-offs in emissions reduction, we examine whether suppliers could obtain (or expect to obtain) tangible benefits after making the GHG representation and reducing emissions. These benefits could either come from existing suppliers more likely to continue receiving future government contract or receiving greater contract value. In Table 9, we regress one-year-ahead contract variables on *GHGRep* in the current year, including the probability of receiving government contracts (*FutureGovContract*), contract value over sales (*FutureGovContractValue/Sale*), and the number of contracts (*FutureGovContractN*). We find that suppliers are more likely to continue as government contractors, receive higher contract value and more contracts in the year after making the (mandatory) GHG representation. These results document the economic benefits of GHG representation, which corroborates our prior findings that suppliers are motivated by economic incentives to reduce emissions.

5.3.3 Reduced information processing costs or enhanced disclosure

We focus on a reduction in federal contracting officers' information processing costs as the main channel through which the GHG representation induces changes in suppliers' emissions. An alternative channel is that GHG representation increases the quantity and quality of public GHG disclosure, which in turn motivates suppliers to reduce emissions (Christensen et al., 2021). FAR 52.223-22 is explicit that it does not require suppliers to start making GHG disclosure. Nevertheless, we attempt to shed light on whether there is a concurrent change in the availability and content of public GHG disclosure in Appendix [E]. Using the GHG information website location provided by firms in the GHG representation, we investigate whether there was a change in the availability of the content and the content when firms start to represent using the Wayback Machine. Descriptive evidence suggests that over 90% of the website links existed at least 180 days before. The content of the website homepage exhibits little changes when compared with a prior version, suggesting little change in either the availability or the content of the GHG disclosure because of the representation. However, we caveat that this analysis is descriptive in nature, and we are only able to analyze firms with sufficient Wayback archives. We caution the readers that we are not able to conclude from this analysis that firms did not alter their disclosure after making the GHG representation. However, we believe that the extensive set of evidence in this paper collectively points to the role of reducing GHG information processing costs in curbing emissions.

6. Conclusion

We examine whether suppliers reduce emissions when their federal customers start requesting information on the existence of their public climate disclosure. We explore a change in the U.S. federal government procurement that requires certain suppliers to represent whether and where they have public GHG disclosure. Using data on the actual representations made by suppliers, we find that those who made the representation decreased emissions more than those

who did not. We perform extensive robustness checks, including an instrumental variable design, to mitigate concerns that firms' decisions to make the GHG representation might be strategic. Further evidence shows that suppliers who are more reliant on federal contracts and face greater uncertainty respond more to the GHG representation, suggesting that suppliers are motivated by economic incentives to reduce emissions. In addition, we do not find that suppliers experience adverse financial consequences when reducing emissions, likely because they are able to engage in cost-efficient abatement efforts. Moreover, emission reductions are greater when contracting officers can better process suppliers' climate disclosure with the information in the GHG representation. Our evidence highlights how a reduction in customers' information processing costs can have real effects on suppliers' polluting activities.

While our setting is specific to government contracting, our results suggest that suppliers are motivated by economic incentives to reduce emissions when their GHG emissions information becomes easier to process for an environmentally inclined large customer. Our findings can inform GHG reduction in more general supplier-customer relations when customers have greater bargaining power and when GHG information becomes more easily accessible to customers. This is particularly relevant with increasing societal pressure on firms to reduce pollution along their supply chain and as the SEC proposed new rules on mandating Scope 3 emissions for large public firms (SEC Release No. 33-11042). In addition, our findings also speak to the growing debates on how governments can promote environmental stewardship through their procurement. Recent empirical studies have examined whether U.S and E.U. governmental agencies' environmental preferences can increase suppliers' overall environmental-related disclosures and their environmental efforts (Even-Tov et al. 2022; Huang 2022; Yu 2022). Our results corroborate these findings and suggest that a contractual mechanism could promote greater environmental responsibility among government suppliers.

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Appendix A: Variable Definitions

Measures of GHG Emissions	
Log(*GHGEmission*) (tCO2e)	The natural logarithm of the sum of Scopes 1 and 2 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent). Scope 1 refers to GHG emissions that are owned or controlled by the company; Scope 2 refers to GHG emissions from the consumption of purchased electricity, heat or steam by the company. *Source: Trucost*
GHGEmissionDecileRank	The decile ranking of the sum of Scopes 1 and 2 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent). *Source: Trucost*
Log(*GHGEmission/Sales*) (tCO2e/$m)	The natural logarithm of the sum of Scopes 1 and 2 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent) divided by revenue (in $ million). *Source: Trucost, Compustat*
Log(*GHGEmission/COGS*) (tCO2e/$m)	The natural logarithm of the sum of Scopes 1 and 2 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent) divided by costs of goods sold (in $ million). *Source: Trucost, Compustat*
Log(*GHGEmissionScope1*) (tCO2e)	The natural logarithm of the sum of Scope 1 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent). *Source: Trucost*
Log(*GHGEmissionScope2*) (tCO2e)	The natural logarithm of the sum of Scope 2 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent). *Source: Trucost*
Log(*GHGScope3UEmission*) (tCO2e)	The natural logarithm of the upstream Scope 3 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent). *Source: Trucost*
Measures of the GHG Representation	
GHGRep	An indicator variable that takes the value of one if any of a firm's UEIs provides the GHG representation (i.e., FAR 52.223-22) in a given fiscal year, and zero otherwise. *Source: SAM.gov*
Mandatory	An indicator variable that takes the value of one if any of a firm's UEIs has received over $ 7.5 million in total contract values in the prior federal year before its current GHG representation submission date, and zero otherwise. It takes the value of zero for fiscal years prior to December 19, 2016. *Source: SAM.gov, USAspending.gov*
GHGRep(Mandatory)	An indicator variable that takes the value of one if any of a firm's UEIs provides the GHG representation as a mandatory requirement (because it has received over $ 7.5 million in total contract value in the prior federal year) in a given year, and zero otherwise. *Source: SAM.gov, USAspending.gov*
GHGRep(Voluntary)	An indicator variable that takes the value of one if all of the firm's UEIs that provide the GHG representation in a given

	year are voluntary in nature (because it has received less than $ 7.5 million in total contract value in the prior federal year), and zero otherwise. *Source: SAM.gov, USAspending.gov*
NoGHGRep(Mandatory)	An indicator variable that takes the value of one if all of a firm's UEIs that received more than 7.5 million in the prior federal year have not made the GHG representation, and zero otherwise. *Source: SAM.gov, USAspending.gov*
GHGRepDiscl	An indicator variable that takes the value of one if a firm, through any of its UEIs, indicates that it has public disclosure of GHG emissions or reduction goals in the GHG representation, and zero otherwise. *Source: SAM.gov*
GHGRepDisclValid	An indicator variable that takes the value of one if a firm, through any of its UEIs, has provided a link to its public disclosure of GHG emissions or reduction goals in the GHG representation. In addition, this link has a valid and accessible archive on the Wayback Machine in the year before the representation date. It takes the value of zero otherwise. *Source: SAM.gov, the Wayback Machine*
FirstGHGRep	An indicator variable that takes the value of one if a firm has made a GHG representation through any of its UEIs for the first time, and zero otherwise. *Source: SAM.gov, USAspending.gov*
FirstGHGRep(Mandatory)	An indicator variable that takes the value of one if a firm has made the GHG representation as a mandatory requirement through any of its UEIs for the first time, and zero otherwise. *Source: SAM.gov, USAspending.gov*
Measures of Federal Government Contracts	
GovContract	An indicator variable that takes the value of one if a firm's total federal contract value in a given fiscal year is positive, and zero otherwise. *Source: USAspending.gov*
CovContractValue	The total contract value a firm receives (in $ thousand) in a given fiscal year. *Source: USAspending.gov*
GovContractValue/Sales	The total contract value a firm receives (in $ million) divided by sales (in $ million) in a given fiscal year. *Source: USAspending.gov, Compustat*
GovContractN	The total number of contracts a firm receives in a given fiscal year. *Source: USAspending.gov*
SingleBid	The percentage of a firm's government single-bid contracts in a given fiscal year. A single-bid contract is one that has only received a single offer. *Source: USAspending.gov*
Variability	The standard deviation of a firm's total contract value scaled by sales in the past five years.

	Source: USAspending.gov, Compustat
MajorGovCustomer	An indicator variable that takes the value of one if a firm reports having at least one federal government customer in Revere, and zero otherwise. *Source: Factset Revere*
NUEICO	The average number of unique entities that a firm's contracting officers are responsible for in a given federal year. When a firm has multiple contracting officers, a weighted average is applied when aggregating to firm-fiscal year level using total contract value as weights. It is computed based on the following formula: $NUEICO_{i,t} = \sum_{j \in N} \frac{ContractValue_{i,j,t}}{ContractValue_{i,t}} \times NumUEI_{j,c,t}$ where i denote firm, j denotes contract, c denotes contracting officer, t denotes firm fiscal year. N is the set of all contracts that firm i received during fiscal year t. $NumUEI_{j,c,t}$ is the number of unique entities that the contract officer c for contract j is responsible for over the federal fiscal year. *Source: SAM.gov, USAspending.gov*
PctUEIGHGRep	The percentage of unique entities making the GHG representation in the current submission period for a contracting officer, weighted by the total contract value when aggregating to firm-fiscal year level. It is computed based on the following formula: $PctUEIGHGRep_{i,t} = \sum_{j \in N} \frac{ContractValue_{i,j,t}}{ContractValue_{i,t}} \times PctGHGRep_{j,c,t}$, where i denote firm, j denotes contract, c denotes contracting officer, t denotes firm fiscal year. N is the set of all contracts that firm i received during fiscal year t. $PctGHGRep_{j,c,t}$ is the percentage of entities with the GHG representation in their most current representation on SAM.gov that the contract officer c for contract j is responsible for over the federal fiscal year. *Source: SAM.gov, USAspending.gov*
Control Variables	
Log(1+*Total Asset*)	The natural logarithm of one plus total asset in millions of dollars. *Source: Compustat*
Log(1+*Age*)	The natural logarithm of one plus the number of years since a firm was covered by Compustat for the first time. *Source: Compustat*
ROA	Net income divided by the average of the beginning and ending total assets. *Source: Compustat*
Leverage	Long-term debt plus debt in current liabilities, divided by total assets. *Source: Compustat*
AssetGrowth	The difference between ending total assets and beginning total assets divided by beginning total assets.

	Source: Compustat
Tangibility	Net property, plant and equipment divided by total assets. *Source: Compustat*
Log(1+*AnalystNum*)	The natural logarithm of one plus the number of analyst following. *Source: IBES*
Log(1+*InstNum*)	The natural logarithm of one plus the number of institutional investors. Source: Thomson 13F
Log(1+*SRIProposalN*)	The natural logarithm of one plus the number of social responsibility shareholder proposals. *Source: ISS*
GRIReporting	An indicator variable that takes the value of one if a firm's sustainability report is published in accordance with the GRI guidelines. *Source: Asset 4*
PriorGHGPubDiscl	An indicator variable that takes the value of one if Trucost reports obtaining a firm's emission data from public sources in the prior year. *Source: Trucost*
Other Variables	
GrossMargin	Sales minus costs of goods sold divided by sales. *Source: Compustat*
Log(Sale)	The natural logarithm of sales. *Source: Compustat*
Log(COGS)	The natural logarithm of costs of goods sold. *Source: Compustat*
Log(CAPEX)	The natural logarithm of capital expenditures. *Source: Compustat*
Log(CAPEX+R&D)	The natural logarithm of capital expenditures plus R&D expenditures. *Source: Compustat*

Appendix B: FAR 52.223-22: Public Disclosure of Greenhouse Gas Emissions and Reduction Goals-Representation

1. FAR 52.223-22

PUBLIC DISCLOSURE OF GREENHOUSE GAS EMISSIONS AND REDUCTION GOALS-REPRESENTATION (DEC 2016)

(a) This representation shall be completed if the Offeror received $7.5 million or more in Federal contract awards in the prior Federal fiscal year. The representation is optional if the Offeror received less than $7.5 million in Federal contract awards in the prior Federal fiscal year.

(b) *Representation. [Offeror is to check applicable blocks in paragraphs (1) and (2).]*

(1) The Offeror (itself or through its immediate owner or highest-level owner) □ does, □ does not publicly disclose greenhouse gas emissions, *i.e.*, make available on a publicly accessible website the results of a greenhouse gas inventory, performed in accordance with an accounting standard with publicly available and consistently applied criteria, such as the Greenhouse Gas Protocol Corporate Standard.

(2) The Offeror (itself or through its immediate owner or highest-level owner) □ does, □ does not publicly disclose a quantitative greenhouse gas emissions reduction goal, *i.e.*, make available on a publicly available website a target to reduce absolute emissions or emissions intensity by a specific quantity or percentage.

(3) A publicly accessible website includes the Offeror's own website or a recognized, third-party greenhouse gas emissions reporting program.

(c) If the Offeror checked "does" in paragraphs (b)(1) or (b)(2) of this provision, respectively, the Offeror shall provide the publicly accessible website(s) where greenhouse gas emissions and/or reduction goals are reported:_____.

Source: https://www.acquisition.gov/far/52.223-22

2. The process of making the FAR 52.223-22 representation on SAM.gov

Registered entities on SAM.gov are required to complete an electronic annual representation in the SAM system and update the representations as necessary or at least annually (FAR 4.12). After December 19, 2016, all entities bidding for government contracts were required to answer a two-part question list related to FAR 52.223-22. Figure [1] provides a diagrammatic illustration.

The first part is described in FAR 52.223-22(a). Answering this question is *mandatory* for all entities registered on SAM.gov. This question states that an entity must check a box on whether it either received $7.5 million or more in federal contracts during the previous federal fiscal year or received less than $7.5 million but still wants to publicly disclose greenhouse gas emissions and reduction goals. If an entity checks "Yes" to this question, it will be prompted to answer (as a mandatory requirement to complete the representation process) two or three follow-up questions as described below. Therefore, we consider an entity that selects "Yes" ("No") to FAR 52.223-22(a) as having made (did not make) the GHG representation.

The second part involves two follow-up questions stated in FAR 52.223-22(b): whether the entity itself or through its immediate owner or highest-level owner, publicly discloses GHG emissions (FAR 52.223-22(b1)) or emission reduction goals (FAR 52.223-22(b2)). If an entity

answers “Yes” to either question, SAM.gov further requires the entity to provide an available URL of their public disclosure of emissions or reduction goals under FAR 52.223-22(c). We consider these entities to have provided the location of their public disclosure of emissions and/or reduction goals.

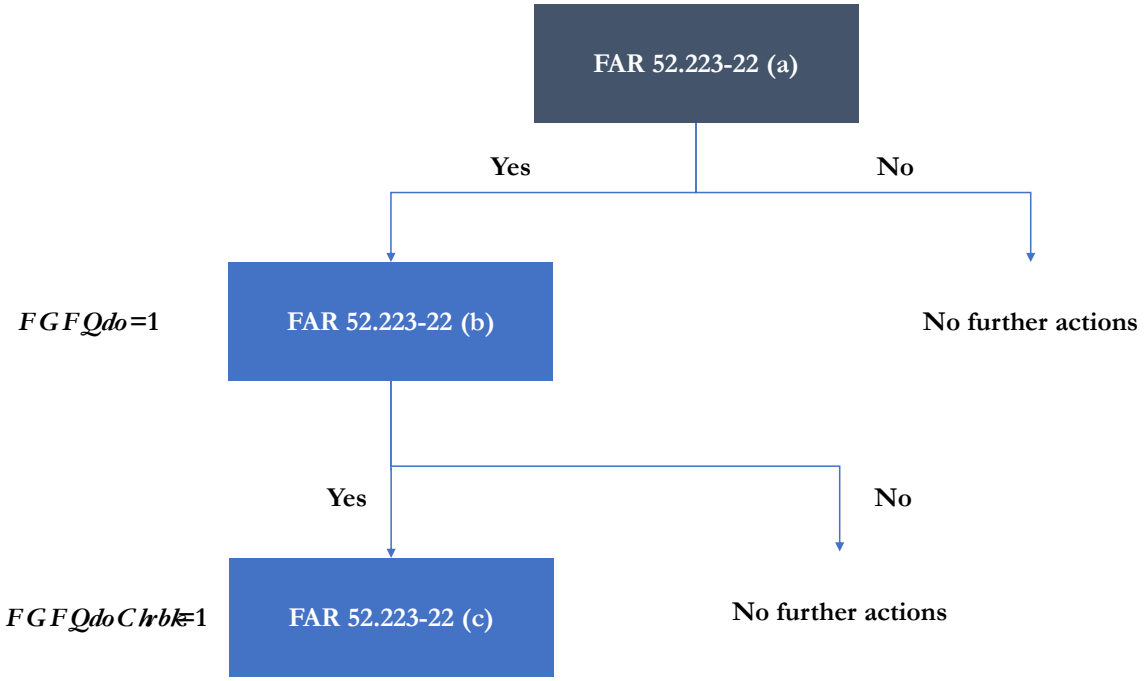

Figure 1: A diagrammatic illustration of the process for making the GHG representation (FAR 52.223-22) on SAM.gov

Appendix C: Collecting Information on GHG Representation from SAM.gov

We collect data on GHG representation from The System for Award Management (SAM.gov) for the 390 unique Compustat firms in the main sample. SAM.gov is an official website of the U.S. Government that processes and stores entity registration information for any entities that wish to do business with the U.S. federal government. Since 2012, SAM.gov has been the single website for users (contracting officials, contractors, and the public) to access relevant information in the federal procurement process from start to finish.

It is important to note that SAM.gov defines a unique entity based on "a separate legal entity associated with a separate physical address" and subsequently assigns it a unique entity identifier (UEI).[22] Consequently, many firms contract with federal agencies under multiple UEIs. For example, each firm in our sample has, on average, 13 UEIs between federal years 2012 and 2021. In this document, we use the terms "company," "firm," and "supplier" interchangeably to refer to a unique Compustat GVKEY and use "entity" to refer to a unique UEI.

From SAM.gov, we collect the following information for all GHG representations made by entities between 2016 and October 2023, which is the date of the collection.

1. The submission date of the GHG representation
2. Whether a UEI makes GHG representation by checking "Yes" under FAR 52.223-22(a)
3. Whether a UEI indicates that it has public disclosure of GHG emissions and reduction goals under FAR 52.223-22(b1) and FAR 52.223-22(b2)
4. The website location of public disclosures of GHG emissions and / or reduction goals provided by the entity under FAR 52.223-22(c), if any

Because manually collecting all current and historical GHG representations made by the entities in our sample entails a time-consuming process, we proceed in the following two steps.

First, we sample up to four UEIs for each firm to conduct manual data collection. We have 3,558 UEIs for firms in our sample with contract awards from federal years 2017 to 2021. For each firm, we select 1) the UEI with the highest contract value (as we wish to identify the main entity that the firm conducts business with the federal government) as well as 2) up to three other randomly selected UEIs, if available. This procedure yields 598 UEIs. With the help of our research assistants, we collect the current and all historical GHG representations made after 2016 for [590] UEIs. The remaining UEIs do not have any registration information on SAM.gov. We aggregate individual representations to the UEI-federal year level. This yields a sample of 2,545 UEI-federal year observations. From this manual collection process, we verify an important feature of the GHG representation: once an entity starts making the GHG representation, it will continue doing so in subsequent years. In fact, only 8 (0.31%) of the sample stopped making the GHG representation at a later year. Based on this observation, we proceed to the second step.

Next, we use the SAM.gov Get Opportunities public API to query the most recent representation made by all remaining UEIs in our sample and successfully obtain records for 1,357 UEIs. If the query results suggest that the entity has made the GHG representation in the current period, we instruct our research assistants to collect all historical representations to determine the precise time the entity starts to represent.

[22] https://www.gsa.gov/system/files/To_Publish_-_FAQs_from_Unique_Entity_ID_Forum.pdf

We construct the following variables based on the collected information on GHG representation. *GHGRep* equals one if any of a firm's UEIs made the GHG representation in a given year, and zero otherwise. Next, we determine if the GHG representation made by a UEI is mandatory or voluntary in nature. We estimate the total contract value for each UEI in a given federal year by summing up the value of all contract awards. A UEI is considered to make a mandatory GHG representation if its total contract value in the previous federal fiscal year before the representation submission date is $7.5 million or more, and voluntary otherwise. At the firm-year level, *GHGRep(Mandatory)* indicates if any of a firm's UEI provides a mandatory GHG representation. In addition, we exploit variations in the content of the information provided by firms conditioning on having made the GHG representations: a UEI could either state "Yes" or "No" when asked about whether it, through itself or its immediate owner or highest-level owner, disclose GHG emission information and/or reduction goals (FAR 52.223-22(b). *GHGRepDiscl* is an indicator variable that takes the value of one if a firm, through any of its UEIs, has provided a link to its public disclosure of emissions or reduction goals. Finally, we examine the quality of the information provided, conditioning on having provided website links. The system on SAM.gov is designed such that all UEIs will have to enter non-missing information on a website link should they have entered "Yes" in the previous question (i.e., FAR 52.223-22(b)). However, the system is not able to verify whether the website link provided is a valid and accessible web address. In order to verify if a link provided by the firm is valid at the point when the representation was made, we use the Wayback machine to determine whether the link was accessible in the past year before the representation date (*GHGLinkDisclValid*).

Appendix D: Contracting Officer Identity

We use the email addresses of the officer who approved a federal contract to identify the individual CO responsible for overseeing the contract (Spenkuch et al., 2023), and thus, likely to process the supplier's GHG information.

First, we download information on who approved the contract on SAM.gov. The approval field usually indicates an email address of the approving contracting officer who is responsible for overseeing the contract. We also have information on who prepared the contract. In 88% of cases, the preparing officer and the approving officer of a contract are identical. We merge it with the initial universe of contracts from USAspending.gov. Matching is based on contract award identifier, modification number, parent award identifier, and transaction number. This results in a match of 43,778,071 unique contracts (representing a 93% match rate) and 63,704 unique email addresses.

Similar to Spenkuch et al. (2023), not all email addresses can reasonably indicate the individual contracting officer. This happens when 1) the email address indicates a generic code representing a sub-agency (e.g., ebs.sysadmin.dla.mil) or 2) the email address lists a system email that cannot be traced back to an individual (e.g., 00.f.systemadmin@gsa.gov). To remove these anonymous email addresses, we require an email address to contain an "@" and a name can be found in the top 5000 most prevalent first names or last names according to the U.S. Census website and the Social Security Account. We obtain these common names from https://www.census.gov/topics/population/genealogy/data.html and https://www.ssa.gov/oact/babynames/limits.html.

From this procedure, we identified 47,629 individual officers who handled 9,636,339 contracts for 256,749 unique entities. In our sample, we successfully identified an individual contracting officer for 8.5% of Department of Defense (DoD) contracts versus 30% of non-DoD contracts. The matching rate is similar to Spenkuch et al. (2023), which used a slightly different sample. They identified the personal data of 32% of non-DoD services and works (excluding R&D) contracts from 2014 to 2019. As noted in Spenkuch et al. (2023), the percentage of contracts awarded by DoD with information on individual contracting officers is smaller than that of other federal agencies.

Using information on the identity of contracting officers, we compute two measures relating to their costs for processing suppliers' GHG emissions. First, we calculate the number of unique entities (i.e., UEIs) that each CO is responsible for within a given federal year as a measure of the CO's capacity constraints (*NUEICO*). Second, we estimate the extent to which the GHG representation helps a CO to compare GHG emissions among suppliers that he/she manages. Specifically, we calculate the percentage of UEIs with the GHG representation, out of all UEIs with API extraction records that a CO manages in a given year (*PctUEIGHGRep*). To calculate this measure, we gather the most current GHG representation for the near universe of UEIs on SAM.gov using the Get Opportunities API. Our procedure gathered the information for 182,091 UEIs, representing 70.9% of the 256,749 UEIs handled by COs identified in our sample. Because of data constraints (i.e., we do not observe historical representations), we made the simplifying assumption to define GHG representation at the UEI level based on the current representation.

Appendix E: Processing of Existing Information versus New Information

Since we have information on the actual representation made by suppliers, we investigate whether there is a change in the existence and the content of disclosure using the actual website location stated in the GHG representation.

Out of the 117 firms that provided the website locations of GHG public disclosure, we searched on the Wayback Machine for two archived versions of the website to make comparisons. As Wayback does not archive websites every day, we require a valid archive within the 90-day period prior to the representation date. This archived website (i.e., base archive) approximates the content of the GHG public disclosure when the representation was made. For 66 firms, we are able to identify a base archive. We then analyze whether there was a change in disclosure content for these 66 firms around the first time they made the GHG representation.

1. Existence

To verify whether the website location for these firms existed before the GHG representation, we try to find a prior archive of the website on Wayback that is between 180 days to 2 years prior to the date of the base archive (i.e., prior archive). For 65 firms (65/66 = 98.5%) of the firms, we are able to identify a prior archive successfully. These results suggest that for over 95% of the firms, the GHG public disclosure they provided in the GHG representation existed at least 180 days prior to making the representation. If we further restrict the criteria and require a prior version of the website to be at least 360 days before the date of the base archive, we are able to identify 54 firms (54/65 = 83.1%). These results suggest that it is unlikely firms started to provide GHG representations in response to the GHG representation.

2. Similarity

For the 65 firms with a prior version, we compute the cosine similarity of the two websites. The median (mean) score is 0.94 (0.83), consistent with little change in the content of the website.

This analysis provides suggestive evidence that there has been little change in the availability or the content of GHG public disclosure as firms started to provide GHG representation. It provides support that the GHG representation likely did not change the total amount of information available but the awareness, acquisition, and integration costs for processing this existing information.

3. Caveat

There are two caveats in this analysis. First, this analysis is limited to the 66 firms with a base archive on the Wayback Machine since the Wayback Machine does not store archives on a regular basis. For the remaining 51 firms without a base archive, this limitation restricts our ability to examine the change in the availability or the content of their GHG public disclosures. Second, in the content analysis, we are only able to compare the root domain of a website. This is because we had difficulty accessing most of the sub-domains of the website on the Wayback Machine since many of these sub-domains do not accessible historical archives. Therefore, we caution readers that we cannot fully tease out the new disclosure channel due to the inherent difficulty in measuring GHG disclosure.

Table 1: Contract-level Descriptive Statistics

This table presents the descriptive statistics of contract-level variables for U.S. federal government contract awards for firms in our sample from federal fiscal years 2012 to 2021 (i.e., October 1, 2011 to September 30, 2021). The table presents the total number of contracts (*ContractN*), the total value of contract awards (*ContractValue* in millions), the average value of contract awards (*AvgContractValue*), the average contract duration (*Duration* in days), the average number of offers per contract award (*OfferN*), the percentage of contracts that only receive one bid (*SingleOffer*).

Federal Fiscal Year	*ContractN*	*ContractValue*($M)	*AvgContractValue*($)	*Duration*(Days)	*OfferN*	*SingleBid*(%)
2012	399,973	20,410	51,030	329	64	34%
2013	361,083	19,431	53,814	298	9	35%
2014	383,658	20,270	52,836	284	9	33%
2015	1,122,153	21,334	19,012	107	11	17%
2016	1,298,028	21,575	16,621	93	8	18%
2017	1,362,313	22,553	16,555	105	7	18%
2018	1,459,403	23,661	16,213	97	18	7%
2019	1,468,170	23,387	15,930	97	48	6%
2020	1,361,293	21,685	15,930	161	26	6%
2021	1,262,392	18,079	14,321	146	48	5%
Total	10,478,466	212,388	20,269	136	16	13%

Table 2 Firm-year-level Descriptive Statistics

Panel A: Yearly Distribution of GHG Representation

This panel yearly distributions of the percentage of firms making the GHG representation. *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. *FirstGHGRep* indicates whether a firm makes the GHG representation for the first time. *FirstGHGRep(Mandatory)* indicates whether a firm makes the GHG representation as a mandatory requirement for the first time. *GHGRepDiscl* indicates whether a firm states that it has public disclosure of GHG emissions or reduction goals in the GHG representation. *GHGRepDisclValid* indicates whether a firm provides a valid link to its public disclosure of GHG emissions or reduction goals in the GHG representation.

Year	N	*GHGRep*(%)	*GHGRep(Mandatory)*(%)	*FirstGHGRep*(%)	*FirstGHGRep(Mandatory)*(%)	*GHGRepDiscl*(%)	*GHGRepDisclValid*(%)
2013	226	0	0	0	0	0	0
2014	272	0	0	0	0	0	0
2015	296	0	0	0	0	0	0
2016	317	0.9%	0.6%	0.9%	0.6%	0.6%	0.6%
2017	306	22.2%	14.1%	21.2%	13.4%	17.3%	13.7%
2018	309	25.2%	15.5%	4.2%	2.6%	20.7%	16.8%
2019	284	27.8%	16.5%	2.5%	2.1%	23.6%	18.3%
2020	36	38.9%	27.8%	8.3%	11.1%	30.6%	25.0%
Total	2046	11.8%	7.3%	4.4%	3.0%	9.6%	7.7%

Panel B: Descriptive Statistics on Firm Characteristics
This panel presents the descriptive statistics of firm characteristics in our main firm-year sample. All variables are defined in Appendix A.

	N	Mean	StdDev	P25	Median	P75
Measures of Emission						
Log(*GHGEmission*)	2046	12.777	2.205	11.148	12.551	14.098
Log(*GHGEmission/Sale*)	2046	4.062	2.820	3.711	5.042	1.824
Log(*GHGEmission/COGS*)	2046	4.741	3.706	4.460	5.591	1.752
Log(*GHGScope1Emission*)	2043	11.781	9.763	11.489	13.322	2.669
Log(*GHGScope2Emission*)	2044	11.548	10.299	11.487	12.891	1.799
Log(*GHGScope3UEmission*)	2046	13.472	12.290	13.526	14.644	1.646
Measures of the GHG Rep						
GHGRep	2046	0.118	0.323	0.000	0.000	0.000
Mandatory	2046	0.159	0.000	0.000	0.000	0.366
GHGRep(Mandatory)	2046	0.073	0.261	0.000	0.000	0.000
GHGRep(Voluntary)	2046	0.045	0.000	0.000	0.000	0.207
NoGHGRep(Mandatory)	2046	0.086	0.000	0.000	0.000	0.280
GHGRepDiscl	2046	0.096	0.295	0.000	0.000	0.000
GHGRepDisclValid	2046	0.077	0.266	0.000	0.000	0.000
FirstGHGRep	2046	0.044	0.206	0.000	0.000	0.000
FirstGHGRep(Mandatory)	2046	0.030	0.170	0.000	0.000	0.000
Measures of Federal Contracts						
GovContractValue	2046	231.837	0.303	3.689	35.139	991.236
GovContractValue/Sales	2046	0.016	0.061	0.000	0.001	0.005
GovContractN	2046	1442.971	10.000	56.000	395.000	4562.299
SingleBid	2046	0.531	0.123	0.559	0.958	0.385
Variability	2040	0.004	0.000	0.000	0.002	0.012
MajorGovCustomer	2046	0.095	0.000	0.000	0.000	0.293
NCOUEI	1284	43.052	9.000	26.304	58.946	50.399
PctUEIGHGRep	1284	0.113	0.035	0.092	0.154	0.102
Other Control Variables						
Log(*Assets*)	2046	9.249	1.527	8.201	9.038	10.222
Log(1+*Age*)	2046	2.845	0.212	2.773	2.890	2.996
ROA	2046	0.054	0.072	0.023	0.048	0.087
Leverage	2046	0.304	0.179	0.180	0.291	0.395
AssetGrowth	2046	0.072	0.201	-0.013	0.044	0.106
Tangibility	2046	0.265	0.250	0.076	0.163	0.402
Log(1+*AnalystN*)	2046	2.224	0.815	1.946	2.435	2.757
Log(1+*InstN*)	2046	6.069	1.037	5.677	6.145	6.625
Log(1+*SRIProposalsN*)	2046	0.229	0.418	0.000	0.000	0.693
GRIReport	2046	0.378	0.485	0.000	0.000	1.000
PriorGHGPubDis	2046	0.517	0.500	0.000	1.000	1.000
Other Variables						
GrossMargin	2046	1.555	0.372	0.614	1.407	2.720
Log(*Sale*)	2046	8.724	7.771	8.583	9.600	1.399
Log(*COGS*)	2046	8.028	6.956	7.995	9.059	1.613
Log(*CAPEX*)	2000	5.573	4.408	5.440	6.729	1.660
Log(*CAPEX*+*R&D*)	2000	5.574	4.408	5.441	6.729	1.657

Table 3: The Effect of the GHG Representation on Suppliers' GHG Emissions

Panel A: Main Results

This panel analyzes the effect of the GHG representation on suppliers' emissions. It estimates Equation (1) using OLS:

$Log(GHGEmission)_{i,t} = \beta_0 + \beta_1 GHGRep_{i,t}$ *or* $GHGRep(Mandatory)_{i,t} + Controls + Firm\ FE + Year\ FE + \varepsilon_{i,t}$

GHGEmission is the sum of Scopes 1 and 2 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent). *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	Log(*GHGEmission*)			
	(1)	(2)	(3)	(4)
GHGRep	**-0.132****	**-0.138*****		
	(-2.349)	**(-2.800)**		
GHGRep(Mandatory)			**-0.130****	**-0.148*****
			(-2.148)	**(-2.801)**
GovContractValue/Sale		-0.372		-0.402
		(-1.085)		(-1.202)
Log(*Assets*)		0.694***		0.696***
		(9.074)		(9.111)
Log(1+*Age*)		-0.323		-0.304
		(-0.949)		(-0.920)
ROA		0.369*		0.395**
		(1.934)		(2.062)
Leverage		0.314*		0.324*
		(1.709)		(1.754)
AssetGrowth		-0.249***		-0.253***
		(-6.104)		(-6.231)
Tangibility		-0.067		-0.029
		(-0.196)		(-0.083)
Log(1+*AnalystN*)		-0.020		-0.028
		(-0.388)		(-0.548)
Log(1+*InstN*)		0.029		0.032
		(0.452)		(0.502)
Log(1+*SRIProposalsN*)		-0.028		-0.031
		(-0.696)		(-0.787)
GRIReport		-0.016		-0.017
		(-0.288)		(-0.309)
PriorGHGPubDis		-0.043		-0.044
		(-0.714)		(-0.740)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	2046	2046	2046	2046
Adjusted R-squared	0.974	0.977	0.974	0.977

Panel B Robustness Checks

This panel estimates Equation (1) using alternative model specifications and alternative transformations of GHG emissions. Columns 1 and 2 estimate Poisson pseudo maximum likelihood regressions using decile-ranked combined scopes 1 and 2 emissions as the dependent variables. Columns 3 and 4 (5 and 6) report the OLS regression results using the natural logarithm of combined scopes 1 and 2 emission intensity, scaled by sales (costs of goods sold) as the dependent variables. *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	*GHGEmission* DecileRank		Log(*GHGEmission /Sale*)		Log(*GHGEmission /COGS*)	
	(1)	(2)	(3)	(4)	(5)	(6)
GHGRep	**-0.039*** **		**-0.138*** **		**-0.119** **	
	(-2.853)		**(-2.813)**		**(-2.271)**	
GHGRep(Mandatory)		**-0.029** **		**-0.150*** **		**-0.127** **
		(-2.092)		**(-2.783)**		**(-2.341)**
GovContractValue/Sale	-0.112	-0.140	0.134	0.109	0.133	0.106
	(-0.732)	(-0.931)	(0.371)	(0.297)	(0.322)	(0.253)
Log(*Assets*)	0.203***	0.201***	0.040	0.043	0.148**	0.150**
	(7.970)	(7.779)	(0.653)	(0.690)	(1.981)	(2.011)
Log(1+*Age*)	-0.002	0.008	-0.121	-0.103	-0.062	-0.047
	(-0.018)	(0.079)	(-0.416)	(-0.361)	(-0.263)	(-0.203)
ROA	0.104	0.113	-0.239	-0.213	0.247	0.269
	(1.342)	(1.456)	(-1.559)	(-1.387)	(1.013)	(1.102)
Leverage	0.101	0.103*	0.280	0.291	0.248	0.256
	(1.632)	(1.653)	(1.572)	(1.616)	(1.323)	(1.359)
AssetGrowth	-0.083***	-0.084***	-0.009	-0.014	-0.052	-0.056
	(-4.829)	(-4.866)	(-0.250)	(-0.377)	(-1.152)	(-1.247)
Tangibility	-0.049	-0.037	0.132	0.170	0.218	0.251
	(-0.550)	(-0.415)	(0.569)	(0.733)	(0.733)	(0.843)
Log(1+*AnalystN*)	-0.010	-0.012	-0.014	-0.022	-0.033	-0.039
	(-0.636)	(-0.780)	(-0.328)	(-0.505)	(-0.642)	(-0.776)
Log(1+*InstN*)	0.022	0.023	-0.021	-0.018	0.004	0.006
	(1.001)	(1.036)	(-0.465)	(-0.400)	(0.061)	(0.103)
Log(1+*SRIProposalsN*)	-0.009	-0.009	-0.037	-0.041	-0.052	-0.055
	(-1.202)	(-1.287)	(-1.232)	(-1.348)	(-1.117)	(-1.184)
GRIReport	0.005	0.005	-0.006	-0.007	-0.031	-0.032
	(0.420)	(0.409)	(-0.126)	(-0.152)	(-0.565)	(-0.584)
PriorGHGPubDis	-0.010	-0.011	-0.043	-0.044	-0.015	-0.016
	(-0.730)	(-0.810)	(-0.830)	(-0.859)	(-0.256)	(-0.277)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2046	2046	2046	2046	2046	2046
Pseudo (Adjusted) R-squared	0.319	0.319	0.974	0.974	0.961	0.961

Table 4: Addressing Endogeneity Concerns

Panel A: *Mandatory* as an Instrumental Variable

This panel analyzes the effect of the GHG representation on suppliers' emissions using an instrumental variable approach and presents 2SLS coefficient estimates. Columns 1 and 2 present the first stage of estimating Equation 2(a). Columns 3 and 4 report the second stage of estimating Equation 2(b). In the first stage, *GHGRep* and *GHGRep(Mandatory)* are the dependent variables. *GHGRep* takes the value of one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. *Mandatory* serves as the instrument that captures (exogenous) variations in *GHGRep*. It takes the value of one if any of a firm's UEIs received over $ 7.5 million in total contract values in the prior federal fiscal year before its current GHG representation submission date, and zero otherwise. In the second stage, the dependent variable, *GHGEmission*, is the sum of Scopes 1 and 2 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent). *PredictedGHGRep* (*PredictedGHGRep(Mandatory)*) is the predicted value of *GHGRep* (*GHGRep(Mandatory)*) from the first stage. Control variables are defined in Equation (1). Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	*GHGRep*	*GHGRep(Mandatory)*	Log(*GHGEmission*)	
	(1)	(2)	(3)	(4)
Mandatory	0.369***	0.439***		
	(8.053)	(9.974)		
PredictedGHGRep			-0.367**	
			(-2.164)	
PredictedGHGRep(Mandatory)				-0.309**
				(-2.164)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	2046	2046	2046	2046
Adjusted R-squared	0.569	0.582	0.977	0.977

Panel B: Emission Outcomes of Voluntary GHG Representations and Failure to Make the GHG Representation Despite Mandatory Requirements

This panel investigates the emission outcomes among firms who voluntarily make the GHG representation and firms who do not make the GHG representation despite being subject to the mandatory requirement. It modifies estimates Equation (1) with the separate indicator variables for 1) firms who make the GHG representation as a mandatory requirement (*GHGRep(Mandatory)*), 2) firms who make the GHG representation voluntarily (*GHGRep(Voluntary)*), and 3) firms who do not make the GHG representation despite having an entity exceeding the mandatory threshold of $ 7.5 million (*NoGHGRep(Mandatory)*). *GHGEmission* is the sum of Scopes 1 and 2 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent). Control variables are defined in Equation (1). Firm and year-fixed effects are included. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	Log(*GHGEmission*)
	(1)
GHGRep(Mandatory)	-0.193***
	(-3.247)
GHGRep(Voluntary)	-0.090
	(-1.588)
NoGHGRep(Mandatory)	-0.101
	(-1.155)
Controls	Yes
Firm FE	Yes
Year FE	Yes
N	2046
Adjusted R-squared	0.977

Panel C: Coefficient Dynamics

This panel investigates the effect of the GHG representation on suppliers' emissions over time. It modifies Equation (1) by replacing *GHGRep* or *GHGRep(Mandatory)* with indicators for the two years before (*Pre2 and Pre1*), during (*Post0*), and two years after (*Post1 and Post 2*) the first year a firm makes the (mandatory) GHG representation (i.e., first treatment). In Column (1), a firm's first treatment is defined based on the first year that it makes the GHG representation (*FirstGHGRep*). In Column (1), a firm's first treatment is defined based on the first year that it makes the mandatory GHG representation (*FirstGHGRep(Mandatory)*). *GHGEmission* is the sum of Scopes 1 and 2 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent). Control variables are defined in Equation (1). Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	Log(*GHGEmission*)	
First treatment defined by	*FirstGHGRep*	*FirstGHGRep(Mandatory)*
	(1)	(2)
Pre2	0.028	0.005
	(0.796)	(0.150)
Pre1	0.034	-0.010
	(0.775)	(-0.231)
Post0	-0.080*	-0.173***
	(-1.650)	(-3.453)
Post1	-0.133**	-0.165***
	(-2.103)	(-2.602)
Post2	-0.142**	-0.185***
	(-2.036)	(-2.842)
Controls	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
N	2046	2046
Adjusted R-squared	0.977	0.977

Panel D: Entropy Balancing Matching

This panel estimates Equation (1) using an entropy-balancing matched sample. Specifically, we use entropy balancing to reweight firms without the (mandatory) GHG representation based on variables that likely affect the decision of (mandatory) GHG representation, including contract value, firm size, institutional ownership, shareholder proposals, GRI reporting, and prior public GHG disclosure. *GHGEmission* is the sum of Scopes 1 and 2 Greenhouse Gas emissions (in tonnes of carbon dioxide equivalent). *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. Controls are all control variables included in Equation (1). Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	Log(*GHGEmission*)	
	(1)	(2)
GHGRep	-0.116**	
	(-2.232)	
GHGRep(Mandatory)		-0.108*
		(-1.755)
Controls	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
N	2046	2046
Adjusted R-squared	0.980	0.983

Table 5: Cross-Sectional Analyses Based on Suppliers' Economic Incentives

Panel A: Reliance on Government Contracts

This panel investigates how economic reliance on government contracts affects suppliers' emission reductions after making the GHG representation. It modifies Equation (1) by partitioning *GHGRep* into 1) firms with high reliance on government contracts (*GHGRep-HighReliance or GHGRep(Mandatory)-HighReliance*) and 2) firms with low reliance on government contracts (*GHGRep-LowReliance or GHGRep(Mandatory)-LowReliance*). In columns 1 and 2, *HighReliance* is proxied by *HighContractValue/Sale*, which indicates if a firm's government contract value accounts for a higher percentage of total sales than the sample median. In columns 3 and 4, *HighReliance* is proxied by *MajorGovCustomer*, which indicates if a firm discloses the federal government as a major customer in corporate communications. *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. Controls are all control variables included in Equation (1). Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	Log(*GHGEmission*)			
HighReliance =	*HighGovContractValue/Sale*		*MajorGovCustomer*	
	(1)	(2)	(3)	(4)
[1] *GHGRep-HighReliance*	-0.159***		-0.238***	
	(-3.043)		(-4.283)	
[2] *GHGRep-LowReliance*	-0.075		-0.116**	
	(-1.033)		(-2.202)	
[1] *GHGRep(Mandatory)-HighReliance*		-0.166***		-0.258***
		(-3.027)		(-4.453)
[2] *GHGRep(Mandatory)-LowReliance*		0.047		-0.112*
		(1.026)		(-1.885)
(2-tailed) p-value: [1]=[2]	*0.243*	*0.000*	*0.019*	*0.025*
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	2046	2046	2046	2046
Adjusted R-squared	0.977	0.977	0.977	0.977

Panel B: Uncertainty in Government Contracts

This panel investigates whether uncertainty in receiving future federal contracts affects suppliers' emission reductions after making the GHG representation. It modifies Equation (1) by partitioning *GHGRep* into 1) firms with high uncertainty in receiving future contracts (*GHGRep-HighUncertainty or GHGRep(Mandatory)-HighUncertainty*) and 2) firms with low uncertainty (*GHGRep-LowUncertainty or GHGRep(Mandatory)-LowUncertainty*). In columns 1 and 2, *HighUncertainty* is proxied by *LowSingleBid*, which indicates if less than 50% of a firm's contract value in a given year are single offer bids. In columns 3 and 4, *HighUncertainty* is proxied by *HighVariablity*, which indicates if a firm's contract variability, defined as the standard deviation of the contract value as a percentage of sales over the past five years, is in the highest quartile of the sample. *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. Controls are all control variables included in Equation (1). Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	Log(*GHGEmission*)			
HighUncertainty =	*LowSingleBid*		*HighVariability*	
	(1)	(2)	(3)	(4)
[1] *GHGRep-HighUncertainty*	-0.165***		-0.214***	
	(-2.810)		(-3.090)	
[2] *GHGRep-LowUncertainty*	-0.087**		-0.098*	
	(-1.982)		(-1.918)	
[1] *GHGRep(Mandatory)-HighUncertainty*		-0.171***		-0.196***
		(-2.744)		(-2.738)
[2] *GHGRep(Mandatory)-LowUncertainty*		-0.077		-0.106*
		(-1.523)		(-1.954)
(2-tailed) p-value: [1]=[2]	*0.099*	*0.157*	*0.080*	*0.194*
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	2046	2046	2046	2046
Adjusted R-squared	0.977	0.977	0.977	0.977

Table 6: Cross-Sectional Analyses Based on Contracting Officers' Information Processing
Panel A: The Information Content of the GHG Representation

This panel investigates how the usefulness of the information in the GHG representation affects suppliers' emission reductions after making the GHG representation. It modifies Equation (1) by partitioning *GHGRep* into 1) firms with more useful information in the GHG representation (*GHGRep-HighUseful or GHGRep(Mandatory)-HighUseful*) and 2) firms with less useful information (*GHGRep-LowUseful or GHGRep(Mandatory)-LowUseful*). In columns 1 and 2, *HighUseful* is proxied by *GHGRepDiscl*, which indicates whether a firm indicates that it has GHG disclosure in the representation. In columns 3 and 4, *HighUseful* is proxied by *GHGRepDisclValid*, which indicates if a firm provides accessible website links to its GHG disclosure in the representation. *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. Controls are all control variables included in Equation (1). Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	Log(*GHGEmission*)			
HighUseful =	*GHGRepDiscl*		*GHGRepDisclValid*	
	(1)	(2)	(3)	(4)
[1] *GHGRep-HighUseful*	-0.161***		-0.177***	
	(-2.998)		(-3.327)	
[2] *GHGRep-LowUseful*	-0.034		-0.071	
	(-0.483)		(-1.141)	
[1] *GHGRep(Mandatory)-HighUseful*		-0.159***		-0.184***
		(-2.884)		(-3.199)
[2] *GHGRep(Mandatory)-LowUseful*		-0.056		-0.061
		(-0.435)		(-0.857)
(2-tailed) p-value: [1]=[2]	*0.091*	*0.444*	*0.074*	*0.093*
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	2046	2046	2046	2046
Adjusted R-squared	0.977	0.977	0.977	0.977

Panel B: Contracting Officers' Information Processing

This panel investigates how contracting officers' information processing ability affects suppliers' emission reductions after making the GHG representation. It modifies Equation (1) by partitioning *GHGRep* into 1) firms having contracting officers with high processing ability (*GHGRep-HighProcessing or GHGRep(Mandatory)-HighProcessing*) and 2) firms having contracting officers with low processing ability (*GHGRep-LowProcessing or GHGRep(Mandatory)-LowProcessing*). In columns 1 and 2, *HighCOProcessing* is proxied by *LowNUEICO*, which indicates if a firm's contracting officers manage fewer UEIs in a year than the sample median. In columns 3 and 4, *HighProcessing* is proxied by *HighPctUEIGHGRep*, which indicates if a firm's contracting officers have a higher percentage of UEIs in its portfolio making the GHG representation. *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. Controls are all control variables included in Equation (1). Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	Log(*GHGEmission*)			
HighCOProcessing=	*LowNUEICO*		*HighPctUEIGHGRep*	
	(1)	(2)	(3)	(4)
[1] *GHGRep-HighCOProcessing*	-0.209***		-0.155***	
	(-3.828)		(-3.148)	
[2] *GHGRep-LowCOProcessing*	-0.067		-0.134**	
	(-1.258)		(-2.014)	
[1] *GHGRep(Mandatory)-HighCOProcessing*		-0.200***		-0.214***
		(-3.724)		(-4.303)
[2] *GHGRep(Mandatory)-LowCOProcessing*		-0.096**		-0.082
		(-2.005)		(-1.271)
(2-tailed) p-value: [1]=[2]	*0.028*	*0.046*	*0.775*	*0.047*
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	1284	1284	1284	1284
Adjusted R-squared	0.979	0.979	0.979	0.979

Table 7: Emission Reduction Channels

This panel investigates suppliers' emission reduction channels. We replace *Log(GHGEmission)* in Equation (1) with the log-transformed Scope 1 emissions (*Log(GHGScope1Emission)*), Scope 2 emissions (*Log(GHGScope2Emission)*), and Scope 3 upstream emissions (*Log(GHGScope3UEmission)*). *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. Controls are all control variables included in Equation (1). Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	Log(*GHGScope1 Emission*)		Log(*GHGScope2 Emission*)		Log(*GHGScope3 UEmission*)	
	(1)	(2)	(3)	(4)	(5)	(6)
GHGRep	-0.080		-0.129**		0.010	
	(-1.147)		(-2.051)		(0.377)	
GHGRep(Mandatory)		-0.093		-0.127*		0.022
		(-1.463)		(-1.859)		(0.839)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	2043	2043	2044	2044	2046	2046
Adjusted R-squared	0.971	0.971	0.946	0.946	0.986	0.986

Table 8: The Effect of the GHG Representation on Suppliers' Financial Performance

This panel examines the effect of the GHG representation on suppliers' financial performance, including *ROA*, gross margin (*GrossMargin*), sales (*Log(Sales)*), costs of goods sold (*Log(COGS)*), capital expenditures (*Log(CAPEX)*), capital and R&D expenditures (*Log(CAPEX+R&D)*). *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. Controls are all control variables included in Equation (1) except *ROA*. Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	*ROA*		*GrossMargin*		*Log(Sale)*		*Log(COGS)*		*Log(CAPEX)*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GHGRep	-0.006		-0.008		-0.024		-0.035		0.009	
	(-1.278)		(-0.063)		(-1.602)		(-1.416)		(0.256)	
GHGRep(Mandatory)		0.001		0.087		-0.016		-0.036*		0.052
		(0.267)		(1.452)		(-1.103)		(-1.754)		(1.489)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2046	2046	2046	2046	2046	2046	2046	2046	2000	2000
Adjusted R-squared	0.624	0.623	0.919	0.919	0.994	0.994	0.989	0.989	0.966	0.966

Table 9: GHG Representation and Suppliers' Future Government Contracts

This panel investigates the effect of the GHG representation on federal suppliers' future government contracts. *FutureGovContract* equals one if a supplier's total federal contract value in the next fiscal year is positive, and zero otherwise. *FutureGovContractValue/Sale* equals the percentage of total government contract value divided by sales in the next year. *LogFutureGovContractN* is the natural logarithm of the number of government contracts in the next year. *GHGRep* equals one if any of a firm's UEIs makes the GHG representation in a given year, and zero otherwise. *GHGRep(Mandatory)* equals one if any of a firm's UEIs provides a mandatory GHG representation, and zero otherwise. Controls are all control variables included in Equation (1) except *ROA*. Firm and year-fixed effects are included in all columns. Standard errors are clustered at the firm level. All variables are defined in Appendix A. t-statistics are reported in parentheses. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels (two-tailed).

Dependent Variable =	*FutureGov Contract*		*FutureGov ContractValue/Sale*		Log(*FutureGov ContractN*)	
	(1)	(2)	(3)	(4)	(5)	(6)
GHGRep	0.064***		0.003		0.157*	
	(2.685)		(1.597)		(1.816)	
GHGRep(Mandatory)		0.031		0.004*		0.207**
		(1.583)		(1.676)		(2.456)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2046	2046	1927	1927	1927	1927
Adjusted R-squared	0.254	0.251	0.943	0.943	0.949	0.949