Supply Chain Greenhouse Gas Management Strategy for Ford Motor Company

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ABSTRACT

The processing of raw materials and the manufacturing of components for the automotive supply chain results in significant life cycle energy consumption and greenhouse gas (GHG) emissions. As a result, automobile manufacturers face potential financial risks from their supply chain operations in the form of energy price volatility and regulatory actions to curb climate change. To understand and address this challenge, Ford Motor Company (Ford) and the University of Michigan School of Natural Resources and Environment student team (team) developed a strategy for managing greenhouse gas emissions in the vehicle supply chain. Since December 2008, the team has supported the engagement of suppliers through the development and administration of a survey to collect allocated greenhouse gas data and environmental management practices information. The student team also advanced industry-wide participation through collaboration with the Automotive Industry Action Group (AIAG) to standardize greenhouse gas reporting requests provided to suppliers. Additionally, the student team evaluated public reporting options, specifically by engaging Ford as tester of the new Corporate Value Chain (Scope 3) Accounting and Reporting Standard drafted by the World Resources Institute and the World Business Council for Sustainable Development. The project findings illustrate a wide range in the sophistication of the greenhouse gas management practices of suppliers and demonstrate the need for a collaborative approach between suppliers and original equipment manufacturers (OEMs) to further emissions reduction efforts. The different components of the master's project have informed short-, mid-, and long-term recommendations for the measurement, management, and reporting of supply chain greenhouse gas emissions by Ford. Specifically, the student team recommends that Ford (1) expand their data collection program, (2) refine and use the proposed Maturity Matrix tool to measure supplier performance, (3) collaborate with suppliers on the improvement of management efforts, and (4) continue to support and pursue an industry-wide approach to greenhouse gas management through involvement with AIAG.

EXECUTIVE SUMMARY

Supply chain and Scope 3 greenhouse gas (GHG) emissions are the newest frontier in emissions measurement and management programs. An estimated 75 percent of the carbon footprint of an industry sector results from Scope 3 activities, primarily from the use of product by the end consumer (Huang, Weber and Matthews 2009), but accounting standards and guidance for best practices are only currently being finalized (The Greenhouse Gas Protocol 2010). Corporate and stakeholder interest in this area is growing, and manufacturing companies—including those in the automotive industry—are recognizing the risks associated with carbon-intense manufacturing given energy price volatility and likely future regulation of carbon emissions to curb climate change. To understand and address this challenge, Ford Motor Company (Ford) and the University of Michigan School of Natural Resources and Environment student team (team) developed a strategy for managing GHG emissions in the vehicle supply chain.

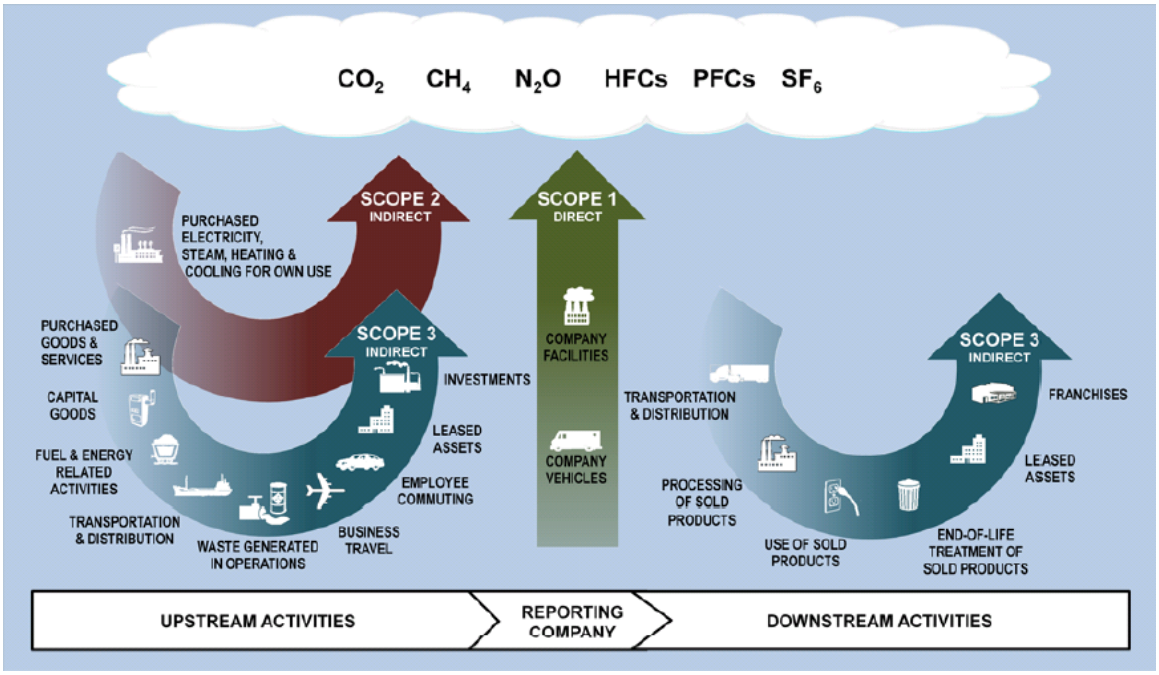

Figure ES-1: Characterization of Greenhouse Gas Emissions Scopes.
Source: The Greenhouse Gas Protocol, Corporate Value Chain (Scope 3) Accounting and Reporting Standard Executive Summary, 2010.

A. PROJECT SIGNIFICANCE

Cars and trucks are complex products. With well over 50 subsystems per vehicle, each of which is made up of several components and parts ranging from textiles to steel and electronics, the sheer volume and variety of materials and parts indicate the massive supply network required to provide them. A vehicle has up to 20,000 parts produced by 6 to 12 levels of suppliers, making insight and oversight of the supply base challenging (Sullivan, et al. 1998). The vehicle supply chain, while not the single greatest source of life cycle greenhouse gas emissions for a vehicle, does represent a significant source of emissions and will become a comparatively larger percentage of total life cycle emissions if the use phase and owned manufacturing emissions decline due to concerted efforts targeting those portions of the life cycle. Exhibit 2 shows the relative proportions of life cycle emissions for a generic product and an automobile.

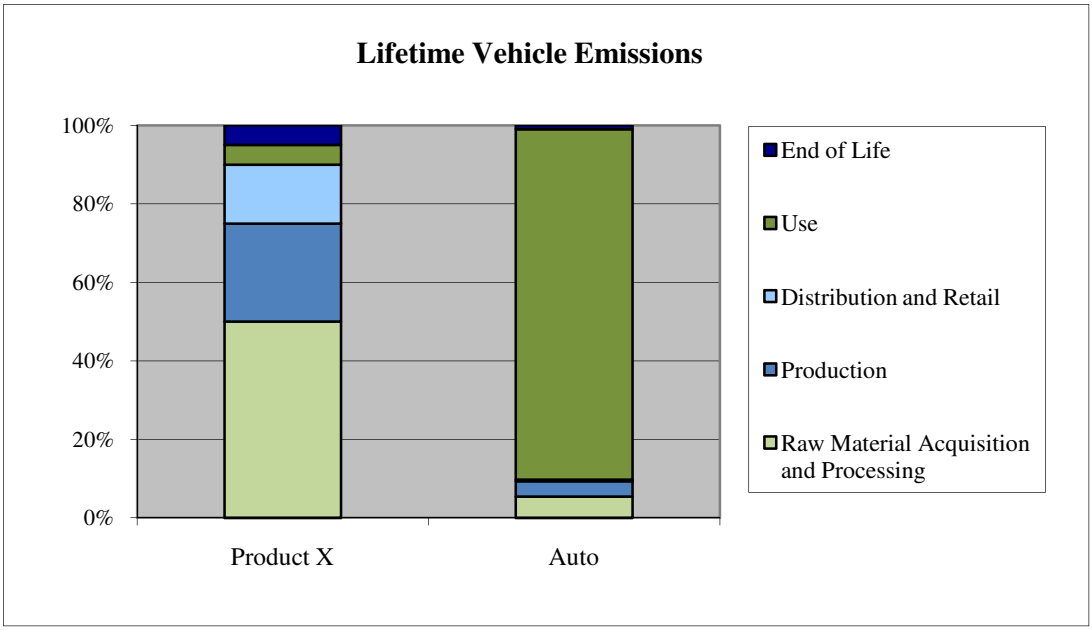

Figure ES-2: Comparison of Lifetime Vehicle Emissions to Representative Other Product.
Source: Adapted from (The Greenhouse Gas Protocol 2010) and (Ford Motor Company 2010).

To begin to understand and manage supply chain GHG emissions, a wide variety of entities have begun to put forward measurement, management, and reporting options. From non-governmental organization reporting schemes and accounting standards to industry-level efforts and Ford's own business objectives, there is a wide variety of management approach options with high potential for increased coordination.

Therefore, this project aimed to integrate and balance available management approaches with the realities of the automotive supply chain. The outcome is a cohesive supply chain greenhouse gas management strategy and associated implementation recommendations.

B. APPROACH

Through the supplier data and information request described in more detail below, the team focused on helping Ford to meet the following supply chain goals:

- Assess supplier readiness to measure and report
- Identify emissions hot spots and establish a baseline
- Lead industry development of universal tools and emission estimation methodologies as well as wider-scale supplier engagement

To do so, since December 2008, the team has supported the engagement of suppliers through the development and administration of an information and data request for allocated greenhouse gas data and environmental management practices information. Additionally, the student team evaluated public reporting options, specifically by representing Ford as a road tester of the new Corporate Value Chain (Scope 3) Accounting and Reporting Standard under development by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The student team also

advanced industry-wide participation through collaboration with the Automotive Industry Action Group (AIAG) to standardize greenhouse gas reporting requests provided to suppliers. The different components of the master's project have informed short-, mid-, and long-term recommendations for the measurement, management, and reporting of supply chain carbon emissions by Ford.

1. Benchmarking of Existing GHG Management Initiatives

Benchmarking supplier engagement sustainability initiatives was employed to assess the best approach for beginning a targeted data and information collection effort from Ford's suppliers. Through research and interviews on best practices for engagement, the team found that key considerations included data utility for and applicability to strategic initiatives, ease of use of the collection tool, data comprehensiveness, and supplier selection. Evaluation of existing measurement, management, and emissions reduction guidance showed that there is no single all-inclusive solution. With regard to supplier selection, the team found that companies use a combination of the following criteria:

- Total spend
- Top-tier suppliers
- Strategic partners
- Heavy emitters of carbon dioxide equivalent emissions (CO_2e)
- Division representativeness (i.e., suppliers from across the company functions)
- Internal choice (i.e., by corporate sourcing department)

Other companies found that any supplier engagement requests should come from within the procurement function at the requesting company. They also determined that supplier contacts should be oriented and educated on the subject and project and that supplier contacts should be in the environmental or sustainability divisions rather than public relations or sales.

2. Supplier Engagement

Two data and information collection approaches were employed: (1) the Carbon Disclosure Project (CDP) Supply Chain Module questionnaire and (2) a unique package containing a data form and accompanying qualitative questions developed by the team for the WRI/WBCSD Corporate Value Chain (Scope 3) Accounting and Reporting Standard road test. In this emerging space of supply chain emissions measurement, the GHG Protocol Scope 3 Accounting Standard and the Carbon Disclosure Project supply chain program represent the current state of the art. Therefore, the team employed both organizations' approaches for this analysis. The CDP questionnaire was sent to 10 suppliers, and the road test request was sent to 25. Both requests included questions covering key areas of GHG management, which are:

- Perceived risks and opportunities from climate change
- Emissions measurement
- Emissions management
- Reporting
- Governance
- Engagement beyond operational control

GHG Protocol Scope 3 Accounting Standard Road Test

The GHG Protocol will soon include two new standards: the Corporate Value Chain (Scope 3) Accounting & Reporting Standard and the Product Accounting & Reporting Standard. The second version of the draft standards was released for public comment in November 2010, extending the public comment period until December 2010 (The Greenhouse Gas Protocol 2010). The final standards will be released in September 2011 (World Resources Institute 2011). To best understand the developing standard, the team, in collaboration with Ford staff, took on the role of "road testers" for Ford for the standard development and feedback process from December 2009 through June 2010.

The team developed a data collection form and guidance for completing the road test (see Appendices B and C). The data collection form was modeled off of the GHG Protocol Corporate Standard, and requested Scope 1 and 2 data for the six Kyoto Protocol greenhouse gases for the most recent year available. The qualitative questions reflect the same types of questions asked in the CDP Investor questionnaire regarding assessment of climate change risk and opportunity, institutional governance, reductions in emissions, and use of life cycle assessment to improve product design or evaluate emissions reduction opportunities. In addition, with an eye toward future expansion of the supply base data collection efforts, a question was included asking whether suppliers worked with any of their own suppliers on these issues.

Carbon Disclosure Project Supply Chain program questionnaire

The CDP Supply Chain program requests data from suppliers on behalf of member companies. The Supply Chain program requests the same information as the CDP Investor program but also includes a Supplier Module through which responding companies allocate their emissions to the requesting company (see Appendix D for the complete questionnaire) (Carbon Disclosure Project 2010). In 2009, 44 member companies reached out to 1,402 of their suppliers (Carbon Disclosure Project 2010).

Supplier selection

When deciding which suppliers to survey, a number of factors were considered. It was important to collect meaningful and useable information in a short period of time, so Ford and the team selected a set of suppliers with specific characteristics in mind. Carbon intensity of parts supplied, relationship with Ford (strategic aligned business framework (ABF) or non-strategic (non-ABF) production suppliers), portion of Ford's business (turnover), geography, and maturity with regard to GHG emissions management were all taken into consideration during the supplier selection process. Based on research and benchmarking of best practices described above, the steps taken to select the 35 suppliers for the two surveys were as follows:

1. Rank carbon intensity of parts for one vehicle (kg CO_2e per vehicle identification number (VIN)) in descending order based on model output.
2. Rank suppliers of parts from step one according to turnover (annual production spend). Select the two highest for each part, prioritizing ABF strategic suppliers.
3. Verify a range of geography and carbon management maturity.
4. Adjust the resulting list based on communications with Ford. Note that this included selection of raw materials suppliers for glass, aluminum, and steel.

C. KEY FINDINGS

Responses to the two information requests showed a range of maturity with respect to GHG emissions management. Overall, response rates were high, and suppliers demonstrated sophistication in many areas related to GHG emissions management. The following exhibit highlights response data.

Table ES-1: Information Request Response Statistics

	Scope 3 Road Test	CDP Supply Chain
Response Rate	72 percent	90 percent
Response Rate among ABF	100	86
Prior Emissions Tracking	80	77
Prior Emissions Reporting	44	55
Use of Life Cycle Assessment	60	44
Beyond Operational Control	0.05	44
Provided Scope 1 Emissions	100	88
Provided Scope 2 Emissions	100	88
Reduction Target	58	66
Made Response Public	0 (not an option)	44

Note: Due to small sample sizes, statistical comparisons between the two surveys would not be meaningful.

While most respondents to the questionnaires were able to provide information or data for each item requested, the results show a wide range in sophistication and experience. A few things are clear from the exercise (the benefits and challenges associated with these are explored elsewhere in this analysis):

- Most suppliers prefer to allocate emissions to Ford based on sales.
- Providing information on each of the six major greenhouse gases is burdensome.
- Streamlining requests for GHG data would be helpful.
- Some suppliers have well-established programs for measuring, managing, and reporting GHG information.
- Some suppliers have conducted multiple life cycle assessments (LCAs).

1. Maturity Spectrum

Given that the goal of supplier engagement is beyond simple reporting of carbon measurements, the qualitative results were grouped in such a way as to provide insight for future steps for Ford. The project team sorted the qualitative responses, resulting in a Maturity Spectrum, which demonstrated the range of corporate actions with regard to carbon measurement and management. Suppliers were grouped along the spectrum, which allowed for a comparison across the supply base.

Through a review of information from leading GHG emissions management organizations such as the US Environmental Protection Agency (US EPA) and its Climate Leaders Program, the Climate Registry, and the CDP, the team distilled a set of key actions that organizations take in the process of establishing a carbon emissions management program. These steps were combined into descriptive groups in order to

define the categories on the Maturity Spectrum. For example, a supplier may have provided emissions information to the CDP, the Climate Leaders program, or the Climate Registry. All three of these actions are considered on the Maturity Spectrum under "Reporting." The graphic below illustrates the spectrum and provides sample actions that fall into each category.

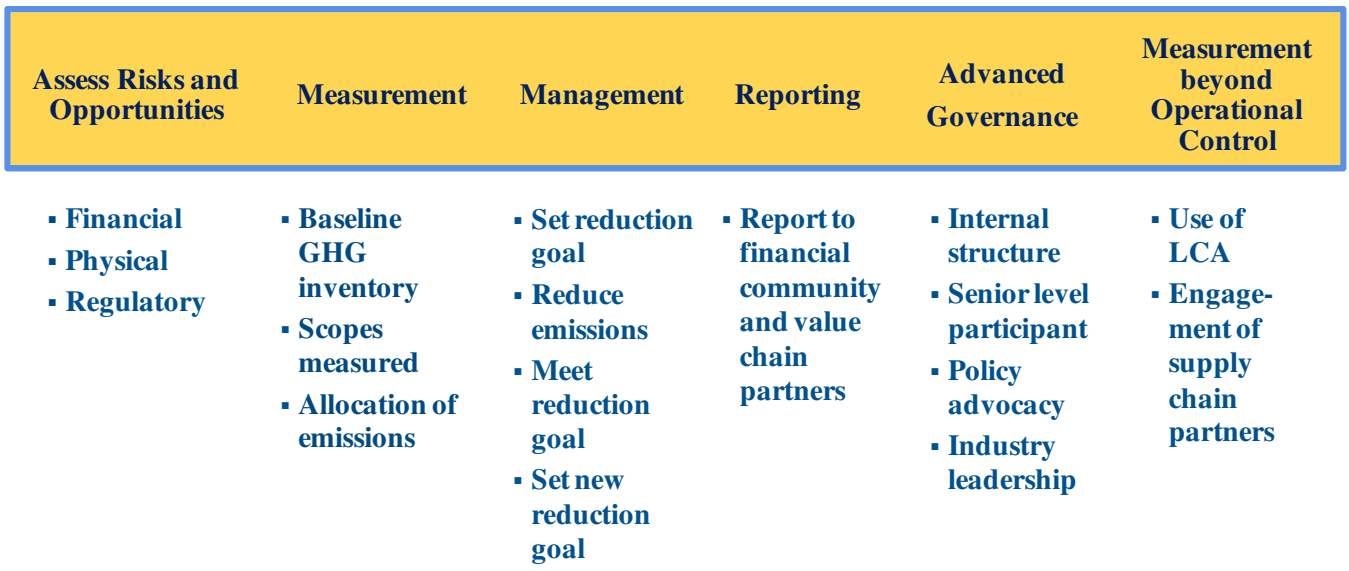

Figure ES-3: Greenhouse Gas Management Maturity Spectrum

The responding suppliers conducted activities in the maturity spectrum to varying degrees, as summarized in the following exhibit.

Table ES-2: Percentage of responses Demonstrating Representative Activity in each Maturity Category

Assess Risks and Opportunities	Measurement	Management	Reporting	Advanced Governance	Measurement Beyond Operational Control
69 percent	85	65	48	78	58

D. RECOMMENDATIONS

Assessment of the current landscape of GHG measurement and management in the automotive industry coupled with information from Ford's suppliers and the analysis presented in this report informed the following recommendations. The recommendations are provided in a chronology of short-, mid-, and long-term actions, similar to other sustainability initiatives at Ford.

The overall recommendations for a Supply Chain GHG Management Program at Ford are based on four key pillars:

1. **Supplier data collection:** Engaging with suppliers, rather than performing a LCA of expected GHG emissions, is key for increasing supplier GHG management capabilities because it signals to suppliers that Ford has a desire to manage GHG emissions through collaboration with its supply chain.
2. **Measuring supplier performance:** The way to engage each supplier in many ways depends on their performance across a wide range of factors including GHG emissions, management sophistication, preferred status, and others. Furthermore, the goal of the program is to improve supplier GHG performance and reduce emissions.
3. **Supplier collaboration:** Working with suppliers to improve management of GHGs and building on the strong relationships that Ford is developing with its suppliers are effective ways of building GHG management competency because they allow suppliers and original equipment manufacturers (OEMs) to learn from one another.
4. **Collaborating with industry:** In order to effectively increase the size of and participation in the program, an industry approach is necessary. This principle is based upon conversations with suppliers as well as with AIAG (Ford Motor Company 2009).

The individual recommendations by timeframe follow.

1. Near-term Recommendations: Year 1

Expand data collection program to measure supplier sophistication

The team recommends using the findings from the supplier engagement program to increase the number of suppliers surveyed. In order to derive the most value from the next phase of supplier engagement, the team recommends splitting the supply pool into four different groups: (1) production ABF suppliers, (2) non-production ABF suppliers, (3) non-ABF production suppliers, and (4) non-ABF non-production suppliers. Specifically, the team recommends: (1) surveying all ABF suppliers during 2010–2011 using both the Carbon Disclosure Project and the AIAG data form and (2) surveying a random sample of non-ABF suppliers, both production and non-production.

The team recommends continuing to expand the number of suppliers surveyed per year, with the ultimate goal being a survey that is part of the expectation of being a Ford supplier (see long-term recommendations). Data from the surveys should be analyzed to understand both the GHG emissions as well as the GHG management maturity of each supplier. This data can then be used to help prioritize supplier engagement in the future (see mid-term recommendations).

The Carbon Disclosure Project supply chain program should be used to survey suppliers about their GHG management maturity. The CDP scoring methods can be used to place a supplier on the GHG management Maturity Spectrum and prioritize which suppliers to work with, as well as to help guide the best areas to focus on with suppliers. Alternatively, the scoring method can be used to help Ford grade suppliers based upon its own Maturity Spectrum.

To ensure supplier buy-in, industry involvement, and continuous improvement in surveying techniques, the team also recommends continuing to work with AIAG to refine and propagate the data request tool for collecting GHG emissions from suppliers.

Working with suppliers through the use and results of the CDP and AIAG information requests will provide the necessary information to assess overall GHG emissions, to determine with which suppliers to engage, and finally to begin working with those suppliers to manage upstream GHG emissions and energy use.

Develop score-able matrix for tracking supplier progress

Adopting a matrix tool can have useful advantages like aggregating numerous pieces of information and demonstrating progress over time in a concise manner. Doing so would require the development of a weightings and scoring system that best reflects Ford's understanding of the relative importance given to the component criteria and categories of GHG management (an example of a Maturity Matrix is provided in the report). Work to translate the actual response information into performance ratings would also be required on an ongoing basis. While significant detail can be provided in supplier responses to requests for information, it might not be possible for such information to be adequately captured in this matrix format. Thus, there is a risk of oversimplification.

2. Mid-term Recommendations: Years 2–5

Continually update Maturity Matrix for GHG measurement, management, and reduction to prioritize supplier engagement

The team recommends using the annual supplier information requests to update the supplier Maturity Matrix and GHG emissions profiles and to prioritize with which suppliers to work with based upon a combination of their overall GHG intensity, any accomplished or anticipated GHG emissions reductions, GHG management maturity, and the strategic importance (i.e., ABF status) of the supplier. Companies that have high GHG emissions, lack GHG management maturity, and that are of strategic importance to Ford should be prioritized for engagement. It will be difficult to know which suppliers have higher GHG emissions and which suppliers are best able to manage their emissions; however, Ford can expect to be able to work closely with ABF suppliers on emissions reductions.

Support training for OEMs and supplier companies through AIAG around GHG data measurement and management

Working with other OEMs through AIAG and with suppliers will be critical for ensuring that Ford and AIAG continue to identify the most effective way to manage GHG emissions in the supply chain. The team recommends continuing to support training for OEMs and suppliers through AIAG on GHG data measurement and management. Trainings may be based on existing materials or developed as best-practice sharing across the industry.

Continue to expand data collection program to measure supplier sophistication

The team recommends continuing to expand the number of suppliers surveyed each year, with the ultimate goal being that completing the survey is expected of all Ford suppliers.

3. Long-term Recommendations: Years 6 and Beyond

Work with AIAG to develop industry-wide database for GHG data submission by suppliers and data management by OEMs

As Ford and other companies scale up their data request efforts, it will be imperative to develop an automated approach to collecting and managing data. With a shared system, suppliers can enter their data just once for all requests. OEMs can also employ an automated system to synthesize and analyze the results for all their requested data without having to manually compile and analyze results.

Streamline data management internally within the organization

Ford should consider how to best meet the needs of the company for sustainability data management across the organization. Ultimately, Ford should maximize ease of data entry and minimize overlap between data collection efforts (e.g., if many suppliers use certain tools to track their operational emissions, the system at Ford would optimally be compatible with these tools). Availability and sophistication of sustainability software continues to increase, and Ford should track developments to ensure that it is using the best system to meet its internal and external data needs.

Formally incorporate GHG management and energy use into the supplier evaluation and management process

The team recommends that Ford use supplier placement and progress along the Maturity Matrix to better understand the relationship between risk and management. Further, incorporation of carbon cost information as it becomes clearer will be important to this evaluation.

E. CONCLUSIONS

There are several key issues characterizing supplier engagement around greenhouse gas emissions in the automotive supply chain. This is an emerging field; measurement standards are still in development, and many questions remain regarding setting emissions profile boundaries, evaluating suppliers, and achieving reductions. As companies like Ford consider how they will measure supply chain emissions, they will need to balance the requirements of gathering product- and supplier-specific data with the need to meet business goals.

The ongoing effort by the AIAG Greenhouse Gas Work Group to collectively increase the sustainability of the automotive industry indicates a material interest and commitment to the issue of reducing greenhouse gas emissions in the automotive supply chain. Currently, Ford is one of the leaders in the industry with regard to measuring and reporting greenhouse gas emissions and should continue to pursue progressive supply chain carbon management strategies.

The first step toward supply chain leadership emissions management is data collection with the goal of measuring greenhouse gas emissions in the supply chain. Next, Ford must determine how it will manage this data with the goal of reducing greenhouse gas emissions in the supply chain. Ford can articulate this management strategy using several approaches including setting greenhouse gas emission reduction targets for its suppliers, engaging in earnest innovation and collaboration with its suppliers, and using suppliers' "greenhouse gas management sophistication" as a means for evaluating progress in the supply base in the future. Ford's suppliers represent a range of maturity with regard to their carbon

management, and finding ways to continuously move suppliers toward decreased emissions should be the ultimate objective.

Continuing to engage with AIAG will be a critical way for Ford to drive, and shape, GHG management methods in the industry. The team recommends that Ford continue its involvement in the development and deployment of a standardized industry-wide data collection form, facilitate the distribution of guidance materials and training workshops, and contribute to the development of an industry-wide GHG database for suppliers and OEMs. Ford should also continue to pursue its own individualized efforts to ensure that it is meeting the organizational goals described earlier in this report.

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I. INTRODUCTION

Ford Motor Company (Ford) engaged the University of Michigan School of Natural Resources and Environment to develop a supply chain greenhouse gas (GHG) emissions measurement and supplier engagement strategy. Starting in January 2009, a team of four SNRE students (team) began working with the Supply Chain Sustainability Department at Ford in order to engage suppliers, evaluate options for measuring emissions, and recommend a strategy for long-term supplier GHG emissions management.

Supply chain and Scope 3 emissions are the newest frontier in GHG emissions measurement and management programs. Accounting standards and guidance for best practices are currently being finalized (The Greenhouse Gas Protocol 2010). Corporate and stakeholder interest in this area is growing, and manufacturing entities, including the automotive industry, are recognizing the risks associated with carbon-intense manufacturing given energy price volatility and likely future regulation of GHG emissions. This project set out to explore and assess the range of opportunities and challenges in this space. Currently there is uncertainty regarding both potential GHG regulation and its impacts on Ford's procurement strategies as well as the supply chain portion of the life cycle GHG impacts of automobiles. This uncertainty prevents Ford from predicting which commodities used in its product manufacturing may become increasingly—or even prohibitively—costly. There is a need for greater understanding of a) likely policy and regulatory impacts, b) the supply chain portion of life cycle GHG impacts of automobiles, and c) the best approach for addressing the supply chain GHG impacts in the automotive industry. This project addressed these needs by evaluating the current state of supply chain GHG management and opportunities to engage suppliers in measuring and reducing the GHG content of their portion of the overall automotive product carbon footprint.

To do so, the team benchmarked other companies, participated in the development of Scope 3 emissions accounting standards, collected data and information from Ford's suppliers, liaised with the Automotive Industry Action Group (AIAG), presented its ongoing work to Ford's aligned business framework (ABF) suppliers on two occasions, followed climate change policy developments, and evaluated measurement and reporting options for Ford. To understand GHG emissions measurement, the team assessed how life cycle assessment (LCA) and Scope 3 emissions accounting relate and may be adopted for business objectives. The team also examined current reporting options, especially the most widely recognized Carbon Disclosure Project (CDP) Supply Chain program. Based on this research, the team developed recommendations for Ford Motor Company to pursue.

The remainder of this report expands on each of these topics, providing further context into which the project brings current and forward-looking assessments of the measurement and management of supply chain GHG emissions for Ford and other companies.

II. PROJECT CONTEXT AND RELEVANCE: LANDSCAPE AND TRENDS

A. INTRODUCTION TO GREENHOUSE GAS EMISSIONS

Greenhouse gas emissions from industrial activity are a major contributor to global climate change and thus are increasingly the subject of regulation in a variety of Ford's international markets (Ford Motor Company 2010). GHG emissions are caused by both natural and human activities. Human-caused emissions are produced through various means including fuel combustion, fugitive emissions from fuels, industrial processes, solvent and other product use, agriculture, and waste (United Nations Framework Convention on Climate Change n.d.). The Kyoto Protocol on the United Nations Framework Convention on Climate Change (UNFCCC) identifies six GHGs: Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Sulfur Hexafluoride (SF_6), Perfluorocarbons (PFCs), and Hydrofluorocarbons (HFC). Each of the greenhouse gases vary in the amount of radiative forcing, and thus greenhouse effect, they produce. This variation is captured in the global warming potential (GWP) measurement, which is used to convert all greenhouse gases into a common unit (CO_2-equivalents, or CO_2-e) (Intergovernmental Panel on Climate Change (J.T. Houghton, G.J. Jenkins and J.J. Ephraums (eds.)) 1990).

1. Calculation and Accounting

The preponderance of GHG emissions are incurred during the combustion of fossil fuels. Exceptions include calcining limestone, which releases CO_2, and mining coal, which releases methane. Calculating GHG emissions is achieved by multiplying emissions factors and energy usage (kWh electricity) or volume of fuel consumed. Specifically, factors that account for the GHG or CO_2-e content of a specific fuel are multiplied by the amount of that fuel used in a process of interest. Further, there are emissions factors for fuel production emissions (i.e., GHGs associated with mining, drilling, and refining fossil fuels). The calculations also account for the location of energy consumption. For example, the consumption of a kWh of electricity from an average grid mix in the US has more GHG emissions than a kWh used in Europe (The Greenhouse Gas Protocol 2004).

The Greenhouse Gas Protocol (GHG Protocol) guidance, which is published by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), has informed most measurements of Scope 1, 2, and 3 emissions (The Greenhouse Gas Protocol 2010).

2. Emissions Scopes

A company's own emissions combined with its use of energy from utilities and the use, manufacturing, and disposal phases of its product's life cycle all form the company's Scope 1, 2, and 3 emissions. Of the Scope 3 emissions—which encompass both the supply and use phases of the product (at either end of the operations controlled by the company)—this report focuses on the supply chain emissions. Scope 1, 2, and 3 emissions are defined below and illustrated in the diagram that follows.

- **Scope 1 emissions** are direct emissions arising from activities owned or controlled by the company.
- **Scope 2 emissions** are indirect emissions that result from the purchase of electricity, heat, or steam by a company.
- **Scope 3 emissions** are other indirect emissions "such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. transmission and distribution losses) not

covered in Scope 2, outsourced activities, waste disposal, etc." (The Greenhouse Gas Protocol n.d.).

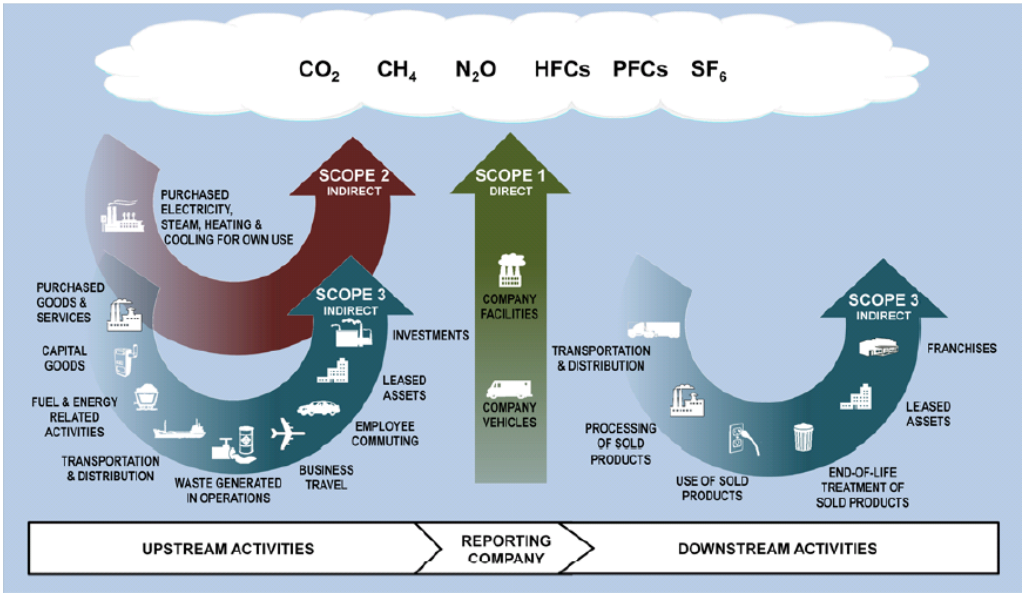

Figure 1: Characterization of Greenhouse Gas Emissions Scopes.
Source: GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard, Executive Summary, 2010 (The Greenhouse Gas Protocol 2010)

3. Introduction to Scope 3 Accounting Standard

The Corporate Value Chain (Scope 3) Accounting and Reporting Standard, also written by WRI and WBCSD with extensive feedback from stakeholders (including Ford), is to be finalized and released in September 2011 (World Resources Institute 2011). The standard provides direction for calculating emissions from 16 categories that are not included in the Scope 1 and 2 accounting standard. The draft accounting standard and its development process have begun to help companies frame and understand their supply chain emissions and understand the relative emissions size compared to their other direct and indirect emissions (The Greenhouse Gas Protocol 2010).

B. TRENDS IN GREENHOUSE GAS MANAGEMENT ACTIVITIES

Several trends form the landscape of GHG measurement and management. These are outlined in the following sections.

1. Corporate Impact

GHG management has emerged as an important trend as corporations are spurred by rising energy costs, increasing consumer awareness of climate change, and the threat of government regulation. From 2002 to 2009, participation in the US Environmental Protection Agency (US EPA) Climate Leaders program grew from 11 members to 275 members, making up 12 percent of US GDP (US Environmental Protection Agency 2009). Similarly, the Carbon Disclosure Project, which began in 2000, states that "some 3,000 organizations in 60 countries around the world now measure and disclose their greenhouse

gas emissions and climate change strategies through CDP" (Carbon Disclosure Project 2010). Research by the Carbon Disclosure Project suggests that companies report their GHG emissions for reasons that include risk avoidance (80 percent of responding companies) as well as seeking opportunities from climate change (90 percent of responding companies) (Carbon Disclosure Project 2010).

2. Automotive Industry Impact

The automotive industry is fairly unique from a GHG emissions perspective because the vast majority of its emissions occur during the use phase of its product life cycle (Sullivan, et al. 1998). The US EPA estimated that in 2003, 27 percent of total US greenhouse gas emissions were due to transportation activities, with "light duty" vehicle use (i.e., "tailpipe" emissions, not life cycle emissions) accounting for 62 percent of these emissions (US Environmental Protection Agency 2010). As a result, climate change-related regulations of the auto industry have primarily focused on use phase fuel efficiency (e.g., Corporate Average Fuel Economy, or CAFE, standards).

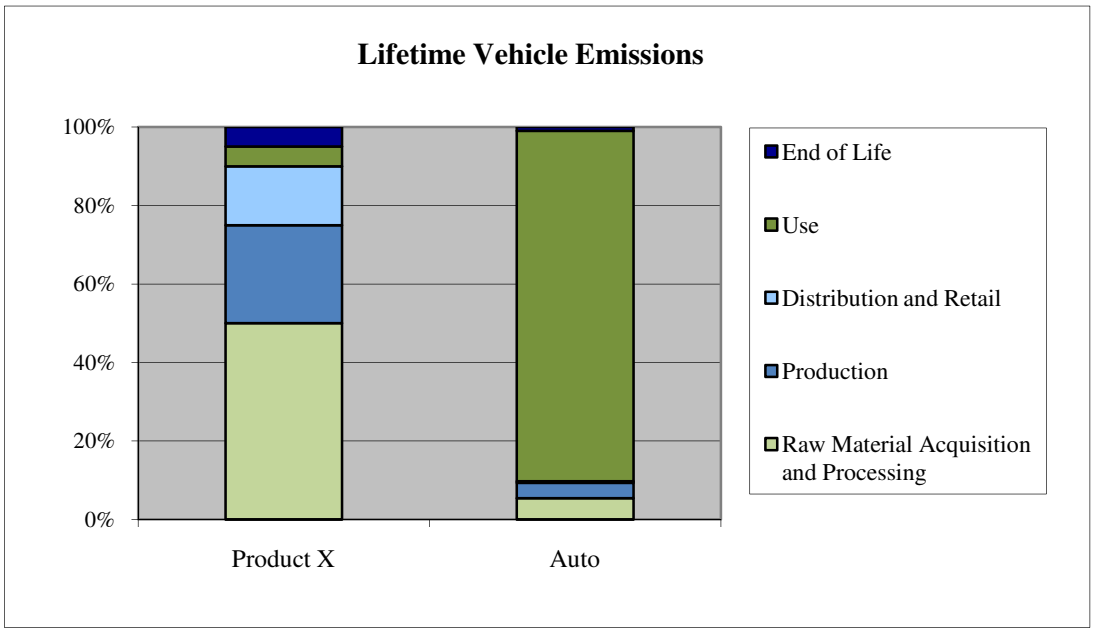

Figure 2: Comparison of Lifetime Vehicle Emissions to Representative Other Product.
Source: Adapted from (The Greenhouse Gas Protocol 2010) and (Ford Motor Company 2010).

3. Carbon Footprinting

Despite the dominant use phase emissions from vehicles, automotive companies also have significant manufacturing-related GHG emissions (Ford Motor Company 2010). Overall, the manufacturing sector accounts for about 27 percent of CO_2 emissions from fossil fuel combustion in the United States (US Environmental Protection Agency 2010). Therefore, most automotive companies have at least begun to establish programs to maximize the energy efficiency of their operations and thereby minimize their GHG footprint (see GHG Management Initiatives in the Automotive Industry section for more information on these efforts). Many companies even have non-binding carbon reduction targets and report to the Carbon Disclosure Project (Carbon Disclosure Project 2009).

4. Supply Chain Focus

Organizations typically address GHG emissions first within their own operations and eventually extend this to their products and supply chains (Kielstra 2010). Most recently, companies in heavy manufacturing have also begun focusing on GHG emissions in their supply chains (US Environmental Protection Agency 2010). With impending regulation on US-based manufacturing, there is a strategic motivation for companies to understand the cost implications of a price on carbon. It is important for companies to know how a carbon-related cost will affect the cost of their purchases from suppliers and to find ways to reduce those future costs.

The importance of supply chain management in achieving environmental goals is not a new idea. In 1996, Lamming and Hampson advocated the importance of environmental considerations in supply chain management and highlighted several early evaluation methods such as Total Quality Management and Environmental Management Systems. They also identified life cycle assessment (LCA) and noted that "LCA is perhaps the key to understanding what makes a 'green' product, and ultimately to determining environmental purchasing strategies" (Lamming and Hampson 1996, S49). Since that time, LCA has gained credence and popularity in academic and industry circles and is applied by businesses more commonly. As discussed in more detail in the analysis below, application of LCA for business objectives comes with its own limitations and challenges.

Despite existing interest and tools such as LCA, relatively little literature exists evaluating the current state of knowledge in supply chain sustainability. This is especially true for any individual sector, such as the automotive industry. In a review of nearly 200 sustainable supply chain articles, Seuring and Müller note a large increase in the number of publications since the mid-1990s but identified only five related to the automotive industry. Among these five, three are relevant to understanding sustainable management of the automotive supply chain with the other two pertaining to specific car types or sub products (e.g., car paint) (Seuring and Müller 2008).

The three automotive industry-focused papers each take a different perspective on supply chain management. They include a case study of Volkswagen (Koplin, Seuring and Mesterharm 2007), the Chinese automobile industry (Zhu, Sarkis and Geng 2005), and "a relationship perspective" (Simpson, Power and Samson 2007). The article by Koplin importantly notes that

> [a] fundamental conceptual review of necessary changes of structures, i.e. the preconditions for the operationalisation of environmental and social standards in supply management, is missing […] a complete approach for integrating sustainability including both environmental and social standards into the supply management of the automobile industry does not exist. (Koplin, Seuring and Mesterharm 2007, 1056)

This finding confirms the need for companies to continually work toward a goal of integrating sustainable principles into supply chain management and to undertake projects such as the one presented here to operationalize the concepts. As the other automotive-specific articles reveal, much work remains to be done.

The article by Zhu examines a single diesel engine plant in detail along with 89 companies in total that are exploring green supply chain management options in China. The article concludes that while pressures are significant for Chinese automakers and suppliers to adopt supply chain management

sustainability, to date implementation has been poor (Zhu, Sarkis and Geng 2005).

Research recently reported by Simpson et al. shows that the performance goals of a customer can have a positive impact on the dedication of the supplier to environmental responsibilities. One of the findings of Simpson et al. from their study of the Australian automotive industry indicates that greater supplier compliance with environmental requests correlates with higher relationship-specific investment but levels off at a point when suppliers have well-established relationships and then perceive less likelihood of being penalized for noncompliance (Simpson, Power and Samson 2007).

Seuring and Müller's extensive literature review also develops a framework for understanding what pressures may trigger a company to focus on sustainability in the supply chain. These include regulatory, stakeholder, and customer pressures exerted on a focal company (defined as companies that "rule or govern the supply chain, provide the direct contact to the customer, and design the product or service offered") (page 1699). Ford is clearly a focal company by this definition and is acting to address anticipated regulatory pressure and engage with its stakeholders. The framework identifies two primary strategies that focal companies can take to address the environmental pressures they face. They title them: Supply Chain Management for Risk and Performance and Supply Chain Management for Sustainable Products. This framework highlights a key tension in supply chain sustainability between a focus on product-level management and a broader strategic level approach to risk and opportunity management. This theme recurred in the team's research and is discussed further at various points in this report.

While Seuring and Müller's work shows a clear increase in emphasis on supply chain sustainability in the literature, in practice, it is still an emerging area. A recent survey of over 540 executives revealed that while for many (35 percent), public relations (not necessarily any deeper strategic intent), is a key driver for climate change action a greater proportion (59 percent) see GHG emissions reduction as an opportunity to gain competitive advantage in their industry (Kielstra 2010). In the 2010 survey, 21 percent had climate change strategies that addressed the supply chain, but greater numbers had strategies that covered only the organization's internal business (28 percent), and even more had no strategy at all (32 percent) (Kielstra 2010). These results highlight the current status and broad range of corporate climate change activities. They also indicate that only leaders in the climate change management space are addressing supply chain emissions.

5. Supplier Scorecards

Some companies have begun looking at the GHG emissions of their suppliers and may be combining those efforts with supplier scorecards that they are already using to rate suppliers on other issues such as quality. For example, Walmart and Procter & Gamble (P&G) have begun implementing supplier sustainability scorecards that include GHG emissions.[1]

In 2009, Walmart announced the launch of a sustainable product index to "establish a single source of data for evaluating the sustainability of products" (Walmart 2009). As a first step, Walmart designed a 15-question survey to track the following areas of its global suppliers' performance: energy and climate,

[1] See, for example, a description of P&G's effort at: http://www.pg.com/en_US/sustainability/environmental_sustainability/operations_suppliers/supplier_engagement.shtml.

material efficiency, natural resources, and people and community (Walmart 2009). Walmart has also collaborated with universities, suppliers, retailers, NGOs, and the government to create a consortium that will develop a global database with life cycle data about products. Ultimately, the sustainable product index will serve as a tool that will allow Walmart to easily communicate this information to consumers (Walmart n.d.).

In 2010, P&G launched a sustainability scorecard that tracks energy use, water use, waste disposal, and GHG emissions on a year-to-year basis. Targeted suppliers (the scorecard was initially rolled out to 400 suppliers) have a full year to prepare to report their data before their rating can adversely affect their supplier rating with P&G (Proctor & Gamble 2009).

While literature about sustainability scorecards is limited but increasing, studies have found positive connections between evaluation via scorecards and performance.[2]

C. CLIMATE CHANGE POLICY STATUS AND TRENDS

From local to international levels, governance entities have instituted policies and regulation to begin to address climate change. In this emerging area, initiatives are constantly changing and evolving, and the case has been no different throughout the course of this study. While many other studies provide an in-depth and detailed assessment of these efforts, this section outlines the status of policies and regulation globally and for five of Ford's major markets at the country level: Brazil, China, European Union, Japan, and the United States. The summaries below call out relevant factors for consideration in management of supply chain GHG emissions for Ford. The key issues for Ford to consider are any restrictions on or requirements of manufacturing industries as well as potential changes to trade that affect import or export tariffs.

1. International Agreements

The subject of international agreements has been studied in detail and reported elsewhere.[3] This section provides a brief review of the current status of international negotiations and highlights aspects of international agreements for Ford to monitor as these continue to develop.

Copenhagen

Global negotiations under the UNFCCC were held in Copenhagen, Denmark in December 2009. Though generally perceived as a failure because of rancorous debate and no binding agreement to succeed the Kyoto Protocol of 1996 (which is set to expire in 2012), the meeting did generate significant attention around the world and over 100 heads of state participated (United Nations Framework Convention on Climate Change n.d.). One outcome of the meeting was the Copenhagen Accord, a political agreement in which the parties "take note" of its non-legally-binding content. The Accord acknowledges the need to prevent an increase in global average temperature of two degrees Celsius and

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[2] See, for example, Schmitz and Platts, 2003. "Supplier logistics performance measurement: Indications from a study in the automotive industry." *International Journal of Production Economics* 89 (2004): 213–243.

[3] See, for example, Aldy, Joseph E; Barrett, Scott; Stavins, Robert N. 2003. "Thirteen plus one: a comparison of global climate policy architectures." *Climate Policy* 3(4): 373–397(25). See also The Pew Center on Global Climate Change, International Climate Negotiations, accessible at: http://www.pewclimate.org/policy_center/policy_maker_s_guide/international/international_negoti.cfm

includes detail on all six items put forth from the prior meeting in Bali (The Bali Roadmap) including mitigation, measurement verification and reporting, adaptation, forestry, finance, and technology (Diringer n.d.). The Accord calls on countries to pledge specific actions they will take. As of September 2010, over 110 countries had submitted commitments (Pew Center on Global Climate Change n.d.). Countries may or may not choose to participate and may or may not choose to select emissions-reducing activities that affect the automotive supply chain. Global agreements can form an important context for action and highlight the complexities of the agreements and any attendant intricacies that global companies must navigate when managing their supply chains.

Cancún

The 2010 UNFCCC meeting in Cancún, Mexico further formalized some of the elements of the Copenhagen Accord into the policy development process for future UNFCCC work but again did not result in any binding global agreement. The major issues addressed were financing for developing country initiatives and transparency in measurement (Pew Center on Global Climate Change 2010). Although these were not dramatic changes in international policy, it has been said that the meeting did reconfirm trust among nations in an agreement that formalizes the commitments outlined in Copenhagen and that a fund to support developing country climate change mitigation efforts and procedures was established to ensure transparency (Pew Center on Global Climate Change, 2010).

2. Leakage and Border Tariffs

The concept of "leakage" refers to problems associated with uneven carbon regulations in different markets leading to companies making manufacturing decisions based on their effort to avoid legislation. For example, if the United States imposes a carbon tax but China does not, companies will be incentivized to move their operations to China. This would effectively lower US emissions, but because Chinese manufacturing is more carbon-intensive due to its heavy reliance on coal-powered electricity sources, it would actually raise overall carbon emissions—the exact opposite of the (hypothetical) intended effect of the US legislation. Avoiding leakage requires either international adoption of carbon emissions regulation or import tariffs on goods imported from countries that do not have carbon regulation (Morgenstern 2009).

3. Policy and Regulation in Ford's Markets

Brazil

Brazil has ratified the Kyoto Protocol but has no quantified reduction obligation under the UNFCCC (Government of Brazil 2007). Even though it is one of the top four developing country GHG emitters globally (La Rovere and Pereira 2007), Brazil has held its stance that because developed countries are responsible for the majority of accumulated carbon dioxide in the atmosphere, they should take the greatest steps toward reducing emissions.

Brazil has traditionally pointed to the relatively significant portion of renewable energy sources in its energy mix (approximately 46 percent) and low per-capita and per-area emissions as reasons to delay action on mitigation (Government of Brazil 2007). This stance has shifted recently to a more proactive approach, demonstrated by the establishment of a Brazilian government committee on climate change and willingness to address emissions before midcentury, a formerly proposed timeline for the country, and to do so independently of actions by other nations (Government of Brazil 2007). On December 29, 2009 Brazil signed the National Policy on Climate, adding legal standing to the previous national plan

that set a target of 36.1 percent to 38.9 percent reductions below business as usual in projected emissions by 2020 (Robinson 2010). The bill formalizes the 2008 plan created by the president-appointed Inter-Ministerial Committee on Climate Change (Government of Brazil 2009). The plan addresses energy, forests and agriculture, transportation, industry, waste, and health. It lists 32 activities in implementation and 13 in a conceptual phase (World Resources Institute 2009). Activities for the transportation sector center on increasing use of biofuels by 11 percent per year throughout the country (Government of Brazil 2007). There is little discussion of activities for industry or manufacturing in the plan. The report offers no activity-specific emissions reductions targets, though it does estimate the potential reductions that could be achieved through the implementation of planned projects (e.g., to reduce deforestation).

It is not clear from the plan and available related information what regulatory mechanisms exist or may be developed to implement the plan, or what (if any) effects it would have on the manufacturing industry or international trade.

China

Historically, China has rejected the notion that it should set any limits on its GHG emissions when the US—which has historically been the world's largest emitter—has not taken any action of its own (Watts, China consider setting targets for carbon emissions 2009). Beginning with the change in US Administration in 2009, however, China appeared more willing to proactively address the issue (Watts, China ready for post-Kyoto deal on climate change 2009). In November 2009, China announced a goal to reduce the overall carbon intensity of its economy (Chinese Government 2009). The voluntary action is intended to reduce carbon dioxide emissions per unit of GDP by 40 to 45 percent below 2005 levels (Chinese Government 2009). In November 2010, China confirmed that this target will be officially included in its next five-year plan; the country also confirmed its intent to establish a carbon market (Business Green 2010).

President Hu Jintao's remarks at the United Nations Summit on Climate Change in New York, during which he first indicated that China would establish emission reduction targets, echoed his country's stated policy for close adherence to the UNFCCC's principle of "common but differentiated" responsibilities for developed and developing countries that also figured prominently in China's 2007 National Climate Change Programme (Jintao 2009). In subsequent reports, the country states that economic development is the core objective of its efforts with accompanying activities to reduce emissions (Information Office of the State Council of the People's Republic of China 2009). The National Climate Change Programme broadly outlines China's approach and stance on addressing issues of climate change through four primary objectives: emissions mitigation, capacity for adaptation, research and development, and raising public awareness (National Development and Reform Commission, People's Republic of China 2007).

Little detail on industry or manufacturing is provided in the document. In a section outlining strengthening measures and policies to promote energy efficiency, some specific industrial processes are identified and technologies recommended such as for the iron and steel industry and non-ferrous metals industry (National Development and Reform Commission, People's Republic of China 2007). In a 2009 progress report on the National Programme, it is evident that some projects are of note.

> The plan for the automotive industry emphasizes cars powered with alternative fuels as the breakthrough, and stresses the renovation and

> improvement of traditional products in terms of energy conservation, environmental protection and safety. The plans for iron and steel industry and petrochemical industry focus on adopting more rigorous standards and establishing a sound mechanism for phase-out of out-of-date production capacity, and have formulated detailed standards on energy consumption per unit of products and the resource recycling rate. (National Development and Reform Commission 2009)

In addition, the report notes that investment of over 50 million yuan by the central government has been given to 14 car and car component manufacturers to support a car component remanufacturing pilot. "The country has researched and put forward the technological standards for the remanufacturing of 3 types of 11 car components, and included them in the '11th Five-year Plan' for standardization" (National Development and Reform Commission 2009).

China adopted its first fuel economy standards for passenger vehicles in 2004, requiring average automobile efficiency to improve by 15 percent by 2010 over 2003 levels (ChinaFAQs (Convened by World Resources Institute) 2010). In 2009, China was anticipated to be working on a new plan for vehicle fuel efficiency that would require automakers in China to improve efficiency by an additional 18 percent by 2015 (Bradsher 2009). Any carbon regulation in China would need to institute a relatively large price on carbon in order to make energy expensive. It is not clear what effect the 2007 National Programme has had to date on the economics of manufacturing in China or how carbon emissions reduction would affect it in the near future. Given China's prominence in global supply chains and manufacturing, taking action to reduce supply chain emissions in this region will likely be effective, even absent of specific regulation (Ediger and Schuchard 2009).

Japan

The political shift in August 2009 in Japan resulted in revised national targets to address climate change. Under the previous administration, Japan had committed to reducing emissions by 8 percent from 1990 levels by 2020 (Maeda and Fujioka, Japan sets 2020 climate target, some say weak 2009). With the Democratic Party of Japan now in power, a new target of a 25 percent reduction over 1990 levels by 2020 was announced in September 2009 (Hirokawa 2009). Japan is not on track to meet its goals, and emissions have in fact increased by almost 9 percent over 1990 levels (Hirokawa 2009). The Japanese Cabinet referred a draft of the proposed climate legislation to Parliament in March 2010, but deliberation on the bill was delayed. In October 2010, the government announced plans to revive discussions on the legislation with the goal of final passage by December 2010 (Maeda, Japan Revives Push for Climate Bill, Outlook Unclear 2010).

The proposed legislation would require the country to establish a national emissions trading scheme within one year (Maeda, Japan Revives Push for Climate Bill, Outlook Unclear 2010). A voluntary market currently exists at the national level. The municipal government of Tokyo has undertaken its own approaches to emissions reductions in its 10-year plan, "Tokyo's Big Change: the 10-year Plan." In this plan, the Tokyo government establishes a goal of emission reduction to 25 percent below 2000 levels by 2020 (Tokyo Metropolitan Government 2006). The activities proposed to implement the plan center around urban planning and efficiencies; it does not emphasize industrial processes or vehicle emissions standards. The plan would, however, include a local emissions trading scheme.

There is widespread opposition from Japanese industry toward the greenhouse gas policy as currently proposed. The Japan Automobile Manufacturers Association (JAMA), Japan Iron and Steel Federation, Japan Cement Association, Japan Chemical Industry Association, and other trade groups produced a public comment document on October 8, 2010 that presented a unified opposition voice to the proposed legislation. The coalition argued that Japanese industries already operate at the highest energy efficiencies in the world and should not face further burdens that might undermine their competitiveness (Japan Automobile Manufacturers Association 2010). The group also called for more details on the relevant sectors and industries affected by the proposed emission reductions, including estimates of implementation costs.

Given the strong opposition to mitigation requirements by Japanese industry, it may be reasonable to assume that any policies developed to reach the newly announced midterm targets will not put significant burdens on the industrial sector.

United States

The United States has no national climate change regulation, though legislation has been proposed numerous times in various forms. Regional initiatives focused on the energy sector have been established to reduce emissions (e.g., the Regional Greenhouse Gas Initiative (RGGI) in New England).

After many years of persistent research but no policy or regulation and no ratification of the Kyoto Protocol under the Clinton or Bush administrations, the US Congress and the Obama administration seemed likely to pass climate legislation in 2009 or early 2010, but as of the publication of this report, no such actions have been taken. Related recent actions have included new fuel economy standards (e.g., 35.5 mpg average for 2012–2016 vehicle models (Office of the Press Secretary 2009)), identification by the US EPA of carbon dioxide (CO_2) as a public health and welfare threat (US Environmental Protection Agency 2009), and a reporting requirement by the EPA for all entities with annual greenhouse gas emissions of 25,000 metric tons or more, which became effective in December 2009 (US Environmental Protection Agency 2010). Vehicle and engine manufacturers emitting at these levels would be required to report beginning with model year 2011 (US Environmental Protection Agency 2009).

One recent analysis considered the impacts of US climate change regulation under the EPA's mandatory reporting rule in the manufacturing sector. It found that for the vast majority of manufacturers, the annual cost of all environmental controls is less than 1 percent of a manufacturer's value of shipments and that because there are relatively few available end-of-the-smokestack solutions for reducing emissions, manufacturers will look for efficiency gains and potentially offset any increase in costs associated with EPA's regulation of carbon dioxide under the Clean Air Act (Bradbury 2010).

European Union

The European Union (EU) has had a CO_2e cap and trade scheme in place since 2005. Prices per ton of CO_2e are about 12–14 Euros (European Climate Exchange n.d.). The total value of the market (carbon price times allowances, which are 1000 tons of CO_2e each) was approximately $125 billion in 2008 (European Climate Exchange n.d.).

Under the system, EU companies emitting large amounts of CO_2e must measure and report their CO_2e outputs to a central authority, which sets the number of allowable permits. Companies are then allowed to trade those permits based upon which companies can reduce emissions levels at a more cost-effective

rate than other companies. The primary sectors covered by the scheme are oil, iron and steel, cement, glass, and pulp and paper. Currently approximately 12,000 facilities across Europe participate (Pew Center on Global Climate Change 2009). Critics of the system say that it made the mistakes of allowing for too many credits and of giving the credits away (Pew Center on Global Climate Change 2009).

In April of 2009, the European Commission reported that emissions had begun dropping in the EU (Kanter 2009), though at least part of the drop was likely due to the economic recession.

4. Industry Voluntary Efforts

Despite the absence of a binding global accord to replace Kyoto, some industries and industry associations have taken an active role in influencing the debate in the US. Ford has been a member of US Climate Action Partnership (USCAP) since 2007. USCAP is a "group of businesses and leading environmental organizations that have come together to call on the federal government to quickly enact strong national legislation to require significant reductions of greenhouse gas emissions" (US Climate Action Partnership 2009).

Despite faltering international and US regulatory efforts, Ford Motor Company has committed to addressing climate change and states in its 2009 Sustainability Report that it supports government action to regulate GHG emissions and especially advocates for a market-based cap and trade system, an approach that is consistent with USCAP's position (Ford Motor Company 2010). Ford has consistently maintained its work in this area and will pursue emissions reductions throughout the value chain to meet multiple objectives.

D. SUPPLY CHAINS AND SOURCING IN THE AUTOMOTIVE INDUSTRY

The automotive industry supply chain is complex, global, and characterized by multiple tiers between the original equipment manufacturers (OEM) and raw material production (Koplin, Seuring and Mesterharm 2007).

1. Supply Chain Structure at Ford

Ford's suppliers are located in over 60 countries around the globe. Over 1,600 tier-one suppliers do business at over 4,600 facilities to contribute to the 130,000 parts the company makes (Ford Motor Company 2010).

Current trends at Ford are toward stronger relationships with key suppliers (ABF suppliers) while also toward consolidating the total number of suppliers. Between 2004 and 2008, Ford reduced its total number of tier-one suppliers from 3,300 to 1,600 (Ford Motor Company 2009). The ABF supplier program began in 2005, and between that time and 2010, Ford has designated 67 production and 23 non-production suppliers to the program for a total of 90 ABF suppliers (Ford Motor Company 2010).

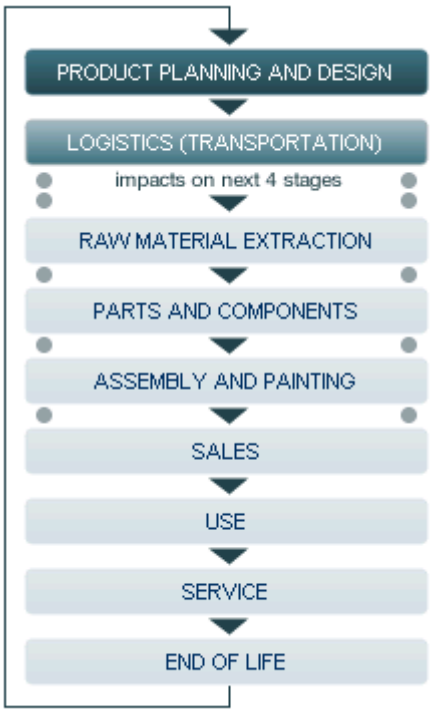

Figure 3: Graphic Showing the Stages of the Value Chain at Ford.
Source: Ford Motor Company, Sustainability Report 2009/2010

2. Current Industry Reporting

Within this complex and global supply chain, Ford has consistently measured and managed its suppliers' labor policies (related to working conditions and human rights) as well as the hazardous materials content of its vehicles. For human rights and working conditions, Ford developed a code of conduct that governs its own operations and mandates that every supplier develop its own code of conduct that meets Ford's expectations (Ford Motor Company 2010). For hazardous materials, Ford uses the International Materials Data System (IMDS), which Ford worked with the Automotive Industry Action Group (AIAG) to develop. IMDS is a database that allows suppliers to enter the materials content of each part they sell so that the OEMs can monitor the materials content for the purpose of avoiding specific hazardous materials. Both of these initiatives rely on industry collaboration through AIAG. This industry-level work sets a precedent for industry-level supply chain GHG management.

E. GREENHOUSE GAS EMISSIONS AND SUPPLY CHAIN

1. Sources of Carbon Emissions in Supply Chains

Greenhouse gas emissions are a part of every phase of the value chain and every tier of the supply chain. Emissions result from the extraction of resources (which can release methane), the transportation of goods (which requires burning fossil fuels), the manufacturing of finished goods or parts (which requires energy), and finally the warehousing and storage of the product (which also requires electricity and heating) (Huang, Weber and Matthews 2009). Supply chain-related emissions can also be produced by non-fuel process sources, such as fugitive emissions from industrial processes, chemical reactions, and agricultural production, as they pertain to the production and distribution of goods and services.

2. Greenhouse Gas Cost of Manufacturing Overview

Energy costs from manufacturing

Energy costs for manufacturing and other activities in Ford's supply chain can be highly variable, but understanding likely increases and variability are important for predicting future cost structures. The US Energy Information Administration (EIA) website (US Energy Information Administration 2010) and the International Energy Agency (IEA) website (International Energy Agency 2010) both provide resources for understanding these costs, including likely global trends. Understanding and predicting likely increases and variability in energy prices will help companies prioritize which types of suppliers to work with on energy use, as described in the recommendations below. For example, on a geographic basis, the Energy Information Administration's *International Energy Outlook* from 2010 highlights the projected energy demand increases in non-Organisation for Economic Co-operation and Development (OECD) countries as far outpacing growth in OECD countries, indicating that energy supply will be tighter and likely more volatile in non-OECD countries (US Energy Information Administration 2010), and hence likely presents higher risk to Ford's supply base there.

Costs from pending legislation

Legislation in various markets around the world is already influencing the price of GHG emissions, and this price will likely affect Ford's suppliers' cost structure (Duggan 2009). Specific cost implications can best be understood through a detailed understanding of the GHG emissions of Ford's suppliers from each geographic area that regulates GHG emissions. The issue is discussed in the preceding policy analyses in this paper.

For Ford specifically, understanding its supply chain's GHG emissions is important due to the cost implications that a carbon tax or cost will have. Energy-intensive activities such as steel and plastics manufacturing (Energy Information Administration 2007) would see their costs increase noticeably with a tax on carbon, making it relevant for Ford to understand how those costs may affect its purchasing activities. Responsibility for understanding these changes is held by the purchasing department at Ford. Sustainable supply chain efforts are housed within this department.

Supply chain GHG emissions reductions

While it is not possible to prescribe specific emissions reductions across the board for suppliers, actions that reduce emissions can be generally described in four categories as follows (Easton 2010):

1. **Energy efficiency increases**: These can include tuning machinery to use less energy during downtime (e.g., using standby modes), switching to more efficient products (e.g., compact fluorescent light bulbs for facility lighting), or behavior change initiatives to increase efficient use of energy-consuming devices.
2. **Process improvements**: These can include the use of new technologies or methods that require lower energy inputs as well as improvements to non-fuel combusting emissions sources. For example, switching from hydraulically powered injection molding machines to electric powered models has proven effective at reducing energy consumption (Gutowski, Dahmus and Thiriez 2006). Because supporting infrastructure and machinery often use a majority of energy for a specific process, increasing the rate of processing can also reduce life cycle energy use for the product being manufactured by maximizing the utilization of the supporting components (Gutowski, Dahmus and Thiriez 2006).

3. **Lower carbon content energy use**: This can be the use of renewable energy sources such as wind or hydropower, or fuels with lower carbon content than a previously used fuel or the grid average (e.g., switching from coal to natural gas (US Department of Energy 2007)). Purchase and retirement of renewable energy certificates can also represent reductions in carbon intensity.
4. **Product life cycle improvements**: When organizations have taken substantial action to improve energy efficiency and reduce emissions from their own operations, the next area of focus is often on "green" products (Kielstra 2010). These may include design changes to reduce use-phase emissions such as lighter weight parts or improved insulation, or material choices that have less impact such as renewable fibers or recycled content (CDP Supply Chain Responses to Ford request 2010).

Emission reduction efforts can lower costs for both the upstream supplier and the downstream customer.

3. Issues in Supply Chain Greenhouse Gas Measurement

Supply chain GHG measurement is an emerging field, and measurement standards are still in development (The Greenhouse Gas Protocol n.d.). Specifically, many questions remain about setting emissions profile boundaries, evaluating suppliers, and achieving reductions. These uncertainties add to the complexity of modeling greenhouse gas-related costs, as described in the above section.

Completeness versus accuracy in data

LCA software can provide a reasonable estimate of a material or product's environmental profile. However, because the emissions from a particular supplier type are generally not available in life cycle inventory (LCI) databases, supplier-reported data, if properly acquired, is likely to be significantly more representative than data from LCA databases. After all, suppliers are far more knowledgeable of their operations, including the materials and fuels required to produce their products. However, due to the dynamic nature of manufacturing and the contrasting "snapshot" view that physical measurements provide, there are some cases when LCA databases or industry average numbers may better represent the supplier's emissions (World Resources Institute 2010).

In order to gain a more accurate picture of year-over-year progress, supplier-reported data is the most accurate and best able to demonstrate a real change in emissions levels over time. Supplier-reported emissions are more likely to reflect the real processes used and therefore are more likely to reflect any improvements made to given processes. Meanwhile, in order to demonstrate a change in emissions resulting from product manufacturing when using LCA measurement, the data used to conduct the LCA would need to be updated. This type of information can be time consuming and costly to obtain, and it would be difficult for Ford to do accurately. Even if feasibly obtainable, the numbers would not reflect the changing practices of individual suppliers but rather changes in broader industry trends.

Allocation basis of emissions to a customer

In LCA, allocation is the process of attributing portions of environmental burdens and their resulting impacts to different products. Selecting an allocation basis to attribute a percentage of a supplier's total emissions to one customer can be difficult for several reasons: (1) if suppliers produce many different products for Ford, they will need to estimate and allocate emissions associated with multiple parts that may be produced with different methods and emissions intensities; (2) if suppliers produce the same product for multiple customers, they may need to estimate emissions from multiple product lines or facilities and allocate to multiple customers; (3) if suppliers produce products in multiple geographic

regions, they will need to calculate emissions based on multiple geography-specific emission factors, based on diverse fuel types and industrial processes and with consideration for transportation of goods to/from factories and customers; and (4) generally, allocating at the product level is most accurate but also the most difficult to implement, while other less difficult allocation bases (e.g., sales) quickly produce inaccuracies. In these cases, the factors that affect the associated emissions are different; therefore, it is difficult to determine a percentage to attribute to an OEM. Additional data and insight into the supply chain (for example, specific data on transportation logistics for each customer) would improve the allocation process, but such information could be unavailable or costly to acquire.

Supplier relationships

Supplier relationship management is a critical aspect of supplier GHG measurement. In the automotive industry, an important consideration when surveying suppliers is survey fatigue. The problem stems from multiple customer requests for similar information, a concern that the team has addressed in its recommendations and that is discussed later in this report. The team anticipates that this program could strengthen the relationship between Ford and its suppliers, but in order for this to be the case, the program must consider and fit within the full range of supplier engagement and incentives.

Because supply chains are complex and because efficient supply chain management involves balancing multiple variables for each product and supplier, measuring and managing one of those particular variables must consider the supplier relationship holistically. Therefore, measuring and managing only GHG emissions from a supplier would be misleading. Instead, Ford must also consider the context of the supplier's relationship with the company and the other ways in which that supplier is already being engaged by Ford on critical issues like price and quality. A more in-depth look at the considerations for how to integrate GHG management within the context of the broader supplier relationship at Ford appears in the Recommendations section.

F. GREENHOUSE GAS MANAGEMENT IMPACT: CALCULATION OPTIONS

The first step in assessing the emissions impact of a supply chain is to calculate the greenhouse gases emitted during the life cycle of a product. The most recognized and comprehensive approach for these calculations is LCA. LCA is a compilation and evaluation of the inputs, outputs, and potential environmental impacts of a product system throughout its life cycle from resource extraction to disposal (US Environmental Protection Agency 2011). The evaluation of impacts can address a wide variety of environmental metrics such as air and water pollution or waste generation. This report is focused on GHG emissions burden. Among other flows, an LCA provides a quantification of the input energy required to create a product. While LCA can provide the most comprehensive accounting of carbon emissions, it is a technical process that requires a high level of expertise since each step along the value chain of a product is evaluated.

There are two broad categories within LCA: conventional process-level LCA and economic input-output LCA (EIO-LCA). A third approach is known as hybrid EIO-LCA and combines elements of conventional LCA and EIO-LCA. A common issue to all LCA methods is the definition of the analytical "boundary," which determines the scope and exclusion of inputs or processes (Hendrickson 1998). The pros and cons of each approach as well as the applicability to the measurement and management of carbon emissions from complex supply chains are discussed below in greater detail.

1. LCA, EIO-LCA, and Hybrid EIO-LCA

Conventional LCA is a detailed process that traces inputs, outputs, burdens, and impacts at each independent process level from material extraction through end of life (US Environmental Protection Agency 2011). This approach quantifies the energy and material inputs used at each stage as well as the associated environmental impacts in terms of greenhouse gas emissions. Conventional LCA requires extensive analysis of processes, often through direct measurement, known as "primary" data collection. As previously noted, the definition of the project boundary is a crucial first step as it determines the processes and environmental impacts included in the LCA results (Hendrickson 1998). The complexity and accuracy of a conventional LCA comes with certain tradeoffs. The analysis requires significant time for completion and a high level of technical expertise. Results are also highly specific to the system defined and analyzed; therefore, an identical end product made using different processes would have different LCA results. The final results of an LCA include LCI calculations, which quantify all the environmental burdens resulting from a specific amount of product, for example, the equivalent carbon dioxide emissions from the production of 1 kilogram of hot rolled steel (World Steel Association 1999).

In contrast, the EIO-LCA approach is less granular and less time consuming. Based upon economic input-output models, the EIO-LCA method identifies the impact felt in one industry from an increased activity level in another industry (Green Design Institute 2010). The input-output models comprehensively link the various industry activities together and estimate the combined environmental impact from the economic transactions, using the entire economy as the system boundary. For this reason, EIO-LCA may capture upstream effects not covered in a process-level LCA. The EIO-LCA approach is based on publically available but highly aggregated data. Results are widely generalizable; for example, since specific processes are not measured, an EIO-LCA method would produce the same result for any type of vehicle. The EIO-LCA approach relies upon regularly updated public datasets and is not subject to the same level of information gathering as a conventional LCA. Models are available to the general public and do not require special knowledge to complete. The speed of analysis, however, comes at the expense of reduced accuracy. The result of an EIO-LCA calculation is the environmental burden per dollar of economic activity in a certain industry sector (for example, the equivalent carbon dioxide emissions from a $1 investment in the automobile sector). Monetary values may not correctly link scale with resource intensity and environmental burdens; for instance, a 50 percent increase in the purchase price of a vehicle may not correspond to a 50 percent increase in life cycle emissions.

A hybrid EIO-LCA approach draws from both conventional and EIO-LCA approaches (Taylor 2009). The hybrid method first breaks down a value chain into relevant components by analyzing a cost ledger, such as a bill of materials. Once the component materials are identified, they are matched to LCI emissions data from previously published LCA reports and public and private data libraries. This hybrid or "streamlined" approach relies upon secondary data, which are not specific measurements on the system under analysis. This approach contrasts with conventional LCA studies, which collect primary data through observation of specific processes or procedures. Since the LCI data provides information about production impacts, a hybrid EIO-LCA can also include estimates of impacts from the transportation of components from supplier to final manufacturer. In this manner, an estimate of the overall life cycle impact is achievable at considerably less financial cost than a conventional LCA and at a more granular level than an EIO-LCA approach.

Life cycle assessment is a valuable tool for quantifying the environmental burdens of a manufactured product. The application of LCA in a business setting can vary from the approach employed in the

scientific community. Researchers are likely focused on completeness, leading them toward fine-grain analyses of processes and materials. In contrast, business goals may include a ranking or highlighting of emissions "hot spots," which permits a greater margin of error in the estimate of impacts because a general picture, not a precise inventory, is desired. Given these considerations, scientific researchers may perform a conventional LCA while a business may prefer the EIO-LCA or hybrid approach. Despite the LCA method used, another issue facing business managers is the ability to easily update LCA results, or to create a dynamic profile of the life cycle impacts of a product. A dynamic and updateable model would allow a manager to track improvements against a baseline without expending the resources to repeat the data-intensive process of a conventional LCA.

2. LCA Results and Supply Chain Management Considerations

An important consideration for supply chain managers is the allocation of specific environmental burdens to various players in the value chain. This issue arises in instances in which a supplier does not complete a conventional LCA and does not track processes and burdens associated with products supplied to specific customers. In these commonly occurring cases, it is not possible to quantify the exact burdens associated with the production of product for a specific buyer. For example, if a supplier creates multiple products using the same process, it must devise a way to accurately assign the associated environmental burdens to all relevant downstream participants in the value chain. This issue, known as "allocation," can be accomplished in a variety of ways. Two common approaches involve physical relationships (such as product weight) or economic value (such as fraction of total sales volume) (Elcock 2007). In each case, the allocation method is used as a weighting factor to divide the environmental burdens from the production activities of a supplier to their customers. This calculation can be described mathematically:

$$Environmental\ Burden\ Customer\ X\ =$$

$$\frac{Sales\ of\ Product\ to\ Customer\ X}{Total\ Sales\ of\ Product} \times Estimated\ Environmental\ Burden\ from\ of\ Production\ of\ Product$$

The following table highlights the pros and cons of the various allocation methods.

Table 1: Pros and Cons of Allocation Methods.

Source: Ekvall 2001.

Basis	Example	Pros	Cons
Material	Mass or volume	Easily determined using physical properties	May not fully represent physical, causal relationship
Economic Value	Percent of sales	Easily determined using financial data	May not necessarily reflect true environmental burden Prices vary, leading to different outcomes

The issue of allocation highlights one of the reasons why LCA results are difficult to compare. There is no set standard for LCI calculations, although key institutions advocate for use of certain allocation methods.[4] The International Organization for Standardization (ISO) 14041 standards for LCI recognize that allocation should be avoided if possible but do provide guidance in the event that the process is unavoidable (Ekvall 2001). This perspective is shared by WRI and WBSCD, which have addressed the issue of allocation in their forthcoming greenhouse accounting standards for Scope 3 emissions. It is noted in both the ISO and WRI/WBCSD documents that the best allocation method is the one that most accurately describes the relationship between activity and burden (The Greenhouse Gas Protocol 2010, Ekvall 2001). Physical relationships, such as mass or volume, are preferred. If this allocation method is not applicable due to lack of data or other constraints, then emissions can be assigned based on economic value (such as percent of total sales or purchases). As previously noted, the choice of allocation method can make comparisons of impacts across products and suppliers difficult.

3. Existing LCA Studies for Vehicles

The completion of a conventional LCA for a vehicle is a daunting task given that the product is estimated to have more than 20,000 parts (Sullivan, et al. 1998). To combat this issue, modeling of a vehicle has been performed to aggregate the various parts into multipart "components." This approach was followed in a comprehensive LCA study performed by the United States Automotive Materials Partnership (USAMP) (Sullivan, et al. 1998). The researchers modeled the components of a generic vehicle, defined as a hybrid of the Intrepid, Lumina, and Taurus from the 1995 model year, thereby reducing inputs to 644 parts or components.[5] Through a combination of primary and secondary data, the environmental burdens associated with the full life cycle of the vehicle (defined as raw material extraction through use, recovery, and disposal) were calculated. The USAMP study specifically reported LCI data in the following categories: material production, manufacturing, operation (use), maintenance and repair, and end of life.

The USAMP study provides a number of important insights for Ford's greenhouse gas management project. The study modeled a generic vehicle estimated to weigh 1500 kg and to have a lifetime distance driven of 120,000 miles. The vehicle was classified into seven subcategories: powertrain, suspension, HVAC, electrical, body, interior, and fluids. The environmental burdens associated with each category were assessed. In terms of contribution of total energy required to create the vehicle, which in turn relates to relative level of greenhouse gases emitted, the body category ranked highest. Ferrous metals (i.e., iron-based metals) are the largest constituent materials in the body category. The report indicates that the generic vehicle is comprised of 985 kg of ferrous metals, which represents 64 percent of the vehicle by mass. In addition, the report finds that the operation phase of the vehicle life cycle causes the greatest percent of the environmental burdens. For example, this phase consumes 84 percent of the life cycle energy and creates 87 percent of the life cycle carbon dioxide emissions. In contrast, the material production and manufacturing phases contribute to 7.5 percent and 4.3 percent of life cycle carbon emissions, respectively.

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[4] The World Resources Institute and the World Business Council for Sustainable Development are in the process of developing a Product Life Cycle Accounting Standard. The International Organization for Standardization (ISO) has published ISO 14040:2006, which describes the framework of an LCA study but does not specify exact methodologies.

[5] Material in this section is drawn from a review of the USAMP study (Sullivan, et al. 1998).

The USAMP study presents a comprehensive view of the life cycle emissions of a generic vehicle. As previously noted, the use phase contributes the greatest amount of carbon dioxide emissions. Approaches to curb these emissions include "light weighting" of vehicles or specific components or increased fuel economy standards, both of which are beyond the scope of the project completed by the student team. Other studies (including some on Ford-specific products) have explored the complex cost and environmental tradeoffs associated with component design, while still others compare activities by OEMs, highlighting the variety of ways LCA is employed.[6,7] The emissions from supply chain activities, which fall into the life cycle stages of material production and manufacturing, are also significant. In order to further assess the opportunities for reducing these emissions, Ford sought to develop a supplier engagement model. To support this effort, Ford used a dynamic model to analyze the energy and greenhouse gas emissions associated with the production of vehicle components for a specific vehicle class. This model provided information on the impacts of components, which provided the data at the level of granularity needed to support a supplier engagement effort. In order to fulfill program goals, a direct supplier engagement method was preferred to a static LCA model since it allowed for greater communication between Ford and its supply base regarding actual emissions measurement and subsequent management efforts. The methodology and results of this upstream model of the vehicle supply chain are discussed in greater depth in the GHG Emissions Mapping Analysis section below.

4. Greenhouse Gas Emissions Measurement and Reporting Options

Reporting represents a commitment to emissions measurement by disclosing data to the public or a requesting entity (Bailis 2009). Numerous initiatives have been developed to allow and encourage GHG emissions data and management strategy reporting. The following descriptions highlight the primary US-based reporting options.

Carbon Disclosure Project / CDP Supply Chain program

CDP is a non-profit organization that collects, synthesizes, and reports on climate change-related data for over 3,000 organizations in approximately 60 countries (Carbon Disclosure Project 2009). The CDP questionnaire collects quantitative information about company greenhouse gas emissions (Scopes 1, 2, and 3) as well as qualitative responses about physical, regulatory, and financial risks and opportunities associated with climate change; organizational governance and business strategy related to climate change, including reduction targets and activities; and climate change communications (Carbon Disclosure Project 2009). The CDP then discloses these results on their website. The results are disclosed fully for companies that choose to make their reports public and in aggregate for those that do not. The CDP also compiles, synthesizes, and reports results for interested stakeholders. Through this publicly available data, the data summary and reporting that CDP conducts, and the diversity of industries involved, CDP makes climate change information available to a wide audience (Carbon Disclosure Project 2009).

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[6] See, for example, Keoleian, G.A. and K. Kar. "Elucidating complex design and management tradeoffs through life cycle design: air intake manifold demonstration project." *Journal of Cleaner Production* 11 (2003): 61–77.

[7] See, for example, J.J. Chanaron, "Life Cycle Assessment Practices: Benchmarking Selected European Automobile Manufacturers." *International Journal of Product Lifecycle Management* 2, no. 3 (2007): 290–311.

The qualitative questions included in the questionnaire encourage responding companies to identify risks and opportunities associated with climate change. While the method for calculating GHG emissions is not specified, CDP does recommend that companies use the GHG Protocol accounting standards (covered in more detail in the next section).

The CDP has five programs through which companies and organizations report their greenhouse gas emissions data and climate change strategy information. These include two key programs for the purposes of this project:

- **Investor CDP:** This program requests data from the largest global companies, based on market capitalization, on behalf of 534 institutional investor signatories. In 2010, over 2,000 companies responded (Carbon Disclosure Project 2009).
- **CDP Supply Chain:** This program requests data from suppliers on behalf of member companies. The Supply Chain program requests the same information as the CDP Investor program but also includes a supplier module through which responding companies allocate their emissions to the requesting company (See Appendix D for the complete questionnaire) (Carbon Disclosure Project 2010). In 2009, 44 member companies reached out to 1402 of their suppliers (Carbon Disclosure Project 2010).

In addition, CDP has the following programs: CDP Water Disclosure, CDP Public Procurement, and CDP Cities (Carbon Disclosure Project 2010).

CDP has recently announced two relevant new components to its programs. First, the results of the questionnaires will now be integrated into a data management system supplied by SAP and allow for numerous manipulations of the data sets to view chosen elements side by side, in graphs, and in other formats (Carbon Disclosure Project 2009). The capability for this type of analysis should be a significant improvement over the current on-screen or portable document format (PDF) viewing options. Second, CDP has partnered with Trucost, an environmental data company, to offer members a new service that would identify supply chain carbon "hot spots," which would allow more targeted management and use of the supply chain questionnaire (Carbon Disclosure Project 2010).

In summary, CDP provides a robust, consistent, and publicly recognized method for reporting Scope 1, 2, and 3 GHG emissions. Because companies can choose their own calculation methods, reporting to CDP is compatible with other measurement and reporting activities in which companies engage.

GHG Protocol

The GHG Protocol was developed through a partnership between WRI and WBCSD. The GHG Protocol "is the most widely used international accounting tool for government and business leaders to understand, quantify, and manage greenhouse gas emissions" (The Greenhouse Gas Protocol 2010). The framework is used widely by GHG standards and programs as well as individual companies and has become the basis for virtually all other accounting and reporting schemes. For example, the EPA Climate Leaders program, the Climate Registry, ISO, and CDP all reference the GHG Protocol as the source for their accounting guidance, or as an accepted practice to meet their own reporting objectives (US Environmental Protection Agency 2005), (The Climate Registry 2008), (International Organization for Standardization 2007), (Carbon Disclosure Project 2009). The standards are not prescriptive (e.g., emission allocation is at the discretion of the user, product-level reporting is not required), nor does the Protocol provide any data collection, management, or reporting services. The GHG Protocol includes

calculation tools and other guidance to support standard users. Standards are available globally at no charge to users (The Greenhouse Gas Protocol 2010).

The GHG Protocol currently includes two finalized standards: the Corporate Accounting and Reporting Standards and the Project Accounting Protocol and Guidelines. These standards include Scope 1 and 2 emissions as required and Scope 3 emissions as optional. Generally, the standards provide guidance on setting organizational and operational boundaries, identifying and calculating emission sources, tracking emissions over time and setting targets, and verification and reporting of emissions (The Greenhouse Gas Protocol Initiative 2004). The GHG Protocol will soon include two additional standards: the Corporate Value Chain (Scope 3) Accounting & Reporting Standard and the Product Accounting & Reporting Standard. WRI/WBCSD released the Second Draft standards in November 2010, extending the public comment period until December 2010 (The Greenhouse Gas Protocol 2010). Finalized standards will be released in September 2011 (World Resources Institute 2011).

The GHG Protocol serves as the de facto standard for GHG emissions accounting at the corporate and project levels and is recommended as part of several measurement and reporting schemes (though it does not provide any data collection or reporting capabilities of its own). GHG Protocol continues to stay relevant with the ongoing development of product and value chain level emissions accounting standards.

The Climate Registry

As defined, "The Climate Registry is a nonprofit collaboration among North American states, provinces, territories and Native Sovereign Nations that sets consistent and transparent standards to calculate, verify and publicly report greenhouse gas emissions into a single registry" (The Climate Registry n.d.). The Climate Registry (the Registry) links together existing registries including the California Climate Action Registry and Eastern Climate Registry. Members are required to report both direct and indirect emissions, though only electricity and steam consumption emissions are required under the indirect category. Results have to be verified (The Climate Registry n.d.). There are currently 432 Registry members representing the corporate, non-profit, and government sectors (The Climate Registry n.d.). The Registry's online greenhouse gas calculation, reporting, and verification tool is called Climate Registry Information System (The Climate Registry n.d.). Public member reports are available on the registry's website. Ford is currently a member of the Registry.

The Climate Registry is an emission reporting scheme that provides a tool for calculating, reporting, and verifying emissions information. Like CDP, member reports are available on the Registry's website. Unlike CDP, however, the Registry does not provide a program for collecting emissions data from suppliers.

US EPA Climate Leaders

US EPA Climate Leaders is a voluntary corporate partnership program for reporting GHG emissions. The GHG accounting methodology used for the reporting is based on WRI's GHG Inventory Protocol (US Environmental Protection Agency 2009). Climate Leaders is a way to publicize companies' ongoing climate initiatives. It provides some guidance, but only in terms of information about GHG Protocol calculations. Climate Leaders is simply a reporting option companies can participate in to gain EPA recognition for their efforts. Specifically, Climate Leaders recognizes companies with publication of corporation-wide inventories of GHGs. To the extent possible, the Climate Leaders program

coordinates with other EPA initiatives such as EnergyStar. Despite being an initiative of the US, the Climate Leaders program does cover the global operations of US companies. It is possible to report Scope 3 emissions reduction measures through the Climate Leaders program.

As of September 15, 2010, Climate Leaders announced that it is phasing down its services and assisting its members with transitioning to other programs.

Climate RESOLVE

Climate RESOLVE (Responsible Environmental Steps, Opportunities to Lead by Voluntary Efforts) is a program of the Business Roundtable, an association of chief executive officers (CEO) of leading companies. RESOLVE, launched in 2003, works with Roundtable members to reduce their GHG emissions through one-on-one counseling, learning sessions, workshops, networking opportunities, and exposure to member company best practices (Business Round Table 2009). Ninety-five companies currently participate, and 70 percent of Roundtable members from every sector of the economy have signed up (Business Roundtable n.d.). Among other things, the initiative coordinates learning sessions on topics such as energy efficiency, green power, government programs, GHG management, best practices and success stories, power, lighting, and heating and cooling (Business Round Table 2009).

The Climate RESOLVE New Member Toolkit collects information from participating companies on whether they engage in program development (e.g., review emissions profile, identify opportunities to reduce GHG intensity, and develop procedures for tracking management goals) and program implementation activities (e.g., take action to reduce GHG emissions, report emissions and reduction projects to the Department of Energy's (DOE) 1605(b) GHG registry, report GHG emissions management actions to the public) surrounding GHG management in past, present, and future time periods. The program collects separate information for those companies seeking to increase energy efficiency in commercial buildings (Business Roundtable n.d.). The Toolkit also provides detailed information for participating companies on how to get started on these initiatives, as well as relevant resources. Under the recommendation to review the company's emission profile, Climate RESOLVE encourages member companies to report their GHG emissions to the DOE's Voluntary Reporting of Greenhouse Gases Program; it also suggests the GHG Protocol for the mapping of emissions. Climate RESOLVE provides support and resources to its members but does not provide a structured emissions measurement or reporting program.

S.E.E. Change

S.E.E. (Social, Environmental, Economic) Change, also an initiative of the Business Roundtable, encourages member companies to adopt business strategies and projects that measurably improve society, the environment, and the economy (Business Roundtable n.d.). The initiative provides a toolkit and resources to guide companies in developing strategy, setting goals and developing metrics, and implementation; the toolkit does not provide detailed recommendations (e.g., how to engage with the supply chain or how to track and report Scope 3 emissions). Water has been elevated as a priority area for the S.E.E. Change initiative. Currently, 37 companies participate (Business Roundtable n.d.).

Like Climate RESOLVE, S.E.E. Change provides resources and support to member companies as they engage in measuring their environmental performance, but it does not provide a structured system.

Global Environmental Management Initiative

The Global Environmental Management Initiative (GEMI) provides tools and strategies for improvement of environment, health, and safety management. Two of the organization's tools relate to Ford's current interests, but neither provides a data collection mechanism comparable to the CDP. The two tools are: (1) the Business and Climate web tool and (2) Forging New Links: enhancing supply chain management through environmental excellence. The first provides guidance for companies interested in assessing risks they may face due to climate change and strategy formulation and implementation for climate change risk management with an emphasis on GHG inventory development (Global Environmental Management Initiative n.d.). While the GEMI resources are quite detailed and numerous tips and links to outside resources are provided, they do not focus on supply-base engagement or data collection. The Forging Links tool places an emphasis on value creation for a company by leveraging cross-functional information sharing. The tool includes a "Value Wizard" to identify areas for improvement in the supply base, but it is not apparent whether carbon mapping is possible.While the tool provides valuable background information, it does not contain methods for or specific guidance on collecting supplier or Scope 3 emissions information in support of LCA or other measurement/management of supply-base emissions (Global Environmental Management Initiative n.d.).

United Nations Global Compact: Caring for Climate

The United Nations (UN) Global Compact Caring for Climate initiative provides Global Compact signatories a method for publicly reporting on corporate GHG emissions. Similarly to the Global Compact, companies must officially endorse or support Caring for Climate at the CEO level in order to be a part of this initiative. Doing so allows companies to be recognized at UN meetings and on the Caring for Climate website and to theoretically influence public policy. Caring for Climate requires companies to report on their carbon emissions and efforts to reduce emissions. It recommends doing so through the Carbon Disclosure Project and in the company's sustainability report. As of now, Caring for Climate recommends that signatories report on Scope 3 emissions through the CDP or other methods but does not require such reporting (Karbassi and Katarzyna 2009). It is worth noting that a study of the progress made under the Caring for Climate program found that using CDP reports was more feasible than the reports prepared specifically for Caring for Climate (Bailis 2009). Note that while Ford has been a member of the UN Global Compact since 2008 (Ford Motor Company 2008), it is not a Caring for Climate signatory (UN Global Compact n.d.).

US Department of Energy Voluntary Reporting of Greenhouse Gases Program

This voluntary reporting program was established by Section 1605(b) of the Energy Policy Act of 1992. The initiative encourages corporations, nonprofits, agencies, households, and other entities to submit annual reports of their greenhouse gas-related activities (emissions, reductions, and sequestration activities). Reported information is entered into a database, and all non-confidential information is made publicly available on a reporter-specific basis. A database for 1994–2005 data is available on the website. After a break from 2005–2009, the guidelines for reporting have been revised, and EIA indicates it has collected 2009 data and anticipates releasing the public database in early 2011 (US Department of Energy n.d.). The Simplified Emissions Inventory Tool (SEIT) collects data on direct and indirect emissions (from purchased steam and electricity; others may be reported but are not included in total emissions), process and agricultural emissions, and deforestation emissions. Additional emission inventory tools and emission reduction tools are also available (US Department of Energy n.d.). As

demonstrated above, there are diverse tools available for measuring, reporting, and managing GHG emissions, with each resource focusing on one or two of these areas. Companies seeking to manage their emissions should evaluate how each method does or does not meet their management objectives and will likely find that more than one is relevant to their operations. In fact, Ford already employs several tools for their GHG management program including CDP, GHG Protocol, The Climate Registry, and US DOE as well as country and region-specific emissions reporting and trading schemes.

G. GHG MANAGEMENT INITIATIVES IN THE AUTOMOTIVE INDUSTRY

Within the automotive industry, GHG emissions measurement, management, and reporting in the supply chain are gaining traction. To date, several OEMs have reported their own operational emissions to the Investor CDP; however, the number of companies that have surveyed their suppliers to request data about carbon emissions is much smaller and efforts have been irregular and inconsistent.

1. Company-level GHG Management

In 2010, several automotive OEMs reported to Investor CDP, including: BMW Bayerische Motoren Werke, Daimler, Fiat, Ford, Honda Motor Company, Hyundai Motor, Nissan Motor, Toyota Motor, and Volkswagen (Carbon Disclosure Project 2010). To benchmark the industry with regards to GHG management, the team reviewed selected publicly available CDP responses.[8] In most cases, these responses represented the global operations of the company; as a result, US-specific activities are not described explicitly. Of those companies reviewed, all report their Scope 1 and 2 emissions and certain companies report selected Scope 3 categories or indicate that they have determined that some emissions in a Scope 3 category are negligible and therefore not worth reporting. Four of five indicate they use the GHG Protocol Corporate Accounting Standard, and some indicate they use additional measurement tools. In most cases, varying percentages of reported emissions are verified. Several of those companies reporting have emissions reduction targets, both through product improvements (e.g., improving fuel efficiency of vehicles, diversifying energy sources for cars) and process improvements (e.g., increasing energy efficiency in manufacturing facilities). Select companies indicate they are performing LCAs on their products; all the companies participate in the EU Emissions Trading Scheme. Finally, almost all indicate that climate change governance lies at the board or executive board level.

The reporting companies' supplier engagement is less well documented in their responses, and, as described in the next section, GHG data collection from the automotive supply base is just now getting started. Select companies indicate they have requirements of suppliers with regard to environmental and social responsibility. One company indicates that the process of collecting data is being discussed within their industry group. A noteworthy initiative to increase the environmental performance of suppliers involves General Motor's international operations. Shanghai GM (China) and the World Environment Center (WEC) have been collaborating to green the automotive supply chain in their "Drive to Green" initiative. The program currently has 128 participating suppliers. The initiative has reduced greenhouse gas emissions, energy consumption, water use, solid waste, and wastewater. GM Holden (Australia) has coordinated with WEC in a similar fashion, engaging 10 suppliers to implement energy and water use efficiencies and improved environmental performance (World Environment Center 2009-2010). Honda Motor Company has also announced that it will expand evaluation of its suppliers to include

[8] Reviewed Investor CDP responses for the following companies: GM, Honda, Peugeot, Toyota, and Volkswagen.

environmental metrics, under its revised Green Purchasing Guidelines. The guidelines will apply to all suppliers (originally they applied only to suppliers in Japan) and aim to track product impacts (including emissions) further upstream beyond tier-one suppliers (Bardelline 2011).

2. Industry-level GHG Management

AIAG was founded in 1982 by Ford, Chrysler, and GM to provide a forum for OEMs, suppliers, and other industry representatives to collaboratively develop solutions to promote the prosperity of the automotive industry (Automotive Industry Action Group 2010). In 2009, Ford and a handful of other automotive manufacturers as well as automotive suppliers and consultants joined the AIAG Greenhouse Gas Work Group with the purpose of improving individual and industry sustainability efforts and to develop a standard approach to gathering GHG inventory data. They believe that "having a common and accepted system which is accepted by the OEM's and Supply base will eliminate duplicate reporting requirements, support a common, comparable, and compliant reporting process, and will result in cost savings for the member companies" (Automotive Industry Action Group 2010).

Participating GHG Work Group members at the time of this report writing include: Benteler Automotive Corporation, Chrysler Group LLC, Daimler AG, DENSO International America, Inc., Ford Motor Company, General Motors Company, GZA GeoEnvironmental, Inc., Honda Motor Company, Inc., Honda of America Manufacturing, Inc., Johnson Controls, Inc., Lear Corporation, Magna International Inc., PTC Product Analytics, RSJ Technical Consulting, Steel Recycling Institute, Summit Energy, Tetra Tech, Toyota Motor Engineering & Manufacturing North America, Inc., and TRW Automotive (Automotive Industry Action Group 2010).

In 2010, the work group released a universal data collection tool and guidance based closely on the team's document for Ford's information request (see Appendix A). Currently, the form requests Scope 1 and 2 GHG emissions, broken out by GHG type and allocated to the requesting customer on the basis of percentage of sales; it will be updated as industry needs change. It will be used by OEMs and suppliers to request GHG data from their suppliers (Automotive Industry Action Group 2010).

III. SUPPLY CHAIN GHG MANAGEMENT STRATEGY DEVELOPMENT AT FORD

A. PROJECT OBJECTIVES

As described above, manufacturing companies are recognizing the risks associated with carbon-intense manufacturing given energy price volatility and likely future regulation of GHG emissions. Ford has determined the importance of engaging with its supply chain to measure and manage GHG emissions as they pertain to the company's GHG footprint. As a result, Ford has identified the following corporate and supply chain objectives for GHG management.

1. Ford Corporate Objectives

- Build on existing Scope 1 and 2 emissions measurement, reporting, and reduction successes
- Secure business protection by understanding the risks from climate change

2. Ford Supply Chain Objectives

- Assess supplier readiness to measure and report
- Identify emissions hot spots and establish a baseline
- Identify opportunities for energy efficiencies
- Understand cost of carbon impacts under cap & trade and accompanying scenarios (e.g., tariffs)
- Lead industry development of universal tools and emission estimation methodologies as well as wider-scale supplier engagement.

3. Project Team Objectives

At the project outset, the team identified several of its own objectives for working with Ford to develop its supply chain carbon management strategy. These objectives are listed below.

- Identify key factors impacting a company's supply chain carbon management approach and relationships between these factors. Balance these factors to best meet Ford's company-specific needs. For example:
    - Measuring carbon in the supply chain can focus on depth or breadth, but accomplishing both is labor and time intensive and may not be necessary for effectively engaging suppliers to identify and reduce carbon emissions.
    - Proxy or estimated data for the entire supply chain enables Ford to identify risks and opportunities across the supply chain while product/supplier-specific data enables Ford to track real, primary data over time.
    - Climate change data and governance serve different purposes in an organization; both are necessary.
- Identify and evaluate carbon impacts on the automotive supply chain, recognizing that this is the newest frontier in company carbon emissions measurement and management.
- Through a supplier engagement survey, assess other companies and industries to assist Ford and the automotive industry to evaluate their options for managing carbon in the supply chain through emissions measurement and supplier engagement.
- Make short-, mid-, and long-term recommendations for future measurement, reporting, and engagement around carbon in the Ford supply chain.

Through the supplier data and information request (described in more detail below), the team has focused on helping Ford meet the following supply chain goals:

- Assess supplier readiness to measure and report
- Identify emissions hot spots and establish a baseline
- Lead industry development of universal tools and emission estimation methodologies as well as wider-scale supplier engagement.

The team provided preliminary insight on the remaining objectives, and Ford will continue to pursue these without the assistance of the University of Michigan team.

B. GHG EMISSIONS MAPPING ANALYSIS

The first step in the project was to evaluate the results of a carbon mapping model used by Ford. Specifically, Ford analyzed the life cycle energy and carbon intensity of a generic European Focus vehicle using proprietary hybrid EIO-LCA software. Because this was undertaken prior to the engagement of the student team, certain assumptions and calculations were taken as given and the focus of the analysis was on the modeling results, not the modeling methods.

1. Goals and Approach of Mapping Analysis

As noted above, although Ford has completed previous research on the environmental impacts of the vehicle supply chain, the model results are not dynamic and cannot be easily updated with new information on materials and processes. As a result, Ford sought a dynamic model of the environmental impacts from energy consumption in its upstream supply chain and therefore turned to proprietary hybrid EIO-LCA modeling software. The environmental impact modeled was "carbon intensity," or the carbon emissions associated with the energy consumption of the upstream value chain for the vehicle, measured as kg CO_2e per vehicle. This approach quantified the energy required from material extraction through processing and shipment of finished components to Ford manufacturing locations. The use and end-of-life phases were not included in the analysis.

2. Analytical Results

The main output of the hybrid EIO-LCA model was the carbon dioxide equivalent emissions per component, on a per single vehicle basis, described as "CO_2 equivalents per vehicle identification number (VIN)." This metric defined the carbon intensity of the various components. The graphing options in the software allowed users to quickly determine the carbon "hot spots" in the value chain.

The output of the model showed the areas of the supply chain contributing to the largest fraction of GHG emissions from energy consumption. The components identified drove the supplier selection process for the bench testing engagement described below in greater detail. The hybrid approach used was not as accurate as a conventional LCA since it did not measure the specific processes used in the manufacturing of the components. However, the level of analysis and specificity matched Ford's project and business goals, namely to develop a dynamic model that provided a ranking of components by energy and carbon intensity.

C. BENCHMARKING SUPPLY CHAIN ENGAGEMENT

At the project outset, the team assessed the automotive industry as well as other industries to determine how other companies are engaging with their supply chain partners on the measurement and reporting of GHG emissions. This would inform the approach to designing a supplier engagement program for Ford. As discussed above, while several automotive OEMs are measuring and reporting their own operational emissions, their supplier engagement efforts around GHG management are just getting started. However, there are several other companies and industries that do collect GHG data from suppliers, as demonstrated by the approximately 50 companies that request climate change-related information from their suppliers through the CDP Supply Chain Program, representing diverse industries such as technology, aerospace and aviation, food and beverage, and energy. To better understand supplier engagement in these other industries, the team interviewed four manufacturing companies[9] that have surveyed their suppliers through the CDP Supply Chain program. These findings are relevant to Ford's involvement with CDP and more broadly to its overall supplier engagement strategy around GHG management. The team's findings are summarized below.

1. Data utility

The usefulness of the data collected depends on the goals of the company. Data collection for the purposes of information disclosure (e.g., CDP) may be useful for prompting companies (e.g., suppliers) to begin or continue measuring their impacts and for being accountable for these impacts. It can also be helpful for understanding what suppliers are able, and willing, to report. However, requesting companies should consider the value gained from collecting information. If the data is not being driven by a sustainability strategy, if it is not being used with clear outcomes, or if the company lacks resources to manage the collection and analysis, then data collection efforts may not be worthwhile. The data collected should be relevant to the audience (e.g., procurement department, investors). Companies should also consider the burden to suppliers who are requested to provide data, particularly if they receive repeated or multiple requests without clear benefit. In summary, it can take companies time to determine how best to use the data they have collected, however, they should be as proactive as possible when making requests to maximize utility and decrease burden to suppliers.

2. Ease of use

When collecting data from suppliers, companies should think about how they will manage the information. Given their goals and anticipated uses of the data, they should request data in a format that maximizes ease of use. A company with limited resources (including staff, time, and/or budget) could consider requesting less data that is more tailored to meet organizational objectives, thereby reducing the volume of data that must be managed and time spent engaging with suppliers to gather data. Companies with increased access to resources can more easily collect and process larger volumes of data. Automating data collection and management can make the data easier to use for all types of companies because it minimizes manual handling of data (e.g., through the compilation of Excel files). CDP Supply Chain uses an online interface to collect data from responding companies and is continuously improving automated processing and analysis capabilities.

[9] The names of the four companies are not disclosed due to privacy reasons.

3. Comprehensiveness of data

Generally, the comprehensiveness of the information provided by companies depends on the question asked. While some questions include strictly a numerical value (e.g., metric tons allotted under a trading scheme), others provide detailed information on qualitative characteristics (e.g., greenhouse gas emissions reporting and reduction initiatives). The comprehensiveness also depends on the company responding (e.g., the level of detail provided or the thoroughness of response). A requesting company should consider what data and level of detail would be most helpful for their objectives.

4. Selection of suppliers for engagement

There is no standard method for selecting suppliers with whom to run a data collection survey. Each CDP Supply Chain member company interviewed took a slightly different approach, but most were based on one or more of the following factors:

- Total spend (i.e., dollar volume of production purchased by Ford)
- Top-tier suppliers
- Strategic partners
- Heavy CO_2e emitters
- Division representativeness (i.e., suppliers from across the company functions)
- Internal choice (i.e., by sourcing department)

High response rates and successful responses (i.e., suppliers who were asked to participate that actually did) were attributed to a variety of factors. Key lessons from the supplier engagement activities conducted to date by the four companies are highlighted below.

- *Request should come from procurement*. Companies noted that because procurement divisions already have established relationships with suppliers, leveraging these relationships tends to yield higher response rates.
- *Supplier contacts should be oriented to and educated on the subject and project.* Some existing supplier relationships may make this unnecessary, but getting the level of detail sometimes requires work with buyers or commodity directors who may or may not have an interest or understanding of the project. One company set up an orientation session that CDP agreed to provide to address this concern.[10] Another company holds an annual supplier expectations meeting, which they have used to introduce sustainability and the CDP project and its value.
- *Supplier contacts should be in the environmental or sustainability divisions and not public relations or sales*. Identifying the person who will assume direct responsibility for the reporting is critical to successful communication and completion of the survey.

The team also researched industry-level initiatives to promote environmental and social sustainability and engage with their supply base. The Electronic Industry Citizenship Coalition (EICC) "promotes an industry code of conduct for global electronics supply chains to improve working and environmental conditions." Membership is open to manufacturers, software firms, ICT firms, and manufacturing service providers (Electronic Industry Citizenship Coalition n.d.). There are two levels of EICC

[10] Note that the session had not yet taken place at the time of the company interview, so effectiveness of the session could not be gauged.

membership, one for companies that are applying for EICC membership status and another for companies that are full members. All members must publicly report their commitments to EICC's goals and guidelines and must use the code of conduct, as well as relevant tools and applications, in their relationships with their suppliers. EICC also produces an annual progress report that incorporates data from members (Electronic Industry Citizenship Coaltion n.d.). Upon deciding to measure energy consumption and carbon emissions in the electronics supply chain in 2009, the EICC developed the Carbon Reporting System, whereby suppliers could enter enterprise carbon emissions data into a central online repository (Business for Social Responsiblity and Electronic Industry Citizenship Coalition 2010).

D. SUPPLIER ENGAGEMENT BENCH TEST

In order to ultimately address carbon emissions management in the supply chain, it is essential to engage suppliers both for data collection to track progress over time and for qualitative contextual information to understand their level of maturity with regard to GHG emissions and climate change management. The latter allows for targeting training, or sharing, of best practices to move companies forward. However, given Ford's extensive network of suppliers (described above), several limitations to a full assessment of GHG emissions in the supply base guided the team toward a targeted initial data and information collection.

The benefits of a targeted information and data request versus a full-scale survey include: the ability to glean lessons from the first iteration and refine the data collection process before expanding it to more suppliers, the possibility for identifying gaps in carbon emissions measurement by suppliers (indicating potential areas to focus on in the future), and collection of feedback on the process from a select subset of suppliers, all while initiating relationships on the topic with strategic suppliers. There are also challenges associated with this effort such as the possibility for incomplete or inaccurate responses that might not provide enough insight for future data requests or results that indicate that data collection is infeasible. Suppliers may also respond negatively to an additional request for information.

To assess supplier readiness to measure and report GHG emissions data, the team utilized two questionnaire approaches. In this emerging space of supply chain emissions measurement, the GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard and the Carbon Disclosure Project supply chain module represent the current state of the art. Therefore, the team employed both organizations' approaches for this analysis.

1. GHG Protocol Scope 3 Emissions Accounting Standard

Scope 3 emissions, the "other indirect emissions" defined in the introductory section of this report, have been an optional reporting category for entities reporting their GHG emissions. Due to the prominence of the existing Scope 1 and 2 standards, the team deemed it appropriate to understand how the new draft Scope 3 standard would address supply chain emissions reporting and data accounting with the expectation that WRI/WBCSD's approach would again become the de facto global standard. WRI/WBCSD develops standards through a collaborative stakeholder participation process and invite companies to trial the standards and provide feedback on their feasibility and usefulness (The Greenhouse Gas Protocol n.d.). To best understand the developing standard, the team, in collaboration with Ford staff members, took on the role of "road testers" for Ford for the standard development and feedback process from December 2009 through June 2010. The following sections detail the process and outcomes.

2. CDP Supply Chain

Prior to the development of the Scope 3 standard, the CDP had added its supply chain module in 2009, which also offered a method for collecting emissions data from suppliers. While the WRI/WBCSD standards are considered state of the art for emissions accounting, CDP has established a leadership position for reporting emissions information. The team had evaluated this option previously (as described previously) and recommended that Ford participate with a limited membership, allowing it to survey 10 suppliers. The process for collecting supplier data via CDP, however, was on a later timeline (not beginning until March) and would not be available as a survey mechanism for the WRI/WBCSD road test. Therefore, the approach discussed above was used for the road test. In effect, it was a limited version of the CDP questionnaire with greater detail in the data request. This approach gave the team the opportunity to survey more than the 10 suppliers allowed via CDP.

E. DATA AND INFORMATION COLLECTION DESIGN

1. Data Collection Methods

Two key components to assessing supplier emissions management are the actual GHG emissions data and qualitative information describing a company's overall approach to climate change strategy. The data provides quantified estimates of emissions and the basis for assessing emissions changes over time. The qualitative information indicates a supplier's level of sophistication in considering climate change risks and opportunities and providing more detail on their actions to reduce emissions. Combined, the two provide a complete picture of emissions management.

To address these aspects of carbon measurement and management, the data and information collection with both methods included questions in each of the following areas:

- Perceived risks and opportunities of climate change
- Emissions measurement
- Emissions management
- Reporting
- Governance
- Engagement beyond operational control

Appendix H displays a complete crosswalk between the specific questions asked under each survey and these categories of information. These six categories of information represent the key aspects of corporate emissions management. Active involvement in each area indicates best-in-class management.

The team opted to only request Scope 1 and 2 emissions from the suppliers. This decision was based on two factors. First, it seemed unlikely that requesting Scope 3 emissions would yield any benefit at this time since information from conversations between Ford and other OEMs at AIAG sessions indicated that any request might meet significant resistance and few suppliers would be able to provide information on their own Scope 3 emissions. Second, in discussing the possibility of carbon-related costs introduced by regulations, it seemed more likely that given the nascent state of LCA use by businesses, any such cost would be passed on in overhead at a corporate level from a supplier to a customer. That is to say that no purchased product-level energy information would be attached to a cost of carbon, and any increase in cost to Ford would come in the aggregate, combined across products from any given supplier. The CDP Supply Chain questionnaire does ask about a supplier's Scope 3 emissions,

but it does not request that these be allocated to the customer (See page 11 of the 2010 Supplier Information Request).

Scope 3 Standard Road Test

For the WRI/WBCSD road test, the team developed a data collection form and guidance for completing it (see Appendices B and C). The data collection form was modeled off of the GHG Protocol Corporate Standard and requested Scope 1 and 2 data for the six Kyoto Protocol greenhouse gases for the most recent year available. The qualitative questions reflect the same types of questions asked in the CDP investor's questionnaire regarding assessment of climate change risk and opportunity, institutional governance, reductions in emissions, and use of LCA to improve product design or evaluate emissions reduction opportunities. In addition, with an eye toward future expansion of the supply base data collection efforts, a question was included asking whether suppliers worked with any of their own suppliers on these issues.

Carbon Disclosure Project Supply Chain program

The CDP Supply Chain questionnaire includes many similar questions (see Appendix D for the complete questionnaire). The survey was used "as-is" because it covered almost all details the team felt were important and because it is not customizable.

2. Supplier Selection

Several factors were considered in selecting suppliers to survey. It was important to collect meaningful and useable information in a short period of time, which led Ford and the team to select a set of suppliers with specific characteristics in mind. While an ideal baseline survey might use a random statistical sample or attempt to cover all suppliers in a given group (i.e., tier one or ABF), important considerations germane to the business environment apply to the selection. Not least among these, the existing business relationship is important. Suppliers who are considered strategic, as indicated by membership in Ford's ABF program, may be more likely to respond, potentially skewing the response rate. However, they may also be more willing to engage in collaborative efforts to reduce emissions—the ultimate goal of the supplier engagement effort. Had WRI/WBCSD already developed a clear, widely-accepted tool for surveying broad groups of suppliers for Ford's Scope 3 emissions, it may have been an appropriate method for surveying a large random sample. Absent such an established tool, a group that represented many characteristics but also had a high likelihood of responding was chosen. Each factor considered in selecting suppliers and how that factor was used to make the final selection is described below.

- **Carbon intensity**: As the first step in supplier selection, using results from a generic model of carbon emissions for a Ford EU Focus vehicle (measured as kg CO_2e per VIN for component parts and as CO_2e per amount of material in a vehicle for raw materials), the team ranked the parts by intensity.
- **Relationship with Ford**: Ford's ongoing ABF strategy has identified suppliers that Ford sees as key to its long-term business objectives (see Supply Chains and Sourcing in the Automotive Industry for a description). Whether or not a supplier was identified as ABF was considered in the selection process. It followed logically that these ABF suppliers were the ones most likely to be able and willing to engage with Ford on this topic. Therefore, when a given emissions-intensive commodity was supplied by more than one supplier, a supplier with ABF status was given preference over the non-ABF supplier for the survey. This category of consideration

extended beyond ABF/non-ABF designation in a few instances, however, as Ford provided several adjustments to the originally selected list to better meet their preferences for which suppliers to work with.

- **Portion of Ford's business (turnover)**: This factor reflected the fact that some suppliers represent major portions of Ford's production purchasing spend and therefore may be providing more parts or parts of higher value. Turnover was used in the selection process to target these relatively more important business partners.
- **Geography**: Location was considered to capture the geopolitical regions represented by the suppliers. Because the survey asked for corporate-level data, the team wanted to know the likely geographies covered in the responses by the suppliers. It was also helpful to know, for example, that even if a supplier was headquartered in North America, they still manufactured abroad and on various continents.
- **Maturity with regard to carbon management**: Previous participation in reporting schemes such as the CDP or US EPA's Climate Leaders program was examined as a proxy for mature carbon management. This information was gathered for context and to insure that a range of existing involvement with the issue was represented. Because the suppliers selected on the basis of the previously described criteria did include a range of CDP and Climate Leaders participants and nonparticipants, the team did not ultimately use this factor to make a choice of suppliers to survey.

To summarize, the steps taken to select the 35 suppliers for the two surveys were as follows:

1. Rank carbon intensity of parts for one vehicle (kg CO_2e per VIN) in descending order based on model output.[11]
2. Rank suppliers of parts from step one according to turnover. Select two highest for each part, prioritizing ABF suppliers.
3. Verify a range of geography and carbon management maturity.
4. Adjust resulting list based on communications with Ford. Note that this included selection of raw materials suppliers for glass, aluminum, and steel.

The range of criteria and the distribution of characteristics across selected suppliers are shown in Appendix E. The initial selection of parts from the model output, which were supplied by 20 different suppliers, was approximately 30 percent of the modeled emissions for the vehicle. The adjustments made to the selected list broadened the number of programs represented, however, and this emissions estimate cannot be recalculated for the final set of selected suppliers.[12] The final selection of suppliers for the survey represented 26 percent of Ford's total fiscal year 2009 turnover and 33 percent of that year's production turnover.

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[11] Note: this list was confirmed by Ford's internal materials and LCA expert (Dr. Wulf-Peter Schmidt) as reasonably representative of the more carbon-intensive components in a Ford vehicle per e-mail dated Feb. 26, 2010 from Dr. Wulf-Peter Schmidt.

[12] Note: because the model output is only for one vehicle program and suppliers were ultimately selected for more than that program based on business relationships and other feasibility issues, the model output cannot be used to estimate the portion of total emissions represented by the final selected list.

The 35 suppliers were assigned to receive either the GHG Protocol or Supply Chain questionnaire. The process was not prescriptive. Care was taken to mix the groups so that suppliers of the same commodity were separated. This step was done to compare the results of the two survey types from within a given industry.

3. Survey Process

A preliminary process step was to identify the correct individual at the responding company who could act as the subject matter expert for the survey process. In some cases, this took up to three weeks. A formal communication was sent from the office of the Global Vice President of Purchasing at Ford to the selected suppliers, alerting them to the upcoming survey (see Appendix F for an example communication). The surveys were then sent to suppliers in early April 2010, and replies were received up until late May 2010 for the road test survey and July 31st for the CDP survey. The team and Ford then replied to questions that arose for suppliers during the response period in order to help them complete the survey. Some questions pertained to how Ford intended to use the information collected, reflecting concern that specific information could possibly be shared externally. Other questions covered a range of topics from specific emissions factors that were allowable to use to product-level footprints and whether these were expected. The responses for the road test are confidential and therefore not included in an appendix to this report.

F. RESULTS OF SUPPLIER DATA AND INFORMATION REQUESTS

Results of the supplier data and information requests are detailed here. Summary information is shown in the exhibit below, followed by a discussion of the results. Note that the requests were all administered with an understanding of confidentiality and anonymity for responding companies. Four of nine CDP supply chain questionnaire responders chose to make their CDP supply chain response public, but in order to preserve confidentiality, company names are not cited in the results discussion. It is also worth noting that one company that has a history of reporting for the CDP Investor questionnaire chose to make that report public as it has for years but not to make the supply chain questionnaire portion for Ford public. There was also a difference with regard to the response rates of strategic suppliers. Specifically, 100 percent of the ABF suppliers replied to the WRI/WBCSD GHG Protocol road test survey. In contrast, there was a 50 percent response rate from the non-ABF suppliers.

Table 2: Information Request Response Statistics

	Scope 3 Road Test	CDP Supply Chain
Response Rate	72 percent	90 percent
Response Rate among ABF	100	86
Prior Emissions Tracking	80	77
Prior Emissions Reporting	44	55
Use of LCA	60	44
Beyond Operational Control	0.05	44
Provided Scope 1 Emissions	100	88
Provided Scope 2 Emissions	100	88
Reduction Target	58	66
Made Response Public	0% (not an option)	44

Note: Due to small sample sizes, statistical comparisons between the two surveys would not be meaningful.

For both methods, the responses ranged from basic with simple yes/no answers, to qualitative questions, to advanced responses with in-depth discussion of context, ongoing projects, and details about the supplied data and methodology used to obtain it along with limitations to it. Without a survey, Ford had no information on the level of maturity for measurement and management represented in its supply base. The responses indicated that while a range from virtually no understanding of the issues to programs more advanced than Ford's own were present, overall, suppliers seem well-positioned to begin to make progress in partnership with Ford on carbon emissions management and reduction. The response rates were both relatively high, and the importance of strategic relationships, represented by the ABF suppliers, play out as expected, showing high response rates among that group.

1. Perceptions of Risk and Opportunity Related to Climate Change

Risks

The majority of suppliers surveyed (with both methods) perceive their companies to be at risk from either regulatory, physical, or energy price volatility associated with climate change. While most indicated perceived risk from regulatory activity and energy price volatility, only about half noted perceived physical risks from climate change. While there was a range of reasons given by one company for why it perceived no likely impact from climate change on its facilities, others stated that the science on climate change impacts was not specific enough for them to draw conclusions about physical impacts on their operations. Several companies noted programs or partnerships in place to help mitigate effects of energy price volatility, while one noted that it had relocated some facilities closer to its customers to reduce transportation costs. Specifically cited risk issues were cost of transportation/fuel prices, energy supply, and raw materials. One company noted that customer requests were likely the biggest issue they would face.

Opportunities

Over two-thirds of surveyed suppliers noted perceived opportunities. These ranged from innovations to meet new requirements and access to new or expanding markets to increased demand for certain

commodities or products that may contribute to more efficient vehicles. Many noted fuel-efficient (lighter weight or otherwise fuel-saving) designs that they already produce.

2. Emissions Measurement

Responding to either survey essentially required emissions measurement for Scopes 1 and 2, so all respondents can be said to have some level of measurement in place. However, reported emissions came in a variety of levels of completeness and with various explanations. For example, in response to the WRI/WBCSD road test survey, no company provided data on all six greenhouse gases as requested. The three most reported gases were CO_2, N_2O, and CH_4. These are the most prevalent GHGs, so if a subset is selected and the fluorocarbons are not an important source of emissions for a supplier, this set of three is reasonable (United Nations Framework Convention on Climate Change n.d.). Again, the range in responses from only numbers with no description of methodology (although it was requested) to full descriptions and recommendations for streamlining the process showed the diversity of experience in emissions measurement among Ford's tier-one suppliers.

GHG Protocol

While both survey options recommend the GHG Protocol approach for emissions accounting, some companies referenced having custom systems for measuring and reporting their data. Approximately 70 percent of road test respondents explicitly referenced using the GHG Protocol methodology. The CDP Supply Chain questionnaire asks respondents to select from a set of methodologies; about 55 percent used the GHG Protocol. Others used regionally specific approaches.

Allocation

As discussed previously in the Carbon Impact: Calculation Options section, allocating emissions from suppliers to customers can be difficult and inaccurate. In the CDP questionnaire, two specific questions address this topic:

1. Question SM 1.3: Describe your system for allocating emissions to your customers.
2. Question SM 1.4: What are the challenges in allocating emissions to different customers and what would help you to overcome these challenges? Please describe whether and how you plan to develop your capabilities to allocate your emissions in the future.

Responses to these questions again showed a range in approach. In answer to SM 1.3, three suppliers selected percentage of sales to Ford, two specified weight, and two specified "volume" (which could be volume of sales or of product—i.e., weight), while the remaining two responders did not provide an answer to this question. One supplier who used a sales basis also noted their extensive product-level LCA accounting and that their responses to SM 1.4 mentioned the following challenges:

- Dissimilar flowpaths for products requiring different energy inputs
- Percentage allocation determination
- Interconnected production facilities and highly integrated value chains that improve resource reuse (e.g., waste heat) but make emissions allocation more complicated
- Use of a weight-basis allocation assumes that each unit of weight has the same emissions associated with it

While not cited specifically in information submitted by suppliers, the same complication holds true for a dollar basis for allocation, which assumes that each dollar of sales has the same emissions associated with it.

Regarding the information collection for the Scope 3 road test: while no specific question was asked regarding challenges in allocating emissions to customers, the team left the method of allocation open to suppliers to get a sense of how suppliers would choose to allocate as a good barometer on what is feasible. The majority selected a market-based option such as sales to Ford or revenue from Ford, although some chose weight of goods sold or an energy basis.

Emissions beyond Scope 1 and 2

Three CDP responding suppliers have begun working on Scope 3 emissions accounting. These three are large companies with global operations and a history of working on environmental issues. In addition, some road test respondents mentioned company transportation and employee travel, which are technically Scope 3 emission and needn't have been included.

3. Emissions Management

Information collected related to emissions management includes whether or not a company has set a reduction target, whether they have met it, and whether they have subsequently set a new target. Also collected was information describing policies or strategies in place for addressing climate change. Among road test respondents, about 60 percent indicated a strategy in place for mitigating effects of climate change (including reduction targets). Among CDP respondents, about 67 percent had set reduction targets, about 44 percent had met them, and about 11 percent had set new subsequent targets.

4. Reporting

Responding suppliers, as summarized in the table at the beginning of this section, do not all report emissions (about 48 percent do). Among CDP responders, five of nine suppliers noted that they report their emissions; most do so in their sustainability reports or annual reports while only two stated that they report to outside bodies (comprised of CDP, Climate Leaders, and Climate Registry). Among the road-test responders, seven of sixteen who completed the question regarding reporting, five report to CDP and two of those report to additional organizations (Climate Leaders, SAM, FTSE-4-Good, socially responsible investors and others via GRI OneReport). The remaining two reported to country-specific or regional schemes. As noted earlier, reporting represents an important level of maturity as a commitment to measurement and public disclosure of that measurement (Bailis 2009).

5. Governance

Governance for emissions includes demonstrated commitment from senior-level executives and established programs and practices around emissions management. In a sense, governance is difficult to define because good participation and reporting in the other areas, taken in sum, represent governance. However, at the same time, without some level of senior buy-in, it may be unlikely that any of the other activities will occur.[13] All but one CDP respondent noted board- or executive-level commitments at their

[13] Questions about level of executive support for climate change or greenhouse gas emissions management were not addressed in survey used to complete the WRI/WBCSD GHG Protocol road test.

companies, and two noted financial compensation associated with performance on climate issues. Six of the nine CDP respondents noted engagement with industry-level groups or trade associations on climate change policy issues.

6. Engagement beyond Operational Control including Use of LCA

While some companies have never considered emissions associated with their operations or products before and others have standard environmental management systems (e.g., ISO 14000) required for suppliers, a few have begun to develop extensive supplier programs. Responses to Ford's information request included examples both of product LCA work and supplier engagement. Of two suppliers that responded to the CDP supply chain request indicating work with their own suppliers, one outlined an engagement plan under which it will assess 250 of its own strategic suppliers (a current pilot is underway not dissimilar to Ford's) along four tiers of sustainability involvement (from lagging to leading) with communication, education, benchmarking, and emissions progress tracking to verify internal material LCAs included in the program (CDP Supply Chain Responses to Ford request 2010). A second supplier noted constant dialogue with its own suppliers and made clear via its reference to engaging the 1 percent that comprise 80 percent of its supply chain GHG emissions that it has assessed Scope 3 emissions in some detail (CDP Supply Chain Responses to Ford request 2010). Among road-test responders, one company cited use of CDP and work with the US EPA to engage its suppliers, while three others cited individual projects or specific programs.

Approximately 54 percent of responding suppliers indicated that they have or continue to conduct LCAs on individual products. Some companies integrate this process into much of their design, while others have completed individual studies.

7. Issues Specific to Data Collection Approaches

It is important to note that while both surveys were similar and collected useful information, each had its limitations for application to a corporate supply chain strategy.

WRI/WBCSD Corporate Value Chain (Scope 3) Standard

Participation in the Scope 3 Standard road test highlighted several issues that will continue to challenge companies seeking to understand their Scope 3 emissions. The standard encompasses much more than supply chain, and also more than emissions associated with a specific product. The broader extent of the standard requires participation by numerous organizations and departments within a company as well as external parties to gather data for everything from logistics to employee travel to purchased goods (supply chain) emissions. The currently drafted standard leaves open to choice two key issues that simultaneously could make the standard more feasible for companies and limit its usefulness:

1. Requirement to report 100 percent of emissions in all categories but ability to exclude any specific categories with justification
2. Data can be either direct, measured quantities or from a secondary source (such as industry averages or LCA databases)

Combined, these two items highlight the tradeoffs that will necessarily be made between data accuracy and data completeness. For example, a complete Scope 3 emissions assessment that could be verified and meet the standard might contain entirely secondary data. On the other hand, as discussed in the Carbon and Supply Chain section, direct or primary data measured from suppliers or internal company

departments might not in fact be more accurate than available average estimates but would require significantly more work to compile. However, the direct or primary data measurement might lead to better opportunities for engagement around governance and reduction by opening dialogue with relevant actors and delving into the processes that actually impact emissions levels.

CDP Supply Chain program

The CDP Supply Chain questionnaire offers a thorough set of information. It offers the benefit of being a common survey tool administered over the Internet that supplier companies may already be completing for other customers or for their investors. The form is quite long with over 60 questions followed by 13 additional questions specific to the supply chain module, a fact that might diminish the quality or quantity of responses.

CDP provides a ranking on both disclosure and performance for its investor questionnaire responders. Discussion with CDP staff has indicated that the next iteration of the CDP membership benefits will come with significant analysis capabilities for companies to more easily work through the variety of responses they receive from suppliers. While supply chain respondents will be ranked on disclosure, there are no current plans to provide performance grading (Gastelum, US Account Manager, CDP Supply Chain at Carbon Disclosure Project 2010). Of the suppliers Ford selected for the CDP questionnaire, one was selected to CDP's Carbon Performance Leadership Index (CPLI) for its investor questionnaire responses. From the group selected for road testing the Scope 3 standard, a second supplier who responded to CDP investor questionnaire was also selected to the CPLI (Carbon Disclosure Project n.d.).

8. Feedback on the Process

The final questions in the data and information requests sent for the Scope 3 road test asked suppliers for feedback on the process. The responses provided can be grouped into two categories:

- **Data and calculations**: Several respondents requested clarification or additional guidance in future iterations for specific elements of the data request such as a calculator for the fluorocarbons (HFC, PFC) and level of detail required for mobile emissions calculations. Three noted specifically that the data collection itself was challenging.[14]
- **Coordination and simplification**: Companies asked for simplification of the data and information request as well as coordination with other schemes to minimize the number of requests that suppliers receive from customers and stakeholders for similar or identical information. Some noted that existing data management tools at their companies that already converted all gas emissions to CO_2 equivalents by facility were not compatible with the request for the six individual gases broken down by Scopes 1 and 2 and thus required several extra steps to provide the data in the format requested. With regard to coordination, others asked what the data would be used for and if it would be possible to see their results compared (blindly) to other responding companies'.

[14] In other communications between Ford and a supplier company, the company noted that it had to contract external help to complete the CDP Supply Chain request (Source: confidential Ford e-mail).

One company noted that due to the global economic downturn in 2008, a project to implement a company-wide electronic data system for multiple environmental measurements (water, energy, etc.) had been postponed, but that it would have made responding to this request easier.

9. Synthesis of Findings

While most respondents to the questionnaires were able to provide information or data for each item requested, the results show a wide range in sophistication and experience. A few things are clear from the exercise (the benefits and challenges associated with these are explored elsewhere in this analysis):

- It is easiest for most suppliers to allocate emissions to Ford based on sales.
- Providing information on each of the six major greenhouse gases is burdensome.
- Streamlining requests for GHG data would be helpful.
- Some suppliers have well-established programs for measuring, managing, and reporting GHG information.
- Some suppliers have conducted multiple LCAs.

G. DISCUSSION OF FINDINGS

1. Maturity Spectrum

The qualitative results from the CDP and WRI/WBCSD GHG Protocol road test information collection processes showed that the selected suppliers are at various levels of comfort with the measurement and management of corporate greenhouse gas emissions. Given that the goal of supplier engagement is beyond simple reporting of carbon impact, the qualitative results were grouped in such a way as to provide insight for future steps for Ford. The project team devised a way to sort the qualitative responses in a Maturity Spectrum, which demonstrates the range of corporate actions with regard to carbon measurement and management. Suppliers were grouped along the spectrum, which allowed for a comparison across the supply base.

In order to develop the Maturity Spectrum, the team reviewed information from leading GHG emissions management organizations such as the US EPA and its Climate Leaders Program, the Climate Registry, and the CDP and drew on experience gained through the course of the project. Through this review, the team distilled a set of key actions that organizations take in the process of establishing a carbon emissions management program. These steps were grouped into descriptive buckets in order to define the categories on the Maturity Spectrum. For example, a supplier may have provided emissions information to the CDP, the Climate Leaders program, or the Climate Registry. All three of these actions are considered on the Maturity Spectrum under the Reporting category. The graphic below illustrates the spectrum and provides sample actions that fall into each category.

Assess Risks and Opportunities	Measurement	Management	Reporting	Advanced Governance	Measurement beyond Operational Control
▪ Financial ▪ Physical ▪ Regulatory	▪ Baseline GHG inventory ▪ Scopes measured ▪ Allocation of emissions	▪ Set reduction goal ▪ Reduce emissions ▪ Meet reduction goal ▪ Set new reduction goal	▪ Report to financial community and value chain partners	▪ Internal structure ▪ Senior level participant ▪ Policy advocacy ▪ Industry leadership	▪ Use of LCA ▪ Engage-ment of supply chain partners

Figure 4: Greenhouse Gas Maturity Spectrum

The placement of suppliers along the spectrum illustrates their level of sophistication with greenhouse gas management. The farther to the right a supplier falls on the spectrum, the more sophisticated are their corporate greenhouse gas management plan and activities. Placement on the left of the spectrum indicates that a supplier has assessed the potential risks and opportunities from greenhouse gases but has yet to take further steps to measure and manage the emissions.

Overall, the qualitative responses showed a range in sophistication of greenhouse gas management activities, as illustrated below by the two sample responses from the CDP questionnaire.[15] Both of these responses were provided by large raw material suppliers to Ford.

> ***Example 1:***
>
> *Question: [If you do not have a target,] please explain why not and forecast how your Scope 1 and Scope 2 emissions will change over the next 5 years.*
>
> *Answer: Until now, these issues have not been evaluated.*

This response shows that the supplier had not previously considered the setting of formal reduction targets for corporate emissions until it received the data request from Ford. Reduction efforts are considered an important part of greenhouse gas management, as illustrated in the Maturity Spectrum. The lack of a target shows limited sophistication on the part of the supplier.

A second example shows a supplier residing at the other end of the maturity spectrum.

[15] The answers included in the text are from the 2010 CDP Supply Chain Questionnaire. Individual suppliers have not been identified. Responses have been edited for clarity and length.

Example 2:

Question: Have you published information about your company's response to climate change/GHG emissions in other places than in your CDP response?

Answer: Specifically, the strategy allows us to:

- *Incorporate the physical impacts of climate change into growth decisions and operational planning for existing assets;*
- *Integrate carbon risk into capital planning and valuation of mergers and acquisitions;*
- *Establish a prioritized action plan for mitigating carbon risk and maximizing business opportunities.*

This example shows that this particular supplier possesses a great deal of sophistication in greenhouse gas management. Not only has the supplier made their strategy public, but it also has directives to include carbon emissions in capital planning decisions and to balance carbon risk and new business growth opportunities. Both of the sample responses presented are from large suppliers of key raw materials. The content of the examples shows that there is a range of knowledge and maturity within Ford's supply base with regard to greenhouse gas emissions management.

In order to gain an overall picture of the greenhouse gas management sophistication of the supply base, the information from the qualitative responses were aggregated along the Maturity Spectrum as shown below in Exhibit 6. There was some art to assigning suppliers to the various categories because responses can show varying degrees of sophistication. For example, the CDP Questionnaire inquires about risk and opportunity assessment. If a supplier provides a reply, this could be considered fully meeting the maturity level for the category. However, it is clear from the text of the responses that some companies have well-established processes in place for regularly assessing risk and opportunity while others provided responses "on the fly" in order to complete the information request and may lack robust processes.

Table 3: Percentage of Responses Demonstrating Representative Activity in Each Maturity Category

Assess Risks and Opportunities	Measurement	Management	Reporting	Advanced Governance	Measurement Beyond Operational Control
69 percent	85	65	48	78	58

As shown in the above exhibit, the Maturity Spectrum implies varying levels of sophistication but does not represent a prescriptive progression. For example, senior-level support for greenhouse gas management efforts is considered within the Advanced Governance category and is an activity already supported by the vast majority of suppliers.[16] Simply having the support at the company does not drive

[16] Specifically, the CDP Questionnaire asked, "Where is the highest level of responsibility for climate change within your company?" This question was not addressed in the GHG Protocol Scope 3 survey form; therefore, only 10 suppliers were asked directly about senior-level support for greenhouse gas management efforts.

reduction or risk management efforts, however. For this reason, a supplier would also need to measure their Scope 1 and Scope 2 emissions and set realistic reduction targets. While there is no set path to follow along the spectrum, the activities within the categories are synergistic.

Simply completing activities in the various categories' areas may not reflect certain progress. To illustrate this point, two contrasting company responses are plotted in the following exhibit.

Table 4: Comparison of Maturity by Category for a Mature and Developing Company

Assess Risks and Opportunities	Measurement	Management	Reporting	Advanced Governance	Measurement Beyond Operational Control
Mature Company					
Robust process described as: Group-wide process dedicated solely to the identification of risks and opportunities associated with climate change; strongly interlinked with general risk management and strategy process	Reports all emissions scopes. Allocates based on volume of sales using product-specific emissions	Reduction targets have been set, some have been met, and long-term goals have been established	Multiple publications (annual report, CDP)	Individual board member and climate protection officer have responsibility; engages in policy; board-level commitment	Uses company-developed version of LCA; constant dialogue with suppliers representing greatest proportions of emissions
Developing Company					
Notes this is the first time the company has considered these issues	Completed inventory for information request and track energy usage	"To be determined"	Has never reported	"To be determined"	None beyond recycling certain materials

Note: lighter blue indicates a more mature response.

As previously mentioned, this spectrum is useful to Ford in a number of ways. It allows for a filtering of the qualitative data provided in the supplier responses. The spectrum also allows Ford to assess the level of sophistication of suppliers across the supply base. In making these comparisons, Ford and AIAG are better equipped to understand the degree to which the automotive supply chain has taken steps to measure and manage emissions. The spectrum also provides insight into potential knowledge gaps. If a significant number of suppliers remain in the "Assessment" bucket, then Ford and AIAG could develop a set of training materials for the industry that covers greenhouse gas measurement techniques. The spectrum also provides a two-way communication between suppliers and Ford regarding successful management initiatives. This information also helps Ford to know which industries are more mature in their management of greenhouse gases, which could lead to the sharing of best practices across industries. By filtering the supply base along the spectrum, Ford is better informed and is better equipped to design engagement efforts that address knowledge gaps.

Expansion and refinement of categories

After defining the categories, the project team cross-referenced them with the questions from the CDP survey. Specific elements of the questionnaire were assigned to the spectrum categories, thereby making

a link that will help Ford staff to quickly populate the spectrum as the supplier engagement program continues and new respondents provide qualitative answers. For more details, please see Appendix H.

The original Maturity Spectrum was developed based on a sample of supplier responses to qualitative questions and a review of the best practices in carbon management as evidenced in reporting programs' recommended progression for organizations. As Ford advances the engagement program and expands the number of participants, it is likely that the categories on the spectrum could be refined. This approach is supported because it will help to make the spectrum a dynamic reflection of the initiatives most relevant to greenhouse gas management and the automotive industry.

2. Quantitative Evaluation

The team explored the option of creating a quantitative scoring system to rank suppliers. This method is a common approach used to create supplier scorecards that supplement sourcing decisions and prioritize which suppliers to engage. As mentioned previously, P&G launched a supplier scorecard in 2010 to measure sustainability metrics (Siranosian 2010). As compared to the maturity spectrum, a scoring system would provide a numerical value with which to rank suppliers. The team concluded that a ranking system would have value and evaluated current ranking approaches used by Climate Counts and the CDP.

ClimateCounts.org, a nonprofit that scores companies' climate change performance with a goal of driving consumer awareness and business action, uses a greenhouse gas emissions scorecard. It is intermediate between the sustainability scorecards that companies such as P&G have developed and the more in-depth methodology used by CDP. It includes questions based on 22 criteria about a company's measurement inventory, its reduction efforts, policy stances, and public reporting with points available for different types of responses (ClimateCounts.org 2011).

CDP has developed a ranking system for respondents as well. This is called a "carbon performance score." The ranking system assigns a point value for each question in the survey and then grades each company on its response to that section. The ranking system is divided into two sections: performance and disclosure. The system is meant to provide a way for companies to evaluate and compare other companies that responded to the CDP survey (Carbon Disclosure Project 2010).

The carbon performance score is broken down based upon both performance and disclosure in the certain categories, as shown in the following table.

Table 5: Summary of CDP Scoring Methodology

Source: Carbon Disclosure Project, 2010.

Category	Additional Criteria
Governance	
Risks and Opportunities	Risks and opportunities identification process Regulatory risks Physical risks Other risks Regulatory opportunities Physical opportunities Other opportunities
Strategy	
GHG Accounting, Energy and Fuel Use, and Trading	Emissions – boundary and methodology Scope 1 Scope 2 Contractual Scope 2 Scope 3 Emissions – other 1 Emissions – other 2 Emissions trading
Communications	

Built into the scoring system is the CDP's subjective valuation, or weighting, of each question's relative importance. The scoring methodology was developed in conjunction with PricewaterhouseCoopers (Carbon Disclosure Project 2010). Once scored, CDP ranks the companies on a scale of A (leading), B (fast following), C (on the journey), and D (just starting) (Carbon Disclosure Project 2010).

While the methodology holds promise for future comparisons of companies and contains elements necessary for any kind of evaluation of responses to GHG emissions information requests, it is currently only available as a service for and applied to companies that are in the S&P 500, the Global 500, or the FTSE 350 indices and that make their responses public (Carbon Disclosure Project 2010). Further, discussion with CDP indicates that performance scores for the supply chain portion of the questionnaires have not yet been developed (Gastelum, US Account Manager, CDP Supply Chain at Carbon Disclosure Project 2010). Therefore, in the near-term recommendations below, the team describes an alternative scoring approach that could be developed for use by Ford.

IV. RECOMMENDATIONS

The following recommendations and areas for further consideration are the result of the team's assessment of the current landscape of carbon measurement and management in the automotive industry, coupled with information from Ford's suppliers and the analysis presented in this report. The recommendations are provided in a chronology of short-, mid-, and long-term actions, similar to Ford's other sustainability initiatives.

The team's overall recommendations for Ford's Supply Chain GHG Management Program are based on four key pillars:

1. **Supplier data collection**: Engaging with suppliers, rather than performing an LCA of expected GHG emissions, is a key for increasing supplier GHG management capabilities because it signals to suppliers that Ford has a desire to manage its supply chain GHG emissions.
2. **Measuring supplier performance**: The best method for engaging suppliers depends on the supplier's performance across a wide range of factors such as the company's GHG emissions, management sophistication, and preferred status. Furthermore, the goal of the program is to improve supplier GHG performance, or reduce emissions.
3. **Supplier collaboration**: Working with suppliers to improve management of GHGs and building on the strong relationships that Ford is developing with its suppliers are effective ways to build GHG management competency because they allow for suppliers and OEMs to learn from one another.
4. **Collaborating with industry**: In order to effectively increase the size and participation in the GHG management program, an industry approach is necessary. This principle is based upon conversations with suppliers as well as with AIAG (Ford Motor Company 2009).

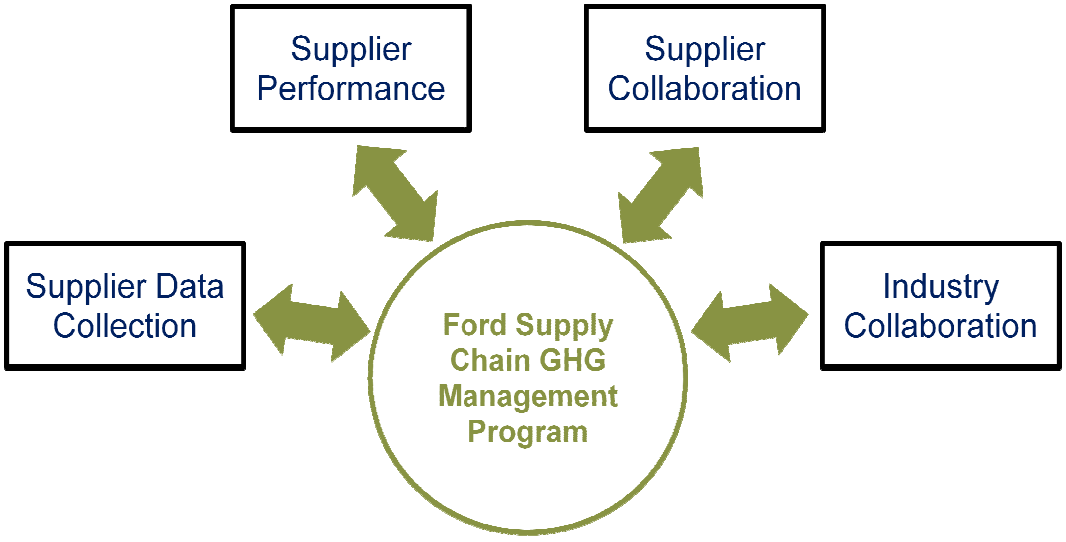

Figure 5: Key Elements of Recommended Strategy

The remainder of this section discusses the near-, mid-, and long-term recommendations for Ford's GHG management strategy. These recommendations are applicable to all the geographies relevant to Ford's supply chain. It will be important to monitor developments as outlined in the climate change policy sections of this report to determine the best way to engage with individual suppliers in the context of their country's climate change management.

The team anticipates that the recommendations included in this report will require Ford to add one full-time employee to its purchasing department team. This person would be responsible for implementing the expanded supplier engagement program (including managing relationships with any service providers and surveyed suppliers), developing a Maturity Matrix to identify and track supplier progress toward GHG management sophistication, and supporting the continued integration of Ford's supplier engagement and data collection efforts with broader industry-level efforts. Implementation of these recommendations will also require the continued involvement of the existing purchasing department capacity along with support from other Ford departments (e.g., the Environmental Quality Office), as relevant.

A. NEAR-TERM RECOMMENDATIONS: YEAR 1

1. Recommendation: Expand Data Collection Program to Measure Supplier Sophistication

Number and type of suppliers

The team recommends using the findings from the initial supplier engagement program, described in this report, to increase the number of suppliers surveyed in the next data collection request. In order to derive the most value from the next phase of supplier engagement, the team recommends engaging with companies in all of the following supply-base categories: (1) production ABF suppliers, (2) non-production ABF suppliers, (3) non-ABF production suppliers, and (4) non-ABF non-production suppliers. Specifically, the team recommends surveying: (1) all ABF suppliers during 2011 using both the CDP and the AIAG quantitative data form and (2) a random sample of non-ABF suppliers (both production and nonproduction).

A random sample of non-ABF suppliers will allow Ford to statistically analyze and estimate the average GHG emissions and energy use, and GHG management maturity, of its entire tier-one supply base, based on a broader and more representative swath of the supply base (i.e., not just ABF suppliers). A random sample must include at least 30 suppliers from each group; so, ideally, the surveyed population would include all ABF suppliers (90 suppliers) plus 30 non-ABF production and 30 non-ABF non-production suppliers for a total of 150 suppliers (summarized below). In order to obtain 30 responses, it is important to factor in an expected response rate when determining how many suppliers to request the information from. Based on the road test experience for the GHG Protocol new standard for Scope 3 accounting, during which participating companies reported a wide range of supplier response rates (though Ford did have one of the highest rates), it may be important for Ford to survey significantly more than 30 suppliers.

Table 6: Recommended Supplier Distribution for Expanded Data Collection Program

	Production	Non- Production
ABF	67	23
Non- ABF	30	30
Grand Total	**150**	

The reason for differentiating between ABF/non-ABF and production/non-production suppliers is the inherent ability to influence and work with those suppliers. By design, ABF suppliers are more likely to work with Ford on measuring, managing, and reducing GHG emissions, as was borne out in the response rates to the data and information collection efforts (described in the Results section above). Due to their direct input into Ford vehicles, dependence on Ford's business, and likely investment in a continued partnership with Ford, production suppliers are likely to be willing to work with Ford to manage GHG emissions.

If Ford determines that a 150-supplier survey is too large, then the team recommends choosing to survey the population of suppliers with which Ford has the strongest relationships in this order: (1) ABF production suppliers, (2) ABF non-production suppliers, (3) non-ABF production suppliers, and (4) non-ABF non-production suppliers. An alternative strategy would be to survey suppliers that are believed to have higher emissions or be of greater risk from GHG regulations and energy price volatility. This strategy could be particularly relevant if Ford sees no strategic or management value in gaining an understanding of its overall tier-one emissions profile.

Method of information collection

As described earlier, Ford intends to use the data collection tool developed by the AIAG Greenhouse Gas Work Group for future data collection requests from suppliers. Because the AIAG form currently collects only quantitative information, the team recommends that Ford use CDP supply chain program to survey suppliers about their GHG management maturity (i.e., through the qualitative questions on the CDP questionnaire). The CDP program provides logistical support for surveying suppliers, a significant amount of quantitative analysis, and the ability to easily compare supplier data and even engage with suppliers (Gastelum, US Account Manager, CDP Supply Chain at Carbon Disclosure Project 2010). Furthermore, CDP is a well-recognized and credible organization, and its supply chain program is currently highly regarded and used by many other Fortune 100 companies (Carbon Disclosure Project 2010). CDP has indicated that it will continue to update its survey to meet the needs of its member companies and is even amenable to updating the automotive industry component of the questionnaire with Ford's input (Gastelum, Personal communication at the BSR conference 2010). The CDP scoring methods can be used to place a supplier on the GHG management Maturity Spectrum and prioritize which suppliers to work with. It can also provide insight for companies regarding the best areas to focus on with their suppliers. Alternatively, the scoring method can be used to help Ford grade suppliers based upon its own maturity spectrum.

Industry-level coordination

To ensure supplier buy-in, industry involvement, and continuous improvement in surveying techniques, the team also recommends continuing to work with AIAG to refine and propagate the data request tool described earlier for collecting GHG emissions from suppliers. Continuing to use and improve a standard industry form through AIAG is something for which suppliers routinely asked and that will help to improve the likelihood of other OEMs choosing to adopt a supply chain GHG management program. The form is currently sufficient for understanding suppliers' enterprise-level GHG emissions, both in their entirety and allocated to Ford, or any requesting OEM.

Engaging suppliers through the CDP and AIAG information requests will allow Ford to assess GHG emissions in its supply chain, prioritize which suppliers to further engage, and finally to begin working with those suppliers to manage upstream GHG emissions and energy use.

2. Recommendation: Develop Score-able Matrix for Tracking Supplier Progress

As one illustration of how the information collected through the questionnaires could be consolidated and used to evaluate suppliers, a weighted matrix can be developed and employed (Moore 2004). By arraying a supplier's response information across multiple years against a set of GHG management activities that serve as criteria demonstrating good performance, the matrix can help efficiently highlight and communicate both progress and areas needing greater attention. The following defines the components of the matrix and outlines the steps required to develop and utilize the matrix.

Categories and Activities	Driver Category	Year 1		Year 2	
Management: 30	**Importance Weighting**	**Performance**	**Score**	**Performance**	**Score**
Set Reduction Target	30%	5	15	5	15
Reduce Emissions	35%	2	7	4	14
Meet Target	20%	0	0	3	6
Set New Target	15%	0	0	0	0
Total (weight x sum of scores)			660		1050
Maximum Possible: 1500			44%		70%
Measurement: 20					
Baseline Inventory Complete	55%	5	27.5	5	27.5
Chan	25%		10		12

Criteria

Figure 6: Example Matrix for Evaluating Suppliers based on GHG Maturity

Rows: Driver categories, criteria, and indicators

The driver categories are the activity set titles taken from the Maturity Spectrum presented earlier, such as measurement, management, and assessing risks and opportunities. Underneath each of these are the criteria (or specific activities) shown under the spectrum that when combined indicate comprehensive GHG management for that driver category. Behind the criteria are indicators, which are specific data points or assessments of the data that inform the criteria. In this case, the indicators are linked to specific questions in the CDP questionnaire (Exhibit H). The indicators can be quantitative or qualitative.

Each driver category is given a weight to reflect its relative importance among the set of driver categories from the Maturity Spectrum. For example, designating a weight of 30 to the management category and a weight of 15 to the governance category would indicate that management was deemed twice as important as governance. Next, each criterion is given a weight to reflect its relative importance as compared to the other criteria *within* that driver category for indicating good GHG management. For example, in the management category, "Set Reduction Target" could be given a 30 percent weight and "Reduce Emissions" could be given a 35 percent weight, and the total for all criteria within the category should sum to 100 percent.[17] Reweighting is appropriate if the relative importance of a specific criteria activity is deemed to have changed.

Columns: Performance and scores

To enter performance values, assessment of supplier responses to the relevant questions (indicators) is required and should be translated to a 1–5 (or other numerical range) rating. This value, created for each criterion, is then multiplied by the associated weight to generate the value in the score column. The score for the overall category is then calculated as the sum of the criteria scores multiplied by the category weight. This category score can then be evaluated against the maximum possible for the category. The maximum is calculated as the total category weight value (e.g., 30) multiplied by the total possible from the criteria and then by the maximum indicator score (e.g., 5 in a 1–5 rating scale).

Communication of progress and results

From the illustrative exhibit above, it can be seen that the supplier achieved an overall improvement against the maximum total possible in the management category, moving from 44 percent to 70 percent. Further, the criteria rows show that this was achieved primarily through an improvement in emissions reduction activities, a heavily weighted activity.

Implications and potential drawbacks

Adopting a matrix tool can have useful advantages like aggregating numerous pieces of information and demonstrating progress over time in a concise manner. Doing so would require the development of a weightings and scoring system to best reflect Ford's understanding of the relative importance given to the component criteria and categories of GHG management. Work to translate the actual response information into performance ratings would also be required on an ongoing basis. There can be significant detail provided in supplier responses to requests for information. It might not be possible for

[17] Note that these should be percentages of an actual numerical value, i.e., 10, to appropriately calculate the maximum possible score.

such information to be adequately captured in this matrix format. Thus, there is a risk of oversimplification.

B. MID-TERM RECOMMENDATIONS: YEARS 2–5

1. Recommendation: Continually Update Maturity Matrix for GHG Measurement, Management, and Reduction to Prioritize Supplier Engagement

The team recommends using the annual supplier information requests to update the supplier maturity matrix and the GHG emissions profile of each surveyed supplier. Ford can use the findings to prioritize which suppliers to work with based upon a combination of their overall GHG intensity, any accomplished or anticipated GHG emissions reductions, GHG management maturity, and the strategic importance (ABF status) of the supplier. Companies that have high GHG emissions, lack GHG management maturity, and that are of strategic importance to Ford should be prioritized for engagement.

2. Recommendation: Support Training for OEMs and Supplier Companies (through AIAG) Around GHG Data Measurement and Management

Working with other OEMs and suppliers will be critical for ensuring that Ford and AIAG continue to identify the most effective way to manage GHG emissions in the supply chain. The team recommends continuing to support training for OEMs and suppliers through AIAG on GHG data measurement and management. Trainings may be based on existing materials or developed as best-practice sharing across the industry.

3. Recommendation: Continue to Expand Data Collection Program to Measure Supplier Sophistication

The team recommends continuing to expand the number of suppliers surveyed each year, with the ultimate goal being that completing the survey is expected of all Ford suppliers (see long-term recommendations below). Data from the surveys should be analyzed to understand both the GHG emissions and the GHG management maturity of each supplier. This data can then be used to help prioritize supplier engagement in the future (see mid-term recommendations).

C. LONG-TERM RECOMMENDATIONS: YEARS 6 AND BEYOND

1. Recommendation: Work with AIAG to Develop Industry-wide Database for GHG Data Submission by Suppliers and Data Management by OEMs

As OEMs begin to request data from suppliers in the near term, they will be required to use the Excel tool developed by the AIAG Greenhouse Gas Work Group. OEMs will then be required to compile the data to best suit their needs (e.g., compiled and analyzed in Excel or entered into internal database systems). As demonstrated by Ford's initial supplier information request, this process can be time consuming and labor intensive, even when working with a smaller subset of the supply base.

Another concern is that with multiple automotive OEMs planning to use the Excel data tool to request data from the shared supply base, suppliers will be subject to fatigue as they complete multiple versions of the form for each customer. Although much of the data will be the same regardless of the requesting customer, suppliers will have to update the allocation information—currently based on sales—to be relevant to each request.

As Ford and other companies scale up their data request efforts, it will be imperative to develop an automated approach to collecting and managing data. With a shared system, suppliers can enter their data just once for all requests. For example, streamlining the data collection and use process could involve a supplier logging on to a database to input its GHG emissions and allocate them to the different OEMs it supplies. Ford could log on to the system to see its overall tier-one supply chain emissions profile, broken down by supplier. OEMs could also employ an automated system to synthesize and analyze the results for all their requested data without having to manually compile and analyze results. There is a precedent for industry-wide data collection and management, as demonstrated by materials reporting for IMDS and chemicals reporting for the REACH program.

2. Recommendation: Streamline Data Management Internally within the Organization

The team also recommends that Ford streamline data management within the Ford organization to best support management of sustainability initiatives across the company. Optimal data management should maximize ease of data entry and minimize overlap between data collection efforts (e.g., if many suppliers use certain tools to track their operational emissions, Ford's system would optimally be compatible with these tools; Ford's Scope 1, 2, and 3 GHG emissions should be readily available to users across the organization). Availability and sophistication of sustainability software continues to increase, and Ford should utilize the system that best meets its internal and external data needs.

The team also recommends including environmental sustainability information in purchasing briefs and institutionalizing the program for gaining supplier product innovation ideas to ensure that those ideas are conveyed to the proper people at Ford in a timely and effective manner.

3. Recommendation: Formally Incorporate GHG Management and Energy Use into Supplier Evaluation and Management Process

In the long term, it is recommended that Ford use supplier placement and progress along the Maturity Matrix to better understand the relationship between risk and management.

Use existing Ford ranking categories

In the near term, it is recommended that Ford finalize the development of the aforementioned Maturity Matrix. In the midterm, it is recommended that Ford use the data collected through the expanded GHG data collection program to place surveyed suppliers on the matrix. This will allow Ford to characterize and engage with suppliers regarding their carbon measurement and management activities. In the long term, as suppliers improve their GHG management maturity (e.g., by setting and meeting reduction targets, creating climate change governance, and reporting their emissions) and increase their matrix score, Ford should use a color-coded system (preferably the green/yellow/red system currently used to characterize suppliers based on their compliance with the Working Conditions Code of Conduct) to prioritize which suppliers to engage around GHG management. As with the current system, suppliers can move from lower (red/yellow) to higher (yellow/green) status by improving their GHG management performance.

Incorporate the "cost of carbon"

Ford could further increase its understanding of supplier maturity and performance, and the relationship between risk and maturity, by updating its internal production cost models to incorporate the "cost of carbon." A key driver for this project has been Ford's objective to understand the cost implications of

GHG regulation schemes, such as cap and trade or a carbon tax, on the cost of vehicle manufacturing and procurement of vehicle components and inputs. Since the project initiation, the likelihood of US regulations first increased and then ultimately declined after proposed measures failed to pass in the US Congress. Despite the fact that cost impacts from US carbon regulation are less imminent, regulations in other markets and supply-base regions as well as the volatility of energy prices could still have an impact on Ford's production and component prices in the future.

D. ADDITIONAL RECOMMENDATIONS AND CONSIDERATIONS

In addition to the primary recommendations presented above, the report includes discussion of two additional relevant issues that Ford will need to evaluate further according to internal priorities and considerations.

1. Recommendation: Evaluate Options for Setting GHG Reduction Goals for Suppliers

As discussed above, the team recommends that Ford develop a Maturity Matrix to characterize and evaluate the GHG management maturity of its suppliers. An important part of a company's GHG management strategy is the setting and meeting of carbon reduction targets.

Currently, Ford has set goals for reducing the carbon emissions associated with its products (e.g., reduce product emissions 30 percent by 2020 relative to a 2006 model year baseline) and operations (e.g., improve facility energy efficiency by 3 percent during 2010, reduce US facility GHG emissions by 10 percent per vehicle produced between 2002 and 2012) (Ford Motor Company 2010). However, Ford currently does not have a specific goal to reduce emissions in its supply chain.

If Ford desires to one day set an emissions reduction goal for its entire supply chain, then working with suppliers to reduce their emissions will be a critical part of meeting this goal. To measure progress toward the goal, Ford would need to first estimate its baseline supply chain emissions. The strategy presented in this report establishes the building blocks for this process. Ford could then set emission reduction targets for suppliers. While setting a universal target (e.g., all suppliers must reduce emissions by 25 percent in the next 10 years) would minimize Ford's effort, the impacts could vary greatly by supplier (e.g., an already "mature" supplier would have to make large investments to meet this goal). Alternatively, individualized or scaled targets (e.g., based on score in the Maturity Matrix) could be more time consuming for Ford but would be more tailored to suppliers' capabilities. Ford could institute supplier emissions reduction targets even if it has not yet set a supply chain-wide emissions target and/or established a supply chain emissions baseline. Setting and pursuing a target could help suppliers improve their score in the Maturity Matrix. Ultimately, Ford seeks to engage with suppliers to improve their environmental performance, and setting targets (whether a universal target or individualized targets) is one possible method for accomplishing this goal.

2. Recommendation: Determine Value of Measuring and Reporting Scope 3 Emissions

As described earlier in this report, Ford piloted the WRI/WBCSD draft Corporate Value Chain (Scope 3) GHG accounting standards. Although Ford did not pilot the standards with the explicit goal of continuing to measure and report all of its Scope 3 emissions (beyond its suppliers' Scope 1 and 2 emissions), the company should determine the value of and resources required for measuring and reporting its Scope 3 emissions in the future.

Scope 3 emissions are the newest frontier in GHG emissions reporting. Because an increasing number of companies will be measuring and reporting Scope 3 emissions, Ford should consider the value of getting on board with measuring these emissions on a regular basis early on. By participating in the road test process, Ford has already gained exposure as a company that is at the leading edge of emerging sustainability issues; this in turn supports Ford's brand as a company committed to sustainability principles and practices. In addition, Ford has gained organizational expertise in the effort required to measure and report emissions included in Scope 3, allowing the company to make informed decisions about future emissions management activities.

Accounting for the upstream and downstream emissions will require coordination amongst internal and external data sources. This coordination could encourage and facilitate communication and collaboration on sustainability issues more broadly at Ford. It could also, however, add a time and labor burden to the managing department within Ford. There is inherent tension between the goals of data accuracy and data completeness, and data estimates make aggregation and reporting simpler, but individual data collection is more important for supplier engagement and reduction efforts. When measuring Scope 3 emissions for the purpose of reporting, Ford should consider the value of collecting primary data directly from suppliers (allowing for the setting and tracking of reduction targets based on real data) as opposed to estimating emissions for the entire supply chain using secondary sources and providing the emissions big picture for Ford (which would make it difficult to track individual supplier reductions over time).

V. CONCLUSIONS

A. FORD MOTOR COMPANY

The AIAG Greenhouse Gas Work Group's ongoing effort to collectively increase the sustainability of the automotive industry indicates a material interest and commitment to the issue of reducing greenhouse gas emissions in the automotive supply chain. Currently, Ford is a leader in the industry with regard to measuring and reporting greenhouse gas emissions. However, given increasing interest from the industry, Ford must continue to pursue progressive supply chain carbon management strategies. In addition, as use-phase emissions continue to be reduced by regulations (e.g., CAFE standards in the US) and through product design innovations, the portion of a vehicle's total emissions that is attributed to the supply chain will increase in relative importance and will therefore need to be actively managed.

The first step toward supply chain leadership in this regard is data collection with the goal of measuring greenhouse gas emissions in the supply chain. Next, Ford must determine how it will manage this data with the goal of reducing greenhouse gas emissions in the supply chain. Ford can articulate this management strategy using several approaches such as setting greenhouse gas emission reduction targets for its suppliers, engaging in earnest innovation and collaboration with its suppliers, and using suppliers' greenhouse gas management sophistication as a means for evaluating progress in the supply base in the future. Ford's suppliers represent a range of maturity with regard to their carbon management, and finding ways to continuously move suppliers toward decreased emissions should be Ford's ultimate objective.

B. AUTOMOTIVE INDUSTRY

As described in detail earlier in the report, Ford and the AIAG Greenhouse Gas Work Group have developed a universal data collection tool with the objective of standardizing and simplifying data requests across the automotive industry. Given the characteristics of the automotive industry, from the typical life cycle emissions profile of a vehicle to shared networks of suppliers, it makes sense for guidance and data collection requests to be organized at the industry level.

While this approach yields benefits through decreased supplier burden, consistent messaging, and a shared information resource, the industry should not lose sight of the real purpose of greenhouse gas measurement and management, which is to reduce these emissions in the supply chain and to improve the environmental performance of vehicles.

Continuing to engage with AIAG will be a critical part of Ford's endeavor to drive and shape GHG management methods in the industry. The team recommends that Ford continue its involvement in the development and deployment of a standardized industry-wide data collection form, facilitate the distribution of guidance materials and training workshops, and contribute to the development of an industry-wide GHG database for suppliers and OEMs. Ford should also continue to pursue its own individualized efforts to ensure it is meeting the organizational goals described earlier in this report. As discussed above, the team recommends that Ford expand its supplier engagement efforts to reach all of its ABF suppliers in the near term and through this process employ both the AIAG data collection form as well as its own methods for capturing qualitative information from its supply base.

C. SUPPLY CHAIN SUSTAINABILITY FOR EMISSIONS MANAGEMENT

There are several key issues characterizing supplier engagement around greenhouse gas emissions in the automotive supply chain. This is an emerging field with measurement standards still in development and many remaining questions around setting emissions profile boundaries, evaluating suppliers, and achieving reductions. As companies like Ford consider how they will measure supply chain emissions, they will need to balance the requirements of gathering product- and supplier-specific data with the need to meet business goals.

Companies considering the value of conducting product LCAs should consider the time and financial investments, technical expertise, and gathering of detailed information that is required to conduct this type of product evaluation. Another consideration for data collection is whether companies should estimate total supply chain emissions using secondary data or request data directly from suppliers. Using secondary data is less time and labor intensive and can more realistically provide a supply chain-wide estimate of emissions. On the other hand, while primary supplier-provided data is more time and labor intensive to collect, this type of data can be important for tracking real changes over time. Companies should also consider where they draw the boundary around their supply chain emissions. The Corporate Value Chain (Scope 3) standards currently under development for the GHG Protocol account for 100 percent of a company's upstream and downstream emissions, which includes emissions from suppliers up the value chain but also several other categories (The Greenhouse Gas Protocol 2010). Measuring Scope 3 emissions will require increasing integration and cross-functional work within and between businesses.

In all cases, it can be difficult for suppliers to allocate their emissions to different customers and products depending on how they track and report emissions data. Also of concern is the fatigue that can result when multiple customers make requests to suppliers for similar information. Finally, with regard to reductions, there is the consideration of who in the supply chain has responsibility to identify and execute reduction initiatives.

Because businesses are continuously engaged in short- and long-term decision making, they will often need this type of information sooner rather than later. Supply chains and the greenhouse gas emissions associated with them are very industry and company specific. Given the breadth, depth, and complexity of many supply chains and the rapid pace of business, greenhouse gas emission measurements are dynamic and will only ever be a snapshot in time. That said, assessing supply chain greenhouse gas emissions will be crucial to getting a complete picture of operational and product emissions on the environment. As a result, companies will need to make choices about how much time and resources to invest in product and supply chain emissions assessments in order to most effectively meet their organizational goals.

D. FUTURE WORK AND SUSTAINABILITY OF THE PROJECT

This project touched on many issues through its progression, and while many were addressed, there are still others that warrant further research. Key areas are described briefly below.

1. Research Possibilities for Balancing Tension between Data Accuracy and Completeness

As discussed previously, there is inherent tension between the need for accuracy and the need for completeness when collecting and utilizing data about supply chain emissions. When seeking an

understanding of emissions across the supply chain, completeness will provide significant value. When seeking to understand and track emissions over time (for example, to measure emissions reductions associated with a supplier or product), accuracy about a narrower portion of the supply chain is most useful. As Ford's engagement with its suppliers develops and evolves, Ford should continue to consider where and how to balance data collection efforts between these two needs, given time/staffing and financial resources available and the value of each approach for meeting Ford's goals. Future research questions could include: (1) Are there methods for conducting "abbreviated" LCAs on car models? (2) How can Ford best utilize the hybrid EIO-LCA approach going forward? (3) Are there software tools or data sets available to more easily estimate emissions for the entire supply chain?

2. Research to Test the Accuracy of Using Sales as Allocation Basis

There are several potential methods for allocating emissions to customers, products, and processes, with each method presenting its own strengths (e.g., increased accuracy) and weaknesses (e.g., lack of product-level emissions data). The standardized data collection form developed by the AIAG GHG Work Group uses sales as the allocation basis. This allocation basis is convenient for reporting purposes because the information is readily available. Suppliers also indicate that reporting this information does not infringe on competitive areas. As a result, allocation by sales is reasonable. However, given that other allocation methods are considered more accurate (e.g., product-level allocation basis), Ford and the industry should test the accuracy of using sales as an allocation basis to ensure that OEMs are collecting data with the highest possible accuracy in the future. And because consensus about the best approach is lacking, Ford should stay abreast of the ongoing developments around reporting standards as they pertain to emissions allocation bases as they are likely to continue to change.

3. Research Opportunities for Integrating GHG Data Collection with Other Data Collection (e.g., Water)

OEMs routinely collect data from suppliers as part of the customer-supplier relationship. GHG data collection in the automotive sector will build on past and ongoing efforts to understand material and chemical inputs to vehicle production. Environmental and social issues will continue to arise and evolve, and, as a result, Ford should continuously research opportunities to integrate data collection for GHG and other metrics (past, present, and future). This can reduce burden to suppliers supplying data as well as internal resources processing collected data.

4. Consider Value and Opportunities for Gathering Data from Suppliers beyond Tier One

Presently, Ford's GHG data collection efforts target tier-one suppliers. As direct suppliers to Ford, these companies have the most pronounced and accessible impact on Ford's operations (e.g., risks, costs, etc.). As a direct customer, Ford has the most leverage to request data from these companies. However, as the company increases engagement with and understanding of its supply chain's emissions, it may find value in increasing the depth to which it gathers information on the supply chain. The data collection conducted for this project engaged tier-one suppliers and requested Scope 1 and 2 emissions (which are relevant to suppliers' internal operations). However, if Ford and AIAG request suppliers' Scope 3 emissions in the future, tier-one suppliers will be required to report on their own supply chains (i.e., Ford's tier-two suppliers). Given this likely future development, Ford should evaluate what information is most useful to gather from tiers two and beyond in the supply chain and should determine how to collect this data most effectively (i.e., should Ford engage directly with tiers two–n, or should Ford engage those suppliers via requests of their tier-one suppliers?).

5. Determine Best Practices for Sharing Emissions Reduction Opportunities Across Supply Base

Through benchmarking and engagement, it has become evident to Ford that GHG management should remain a pre-competitive issue. It is Ford's goal to engage with suppliers to reduce the GHG emissions in its supply chain. While Ford has some expertise and capacity to share with its suppliers, there will be other methods, opportunities, and best practices that other suppliers in the automotive supply base are best suited to share. As a result, Ford should determine best practices for sharing emission reduction opportunities across the supply base. Concerns about proprietary information and loss of competitive advantage should be addressed through creative solutions that reward suppliers who can bring a valuable practice to the rest of the industry, thereby advancing emissions reductions for the entire automotive industry.

VI. ACRONYMS

ABF: Aligned Business Framework

AIAG: Automotive Industry Action Group

CAFE: Corporate Average Fuel Economy

CDP: Carbon Disclosure Project

CO_2e: Carbon dioxide equivalents

GHG: greenhouse gas

LCA: Life cycle assessment

LCI: Life cycle inventory

OEM: Original equipment manufacturer

WRI: World Resources Institute

WBCSD: World Business Council for Sustainable Development

VII. GLOSSARY OF TERMS

Aligned business framework: Ford Motor Company's strategic supplier program, currently involving 90 suppliers.

Carbon: Chemical element included in carbon dioxide (CO_2) and other greenhouse gases. With regard to air emissions, *carbon* can be used to describe carbon content of emissions, carbon dioxide (CO_2), carbon dioxide equivalent (CO_2-e), and greenhouse gas (GHG).

Carbon dioxide equivalent: Used to describe greenhouse gas emissions where each type of GHG emissions has been normalized (using their individual global warming potentials) to produce one number. Acronym is CO_2-e.

GHG or greenhouse gas: Typically refers to the six gases defined for the Kyoto Protocol: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and sulfur hexafluoride (SF_6).

GHG Protocol Initiative: A partnership between the World Resources Institute and the World Business Council for Sustainable Development. Authoring organization for GHG emissions accounting standards.

Life cycle assessment: Used to measure the inputs, outputs, and the potential environmental impacts of a product or product system.

Primary data: Emissions data, as defined for accounting using the GHG Protocol, from specific activities with a company's value chain. "Primary data includes specific data provided by suppliers or other companies in the value chain related to the reporting company's activities, including primary activity data and emissions data that is calculated using primary activity data (e.g., primary activity data combined with a secondary emission factor). Primary data does not include financial data (e.g., spend) used to calculate emissions" (The Greenhouse Gas Protocol 2010).

Scope 1 emissions: Direct emissions arising from activities owned or controlled by the company.

Scope 2 emissions: Indirect emissions from purchased electricity, heat, or steam.

Scope 3 emissions: Other indirect emissions "such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc." (The Greenhouse Gas Protocol n.d.).

Secondary data: Emissions data, as defined for accounting using the GHG Protocol, not from specific activities within a company's value chain. "Secondary data includes industry-average data (e.g., from published databases, government statistics, literature studies, and industry associations), financial data, proxy data, and other generic data. In certain cases, companies may use specific data from one activity in the value chain to estimate emissions for another activity in the value chain. This type of data (i.e., proxy data) is considered secondary data, since it is not specific to the activity being calculated" (The Greenhouse Gas Protocol 2010).

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X. APPENDICES

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OHS-11

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AIAG Supplier Guidance for Estimating GHG Emissions for OEMs

Background

AIAG member companies, along with many other companies globally, are being affected by efforts to manage the challenging risks of climate change. Climate change has become a key sustainability issue. Governments are taking steps to reduce green house gas (GHG) emissions through national policies such as emission trading programs, carbon or energy taxes, voluntary reduction programs, and regulations. Financial institutions are also asking for GHG emission estimations for evaluating risk. Many companies have put programs in place to understand and manage their GHG risks.

As companies progressed from mass production to lean production, now it is time to progress from lean production to sustainable production. As a part of sustainability programs, forward-looking companies are going beyond their direct GHG emissions and looking at the risk of indirect GHG emissions such as purchased electricity, transportation of goods to their facilities, and the production of purchased materials from their suppliers.

In 2009, a team of OEMs and Suppliers assembled at AIAG to jointly develop a consistent approach for calculating GHG emissions that could be reported to all OEMs and other customers if requested. The purpose of the team was:

- To determine unified OEM expectations for estimating, collecting, and reporting manufacturing facility-based GHG data
- To develop a common process, methodology, tool, and format for estimating and reporting GHG emissions from the manufacturing supply base operations.

The development of a common approach to reporting GHG emissions for the automotive industry has tremendous opportunity and benefit. This guidance, which was developed jointly by your customers and peers at AIAG, provides a common approach that is efficient and harmonizes data across the automotive industry.

Information requests will come from an individual OEM and the GHG emissions information will be used as part of their sustainability efforts.

GHG Reporting Standards and Tools

The AIAG GHG team has reviewed several GHG reporting standards and tools and has chosen the GHG Protocol Corporate Standard, developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), to be used for this common approach initiative. This guidance is to further clarify the GHG Protocol Corporate Standard, which should be consulted in its entirety before consideration of AIAG Guidance and tools. The WRI GHG Protocol Corporate Standard has several advantages:

- Internationally accepted - used by two thirds of S&P 500
- Policy neutral - basis of many leading GHG registries (EPA Climate Leaders, The Climate Registry, California Climate Action Registry, Chicago Climate Exchange, etc.)
- Flexible - allows users to narrow scope and expand to value chain accounting, if desired
- Globally Available - Standard and associated calculation tools are free to use.

The WRI GHG Protocol Corporate Standard and tools can be found at http://www.ghgprotocol.org. Individual tools (including spreadsheets and accompanying guidance) are available for several different processes. A free password-protected account is required to download these files, and can be easily created when first clicking to download a file. This website also includes a compilation of emission factors for the various GHGs - carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6).

Organizational Boundaries:

In the GHG Protocol Corporate Standard, there are two distinct approaches that companies can use to consolidate GHG emissions: equity share and control. Under the equity share approach, a company accounts for GHG emissions from operations according to its share of equity in the operation. Under the control approach, a company accounts for 100 percent of the GHG emissions from operations over which it has control. There are two kinds of control, financial control or operational control. Under the financial control approach, a company accounts for 100 percent of the GHG emissions from operations over which it has financial control. Financial control is the ability to direct the financial and operating policies for the purpose of gaining economic benefits from its activities. It does not account for GHG emissions from operations in which it owns an interest but has no financial control.

Under the operational control approach, a company accounts for 100 percent of the GHG emissions from operations over which it has operational control. Operational control is the authority to introduce and implement its operating policies at the operations. It does not account for GHG emissions from operations in which it owns an interest but has no operational control.

Total emissions may vary depending on the approach a company uses to determine its organizational boundaries. The AIAG Guidance recommends companies to account for and report their consolidated GHG data according to the approaches as presented in the GHG Protocol Corporate Standard. For consistency, once an approach is chosen, companies are suggested to continue using this approach in future years. Based on recent AIAG surveys, the majority of the companies (49%) stated that they preferred operational control method, 16% preferred financial control method, and 10% preferred equity share method (with 25% had no response)

Calculating GHG Emissions:

In estimating GHG emissions, there are three Scopes, which cover the different direct and indirect emissions.

Scope 1: Direct Emissions from Owned/Controlled Operations

Direct GHG emissions are emissions from sources within the entity's organizational boundaries that the reporting entity owns or controls. Scope 1 direct GHG emissions are principally the result of the following types of activities undertaken by the company:

- Generation of electricity, heat, or steam: These emissions result from combustion of fuels in stationary sources, e.g., boilers, furnaces, turbines

- Physical or chemical processing: Most of these emissions result from the manufacture or processing of chemicals and materials, e.g., cement, aluminum, adipic acid, ammonia manufacture, and waste processing

- Mobile combustion (transportation of materials, products, waste, and employees): These emissions result from the combustion of fuels in company owned/company controlled (i.e., leased) mobile combustion sources (e.g., fork lifts, lift trucks, trucks, trains, ships, airplanes, buses, cars, and construction vehicles). On the data collection sheet, see Question 5, Data Reliability and Quality, for specifying the types of mobile combustion emissions.

- Fugitive emissions: These emissions result from intentional or unintentional releases, e.g., equipment leaks from joints, seals, packing, and gaskets; methane emissions from coal mines and venting; hydrofluorocarbon (HFC) emissions during the use of refrigeration and air conditioning equipment; and methane leakages from gas transport. To reduce the burden of collecting information to calculate HFC emissions, you have the option to only report HFC emissions from refrigeration and air conditioning equipment with a capacity of greater than or equal to 50 pounds of HFC.

Scope 2: Indirect Emissions from the use of Purchased Electricity, Steam, Heating, and Cooling

Indirect GHG emissions are emissions that are a consequence of activities that take place within the organizational boundaries of the reporting entity, but that occur at sources owned or controlled by another entity. For example, emissions that occur at a utility's power plant as a result of electricity used by a manufacturing company represent the manufacturer's indirect emissions.

Scope 2 is a special category of indirect emissions and refers only to indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling. It typically represents one of the largest sources of emissions for an entity; therefore, it represents a significant opportunity for GHG management and reduction. Reporting of Scope 2 emissions enables transparent accounting and reporting of emissions and reductions associated with such opportunities. Also, in comparison to other indirect emissions, data for Scope 2 emissions can be gathered in a relatively consistent and verifiable manner.

Total Emissions vs. Prorated to OEM by Percent Financial Sales

The AIAG Guidance, consistent with OEM expectations, is suggesting companies provide their total percent financial sales for the individual OEM entities that they will be reporting to. This methodology was selected to preserve business confidentiality and to reduce complexity in reporting GHG emissions. This percentage will be applied to the supplier's global GHG emissions to estimate the GHG emissions for each OEM entity.

Recalculating Past Year GHG Emissions

Companies can go through several changes over the years that could affect GHG emissions. When should companies recalculate past year emissions due to these types of changes? AIAG Guidance recommends that the GHG emissions be recalculated if the cumulative effect of all the changes is a significant change on base year emissions. WRI defines what a significant change is. It is recommended that a company recalculate past year GHG emissions for the following:

- Transfer of ownership or control of emissions-generating operations from one company to another (e.g. mergers, acquisitions, and divestments)
- Changes in calculation methodology or improvements in the accuracy of emission factors or activity data
- Discovery of errors in the data or calculations

It is not recommended to recalculate the past year GHG emissions estimates for the following actions:

- Closed facilities
- Outsourcing / insourcing of emitting activities

Data Reliability and Quality

Good quality data is essential to this process. The following questions are asked at the end of the survey to qualitatively drive good estimating and reporting:

1. Explanation of Significant Changes since the Previous GHG Inventory Submittal
2. Does your company have a written QA/QC policy or procedure for GHG data collection and reporting? Yes or No
3. What protocol was used to calculate GHG data? WRI, Other (specify)
4. What type of system was used to calculate GHG data? 3rd Party, WRI worksheet, Other (specify)
5. What are the sources included in your Scope 1 Mobile Emissions?

Also, the following certification statement is required: This data has been prepared and reviewed using the AIAG and WRI guidance and appropriate industry standards. It is accurate and represents our best estimate at this point in time.

Current Reporting

Companies are at different levels of maturity and may not be prepared to report on all aspects (or entire scope) of GHG emissions. Suppliers should develop systems for managing their own emission inventories. OEMs, and eventually Tier 1 suppliers, will request this data. Continuous improvement in data collection and emission estimation is critical towards improving data reliability, data quality and sustainability efforts.

Monthly collection of data is encouraged to allow for the ability to estimate emissions on an as needed basis. For response to OEMs' initial GHG emissions data requests (occurring in 2010/2011), the following is recommended:

- Tier 1 suppliers only
- Manufacturing facilities only (This excludes separate office facilities, warehouses, and research facilities. If a manufacturing facility contains office facilities, warehouses, and research areas in one building, then include those areas in your emission estimates)
- Emissions should be derived from and consistent with WRI Protocol:
  - invoices (actual energy bills and utility)
  - metered data
  - calculations (engineering)
  - estimates (engineering)

The following is the basic report information that is contained in the GHG Data Collection Sheet that was developed by the AIAG GHG team that should be used to submit your data:

- Date of Report Submittal

- Reporting period - either calendar year basis or fiscal year basis. List the beginning quarter and the ending quarter that you are reporting. For example, for calendar year reporting, the beginning quarter would be 1Q2011 and the ending quarter would be 4Q2011, and for a fiscal year reporting, the beginning quarter could be 2Q2011 and the ending quarter could be 1Q2012. Each OEM will specify the reporting period; therefore it is important that you are able to report according to the different reporting periods.
- Company name, supplier code, contact name, contact phone number, and contact email
- Name of the OEM that the report will be submitted to
- Percent financial sales to the OEM
- Organizational boundary used to calculate GHG emissions [based on recent AIAG surveys, the majority of the companies stated that they would prefer operational control method]
- Scope 1 GHG emissions

  Enter GHG emissions for CO2, CH4, N20, HFCs, SF6, PFCs, and total carbon dioxide equivalent (CO2e) in metric tons for the following processes:

  - Total global emissions from on-site generation of electricity, steam or heat and source of data
  - Total global emissions from physical/chemical processing and source of data

  - Total global emissions from mobile combustion (see Question 5, data reliability and quality)
  - Total global emissions from fugitive sources and source of data
- Scope 2 GHG emissions

  Enter GHG emissions for total CO2e in metric tons.
- Data reliability and quality section - complete the questions in this section
- Certification statement - must be completed.

Future Reporting

This process of GHG emission estimation is evolving and new methods, guidance, and information is coming forward all the time. Therefore, AIAG will revise this document and supporting information based on any new information and industry needs. Although the ultimate use of this data is up to the OEM, suppliers should consider setting objectives and targets that fosters sustainable production.

- Scope 3 GHG emissions:
  - From the Tier 2 supplier manufacturing emissions (Tier 3 to the OEM)
  - Other indirect GHG emissions
- Office facilities, warehouses, and research facilities, which are not currently included as part of Scope 1 or 2 estimates

Supporting Information and References

All WRI Guidance can be found at wri.org.

There is a range of information available on this topic. Some examples of companies taking these kinds of steps are available through the CDP Supply Chain Program. (https://www.cdproject.net/en-US/Programmes/Pages/Members-List-Supply-Chain.aspx)

In addition, for estimating scope emissions, the WRI has completed a Scope 3 Road Test and has information in the following press release: http://www.wri.org/press/2010/01/sixty-corporations-begin-measuring-emissions-products-and-supply-chains

Conclusion

If are there are any queries regarding the use or application of this data collection sheet that are not adequately explained, please contact your customer requesting this information.

***Definitions and Conversion Factors**

Metric tons = 1,000 kilograms

AIAG GHG Data Collection Sheet

Base Report Information

Date of Report Submittal			
	Beginning Quarter	Ending Quarter	
Reporting Period (select quarters)	2Q2011	1Q2012	
Supplier Company Name	Ford Motor Company		
Name of OEM Report Being Submitted To	Honda - North America		9/30/2010 17:22
OEM Top Level Supplier Code			
Contact Name			
Contact Phone Number			
Contact Email			
Percent of Financial Sales to OEM Entity Listed Above			
Organizational Boundary Used to Calculate GHG Emissions	Operational Control Approach		

Key	
	Enter data as metric tons of the parameter requested
	Enter data as metric tons of CO2 equivalent
	Pulldown selection
	Calculated Field

Estimated GHG Emissions

Scope 1: Direct Emissions from Owned / Controlled Operations

Enter Units by each GHG (cells in light blue) and as CO2e (cells in orange), both values in metric tons	Data Entry	Data Entry	Calculated Field	Data Entry	Data Entry	Calculated Field	Data Entry	Data Entry	Calculated Field	Data Entry	Data Entry	Calculated Field	Calculated Field	Calculated Field
	Total Global Emissions from On-Site Generation of Electricity, Steam or Heat	**Source of Data**	**Total Global Emissions from On-Site Generation of Electricity, Steam or Heat Prorated to OEM by % sales**	**Total Global Emissions from Physical/ Chemical Processing**	**Source of Data**	**Total Emissions from Physical/ Chemical Processing, Prorated to OEM by % sales**	**Total Global Emissions from Mobile Combustion (see Question 5, Data Reliability and Quality)**	**Source of Data**	**Total Global Mobile Combustion Prorated to OEM by % sales**	**Total Global Emissions from Fugitive Sources**	**Source of Data**	**Total Global Emissions from Fugitive Sources, Prorated to OEM by % sales**	**Total Global Emissions**	**Total Global Emissions Prorated to OEM by % sales**
CO2 (metric tons)			0			0			0			0	0	0
CH4 (metric tons)			0			0			0			0	0	0
N20 (metric tons)			0			0			0			0	0	0
HFCs (metric tons)						0						0	0	0
SF6 (metric tons)						0						0	0	0
PFCs (metric tons)						0						0	0	0
Total CO2e (metric tons)			0			0			0			0	0	0

Scope 2: Indirect Emissions from the use of purchased electricity, steam, heating & cooling

Enter Units as CO2e (metric tons)	**Total Global Emissions from Indirect**	**Data Entry (Source of Data)**	**Total Global Emissions, Prorated to OEM by % sales**
CO2 (metric tons as CO2e)			0

☐

Data Reliability and Quality

AIAG GHG Data Collection Sheet

1. Explanation of Significant Changes Since the Previous GHG Inventory Submittal (see wri.org)

2. Does your company have a written QA/QC policy or procedure for GHG data collection and reporting? Yes or No

3. What protocol was used to calculate GHG data? WRI, Other (specify)

4. What type of system was used to calculate GHG data? 3rd Party, WRI worksheet, Other (specify)

5. What are the sources included in your Scope 1 Mobile Emissions?

Certification Statement

This data has been prepared and reviewed using the AIAG and WRI guidance and appropriate industry standards. It is, to the best of our knowledge, accurate and represents our best estimate at this point in time.

Name:	
Title:	
Date:	

Maintenance Request Form

Name of Submitter: **Date:**

Company:

Company Address:

Phone: Fax: **E-mail:**

MAINTENANCE REQUEST

Page Number of Change:

Document Currently Reads:

Recommended Changes/Should Read:

Reason for Change (Use additional sheets if necessary):

Signature of Submitter:

DISPOSITION (AIAG USE ONLY)

Manager's Recommendation:

Final Disposition:

Comments:

Note: Complete form and return to the AIAG Publication Specialist for consideration.

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APPENDIX B:
WRI/WBCSD Scope 3 Road Test Data Collection Form

Data Collection Form

Scope 1 & 2 Emissions

Instructions

- Please report emissions for your entire company.

- Please report data for Calendar Year 2009 .

- For each emissions entry, total emissions are captured in column R. In column W, please indicate what percentage of this total is allocated to your business with Ford Motor Company

		Calendar Year 2009 Data											
	Supporting Information	**CO2** (metric tonnes)	**HFCs** (metric tonnes)	**SF6** (metric tonnes)	**CH4** (metric tonnes)	**N2O** (metric tonnes)	**PFCs** (metric tonnes)	**Total CO2-e** (metric tonnes)	**Units** *(if not metric tonnes)*	**Reporting Year** *(if not 2009)*	**Percentage allocated to business with Ford**	**Total allocation to Ford**	**Basis for Allocation** *(revenue, # sold, value-add, product-level, weight)*
Scope 1: Direct Emissions from Owned/Controlled Operations													
Of Scope 1 emissions, we are most interested in direct emissions from category 1, below.													
1 Direct emissions from stationary combustion - *For assistance with calculating stationary combustion emissions, please refer to the accompanying GHG Protocol tool (see Guidance for details on access and use) .*													
Fuel types used (*please list*)*													
Energy produced on sitewith these fuels (*list quantity for each*)*													
GHG emissions associated with this energy production.								0				0	
* Or, attach completed WRI calculation tool.													
2 Direct emissions from mobile combustion - *For assistance with calculating mobile combustion emissions, please refer to the accompanying GHG Protocol tool.*													
Types of fuel consumed during mobile combustion *(please list)*													
GHG emissions associated with mobile combustion								0				0	
3 Direct emissions from processing sources *(physical, chemical processing) **													
Processes emitting non-combustion GHGs *(please list)*													
GHG emissions associated with these processes								0				0	
*These types of emissions are most relevant for raw materials processing, such as smelting.													
4 Direct emissions from fugitive sources (*e.g., refrigerant HFCs, equipment leaks*)													
Processes/sources emitting fugitive GHGs *(please list)*													
Fugitive GHG emissions from these processes/sources								0				0	
Total Scope 1 Emissions		0	0	0	0	0	0	0				0	

Scope 2: Indirect Emissions from the Use of Purchased Electricity, Steam, Heating and Cooling

Of Scope 2 emissions, we are most interested in indirect emissions from category 5, below.

5 Indirect emissions from purchased/acquired electricity - *For assistance with calculating emissions from purchased electricity, please refer to the accompanying GHG Protocol tool (see Guidance for details on access and use) .*

KWh consumed through purchased/acquired electricity												
Energy type for this electricity - *insert % of each energy type to the right*												
Coal												
Wind												
Gas												
Nuclear												
Other												
GHG emissions associated with these KWh							0				0	

6 Indirect emissions from purchased/acquired steam

BTUs of steam consumed												
GHG emissions associated with these BTUs							0				0	

7 Indirect emissions from purchased/acquired heating

BTUs consumed from P/A heating if known												
Energy type for this heat - *insert % of each energy type to the right*												
Coal												
Wind												
Gas												
Nuclear												
Other												
GHG emissions associated with BTUs consumed							0				0	

8 Indirect emissions from purchased/acquired cooling

BTUs consumed from P/A cooling												
Energy type for this cooling - *insert % of each energy type to the right*												
Coal												
Wind												
Gas												
Nuclear												
Other												
GHG emissions associated with BTUs consumed							0				0	
Total Scope 2 Emissions	0	0	0	0	0	0	0				0	

9 Please describe the process you used to collect and calculate the emissions you have entered into this data collection form, including your calculation methodology and the data type used (i.e., product level, facility level, corporate level). Please attach any tools/spreadsheets employed (e.g., completed WRI tools).

10 How have you defined your organizational boundary for this exercise? For example, did you include or not Joint Ventures? Did you set a minimum equity share amount to specify inclusion or exclusion of specific assets?

Sources:
1) GHG Protocol
2) EPA for emissions conversion factors to CO2-e

Qualitative Questions Related to Your Company's Climate Change Strategy *

Ford is interested in learning more about how climate change could impact your business. Please answer the following questions to the best of your knowledge.

1) Does your company perceive itself to be at risk from:

- **a)** The impacts of climate change legislation, including a price on GHG emissions?
- **b)** The physical impacts of climate change?
- **c)** Energy price volatility?
- **d)** Please describe:

2) Has your company developed a strategy or policy for:

- **a)** Mitigating climate change (e.g., GHG reduction strategy with targets)?
- **b)** Adapting to climate change (e.g., adapting to water scarcity in areas of operation)?
- **c)** Energy price volatility (e.g., using sources of energy with less price volatility)?
- **d)** Please describe:

3) Does your company perceive any opportunities from:

- **a)** Climate change, including from climate change legislation?
- **b)** Reducing GHG emissions (e.g., developing products that reduce GHG emissions)?
- **c)** Energy price volatility?
- **d)** Please describe:

4) GHG emissions tracking

- **a)** Aside from this data request, has your company tracked its GHG emissions and/or set benchmarks for reduction?
- **b)** If so, at what level do you collect the data (product, facility, geographic area, or corporate level)? *List all that apply.*
- **c)** Please provide any details.

5) GHG emissions reporting

- **a)** Does your company report GHG emissions to any voluntary or non-voluntary reporting schemes?
- **b)** If yes, which ones *(e.g., Carbon Disclosure Project, EPA Climate Leaders)*

6) Carbon accounting

- **a)** Is your company located in a place where GHGs are already regulated?
- **b)** If not, how does your company anticipate accounting for the cost of carbon (e.g., under a cap and trade legislation)?
- **c)** How would this be integrated into your financial management?

7) Carbon measurement at the product-level

- **a)** Has your company performed a Life Cycle Assessment (LCA) of any of its products?
- **b)** If so, are the findings publicly available?
- **c)** What was the motivation for performing an LCA?
- **d)** Did your company use the LCA to make decisions on how to reduce environmental impacts?
- **e)** If so, has the LCA been updated to assess any improvements?
- **f)** Does your company plan to perform any additional LCAs?

8) Relationship with your suppliers

- **a)** Do you request GHG emissions data from your suppliers?
- **b)** If so, please describe this program.
- **c)** Do you have any supplier partnerships to reduce environmental impact?

**** Questions were adapted from the Carbon Disclosure Project 2009 Supply Chain Questionnaire to be relevant for Ford as part of this data collection effort.***

APPENDIX C: WRI/WBCSD Scope 3 Road Test Guidance

Ford Motor Company
Supplier Guidance for Calculating Greenhouse Gas Emissions for Business with Ford
FY 2009 Data Collection

A. Overall Guidance:

1. Please report data at the corporate level.
2. Please be sure to complete the allocation columns W and Y, and provide further detail on allocation method in the method section (row 56).
3. Please use emissions factors relevant to your operations at the smallest scale necessary to capture differences.
    a. For example, if you have two facilities that produce goods for Ford, with one operating on electricity from coal, and the second on electricity from natural gas, use the coal emissions factor for the first plant, and the natural gas emissions factor for the second. Then sum the total greenhouse gas emissions for the two plants before entering it in the data form.
    b. The GHG Protocol (see below for description) defines data quality levels that are relevant to this process. As a general rule of thumb, follow the guide below to determine the type of data to provide (ranked from most accurate to least accurate) for completing a GHG inventory. Ford recognizes that many companies may have data limitations, including not having disaggregated data available at the Product or Process level. At this stage, the accompanying Ford data collection form is mainly focused on reporting of Data Type 5 (Corporate Level Data), although facility level data may need to be analyzed and understood to accurately determine corporate level data. Please see the remainder of this supporting guidance document and calculation tools for more information.

Data Type	Description
1. Product-level Data	Life cycle GHG[1] emissions data for the specific product of interest
2. Process-level Data	GHG emissions and/or energy consumption data from processes that produce the product of interest
3. Facility-level Data	GHG emissions and/or energy consumption data for facilities that produce the product of interest
4. Business Unit-level Data	GHG emissions and/or energy consumption data for business units that produce the product of interest
5. Corporate-level Data	GHG emissions and/or energy consumption data for your entire corporation

4. Please complete the "Supporting Information" section (column D) as indicated in the detailed guidance below.

B. Resources and References:

Greenhouse Gas Protocol, Corporate Guidance: The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard. Revised Edition. World Resources Institute and World Business Council for Sustainable Development. Available here: http://www.ghgprotocol.org/standards/corporate-standard

Greenhouse Gas Protocol Calculation Tools: Available for download on the Greenhouse Gas Protocol website: http://www.ghgprotocol.org/calculation-tools/all-tools. Where applicable, individual tools

[1] Greenhouse gases (GHG) include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

(including spreadsheets and accompanying guidance from the GHG Protocol) are referenced in the sections below. A free password-protected account is required to download these files, and can be easily created when first clicking to download a file.

The Climate Registry: General Reporting Protocol, Version 1.1. Available for download at: http://www.theclimateregistry.org/resources/protocols/general-reporting-protocol/ All subsequent references to The Climate Regsitry chapters and page numbers refer to locations in this file.

Emissions Factors: A reference file with emissions factors is included in the materials you were sent, titled "WRI_GHG_emissions_factors_compilation.xls". Note that individual factors may be U.S.-specific. Please use emissions factors that you know to be most appropriate for your process, region or country, and provide information explaining it.

C. Detailed Guidance:

Scope 1: Direct Emissions from Owned/Controlled Operations

Direct GHG emissions are emissions from sources within the entity's organizational boundaries that the reporting entity owns or controls.
Please note that we are most interested in Category 1 (Direct Emissions from Stationary Combustion) here.

1. **Direct Emissions from Stationary Combustion:** *Stationary combustion* refers to the production of electricity, steam, heat or power using equipment in a fixed location.

   Supporting Information (col. D): Please list the fuel types combusted on-site (row 7), and enter the total energy produced by stationary combustion sources at owned/controlled operations and include the units (row 8).

   1. Determine annual consumption of each fuel combusted at each facility
   2. Determine total emissions:

      Option A:

      1. Use the included spreadsheet created by the WRI to calculate emissions: GHG Emissions from Stationary Combustion, Version 4.0, February 2009 ("Stationary combustion tool (Version 4.0).xls")
      2. Enter values into row 8 of the data collection form for Ford; note that the spreadsheet will automatically calculate total values

      Option B:

      1. Determine appropriate CO2, CH4, and N2O emission factors for each fuel
      2. Calculate each fuel's CO2, CH4, and N2O emissions
      3. Convert to metric tonnes if necessary
      4. Enter values into row 8 of the data collection form for Ford; note that the spreadsheet will automatically calculate total values

   -More detailed guidance: The Climate Registry Chapter 12 (pdf pg. 77-97)

2. **Direct Emissions from Mobile Combustion:** *Mobile Combustion* refers to the combustion of fuels in transportation sources (e.g., cars, trucks, marine vessels and planes) and emissions from non-road equipment such as in construction, agriculture, and forestry.

   Supporting Information: Please enter the types and quantities of fuel combusted in mobile sources (i.e., diesel, kerosene, gasoline). For example: Diesel (500 gallons); Fuel oil (100 gallons).

   1. Identify total annual fuel consumption by fuel type
   2. Determine total emissions:
      Option A:
      1. Use the included spreadsheet created by the WRI to calculate emissions: GHG emissions from transport or mobile sources, Version 2.0, June 2009 ("WRI_Transport_Tool.xls")

      Option B:
      1. Determine appropriate emission factors
      2. Calculate each fuel's CO2, CH4, and N2O emissions
      3. Enter values into row 12 of the data collection form for Ford; note that the spreadsheet will automatically calculate total values

      -More detailed guidance: The Climate Registry Chapter 13 (pdf pg. 98-112)

3. **Direct Emissions from Processing Sources:** *Processing Emissions* refers to emission from chemical and physical processes other than fuel combustion (e.g., from manufacturing cement, aluminum, adipic acid, ammonia, etc.). Note that many processes will only have emissions associated with the electricity used to operate the machinery involved. In these cases, the emissions should already be accounted for under Scope 1-Category 1, or Scope 2.

   Supporting Information: Please list the sources of process emissions. For example: Aluminum manufacture.

   1. Enter values into row 17 of the data collection form for Ford.
   -More detailed guidance: WRI Corporate Standard (scopes 1 and 2) for calculation tools for specific sectors (http://www.ghgprotocol.org/calculation-tools/all-tools)

4. **Direct Emissions from Fugitive Sources:** *Fugitive Source Emissions* refers to unintentional releases from the production, processing, transmission, storage, and use of fuels and other substances, that do not pass through a stack, chimney, vent, exhaust pipe, or other functionally-equivalent opening. For example, this includes releases of sulfur hexafluoride from electrical equipment, hydrofluorocarbon releases during the use of refrigeration and air conditioning equipment, and methane leakage from natural gas transport.
   There are several methods for calculating emissions from fugitive sources. In general, follow these steps:

   Supporting Information: Please list the sources of fugitive emissions. For example: hydrofluorocarbon (HFC) emissions during the use of refrigeration and air conditioning equipment

1. Determine the base inventory of each refrigerant in use at each facility
2. Calculate changes to the base inventory for each refrigerant based on purchases and sales of refrigerants and changes in total capacity of the equipment
3. Calculate annual emissions of each type of refrigerant, and determine total HFC and PFC emissions for each facility.
4. Enter values into row 19 of the data collection form for Ford; note that the spreadsheet will automatically calculate total values

-More detailed guidance: WRI Corporate Standard (scopes 1 and 2) Appendix D (pdf pg. 94-96)
-More detailed guidance: The Climate Registry Chapter 16 (pdf pg. 137-148)

Scope 2: Indirect Emissions from the use of Purchased Electricity, Steam, Heating, and Cooling
Indirect GHG emissions are emissions that are a consequence of activities that take place within the organizational boundaries of the reporting entity, but that occur at sources owned or controlled by another entity. For example, emissions that occur at a utility's power plant as a result of electricity used by a manufacturing company represent the manufacturer's indirect emissions.

Scope 2 is a special category of indirect emissions and refers only to indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, or cooling. It typically represents one of the largest sources of emissions for an entity; therefore, it represents a significant opportunity for GHG management and reduction. Reporting of Scope 2 emissions enables transparent accounting and reporting of emissions and reductions associated with such opportunities. Also, in comparison to other indirect emissions, data for Scope 2 emissions can be gathered in a relatively consistent and verifiable manner.
Please note that we are most interested in Category 5 (Indirect Emissions from Purchased Electricity) here.

5. **Indirect Emissions from Purchased Electricity:** *Purchased Electricity Emissions* refers to indirect emissions from electricity purchased from utilities. The generation of electricity through the combustion of fossil fuels typically yields carbon dioxide and other greenhouse gasses.

   Supporting Information (col. D): Row 28: Please enter the total kilowatt-hours (or other measure of electricity) consumed from purchased or acquired electricity sources. This number can likely be obtained from utility bills. Rows 30-34: Please enter the percentage each fuel source represents of the total kilowatt-hours entered in Row 28. Note, if quantities do not sum to 100%, pleas provide additional information on other fuel sources, etc.

   To calculate indirect emissions from electricity use, follow these steps:
   1. Determine annual electricity use at each facility
   2. Determine total emissions:
      Option A:
      1. Use the included spreadsheet created by the WRI to calculate emissions: GHG emissions from purchased electricity, Version 2.1, June 2009 ("ghg-emissions-from-purchased-electricity-version-2.1.xls")

Option B:

1. Select the appropriate emissions factors that apply to the electricity used
2. Determine your total annual emissions
3. Enter values into row 35 of the data collection form for Ford; note that the spreadsheet will automatically calculate total values

-More detailed guidance: The Climate Registry Chapter 14 (pdf pg. 113-124)

6. **Indirect Emissions from Purchased / Acquired Steam:** *Purchased Steam Emissions* refers to emissions from the production of steam that the company purchases. This applies to companies who purchase steam or district heating.

   Supporting Information: Please enter the BTUs consumed from purchased steam.

   1. Determine energy obtained from steam or district heating
   2. Determine appropriate emissions factors for the steam or district heating
   3. Calculate emissions from steam
   4. Enter values into row 39 of the data collection form for Ford; note that the spreadsheet will automatically calculate total values
      -More detailed guidance: The Climate Registry Chapter 15 (pdf pg. 125-136)

7. **Indirect Emissions from Purchased / Acquired Heating:**

   Supporting Information: Row 42: Please enter the BTUs consumed from P/A heating. Rows 44-48: Please enter the percentage this fuel source represents of the total BTUs entered in Row 42. Note, if quantities do not sum to 100%, pleas provide additional information on other fuel sources, etc.

   1. Follow steps from above for other purchased/acquired items
   2. Enter values into row 49 of the data collection form for Ford; note that the spreadsheet will automatically calculate total values
      -More detailed guidance: The Climate Registry Chapter 15 (pdf pg. 125-136)

8. **Indirect Emissions from Purchased / Acquired Cooling:** *Emissions from Purchased Cooling* refers to emissions generated for cooling services that companies purchase, such as chilled water for production purposes.

   Supporting Information: Row 52: Please enter the BTUs consumed from P/A cooling. Rows 54-58: Please enter the percentage this fuel source represents of the total BTUs entered in Row 52. Note, if quantities do not sum to 100%, pleas provide additional information on other fuel sources, etc.

   1. Determine total cooling-related emissions from the district cooling plant
   2. Determine fraction of cooling emissions attributable to your operations
   3. Determine total yearly emissions
   4. Enter values into row 59 of the data collection form for Ford; note that the spreadsheet will automatically calculate total values
      -More detailed guidance: The Climate Registry Chapter 15 (pdf pg. 125-136)

9. **Methodology:** Please describe your methodology for developing the information provided in the spreadsheet. For example, if you used the WRI spreadsheet tools, or others, please indicate such. Specifically, please:
    a. Provide a description of and comment on the data types (as defined in the first section of this guidance document) used in the process of completing the form.
    b. Provide any additional files used or bases for calculations where possible, and please list the file names in this box.

10. **Organizational Boundary:** Please describe how you have defined your organization for purposes of this data collection form. If you were able to report for the entire corporation, please indicate such. If you segmented some smaller portion, please describe.

Qualitative Questions
Please answer these questions as comprehensively and accurately as possible.

Feedback
Please provide any feedback you have about this information collection process.

Carbon Disclosure Project 2010 Supplier Information Request

We request a reply to the following questions by 31 July 2010.

Please respond to the information request using our Online Response System (ORS). In early April 2010, instructions on how to access the ORS will be sent to you by e-mail.

We encourage companies to consult the CDP 2010 reporting guidance (see https://www.cdproject.net/en-US/Respond/Pages/CDP2010-Supply-Chain-Public-Procurement-Guidance-Index.aspx) and to use the guidance within the ORS.

Please answer the questions as comprehensively as possible. Where you do not have all of the information requested, please respond with what you have as this is more valuable to us than no response.

Companies will be able to explain why some questions are not relevant to their business. This symbol ¿ indicates those questions. For example, the symbol appears after question 15.1:

> 15.1 Please provide data on sources of Scope 3 emissions that are relevant to your organization. ¿(15.2)
> When ¿(15.2) is selected, a text box will open with a prompt for an explanation:
> 15.2 Please explain why not.
> This pattern is followed whenever the ¿ appears. In these cases, companies can explain why the question is not relevant to their company instead of answering the question.

We encourage companies to assess the relevance of questions in accordance with the principles of “The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)” developed by the World Resources Institute and the World Business Council for Sustainable Development (www.ghgprotocol.org).

According to these principles, which are also set out in the CDP guidance, information is relevant if it contains the detail that users, both internal and external to the company, need for their decision-making.

Next to certain CDP 2010 questions is the number of the CDP 2009 question that covered the same subject. Please note the wording may have changed. Please see the guidance for details.

CDP has written a draft framework which companies are invited to trial in reporting their greenhouse gas (GHG) emissions to CDP in 2010. The aim of the framework is to increase comparability of emissions figures, providing further guidance where required. It is not intended to introduce a new set of rules, rather it draws on existing reporting requirements and protocols, including the GHG Protocol, and will describe the approach that companies should take where they are subject to mandatory reporting requirements but also wish to provide information on emissions not covered by these requirements (see www.cdproject.net/cdp-framework).

The ORS has evolved to request data in a more structured format to allow for greater automated analysis of responses by data-users. Therefore, there are fewer free text fields and more tables with fields with drop down menus and fields that only accept numerical values.

Please note that the reporting period for which you will be providing data will be collected on a page of the ORS before the actual start of the CDP 2010 questionnaire.

Governance

1. Group and Individual Responsibility: (CDP 2009 Q25)
1.1 Where is the highest level of responsibility for climate change within your company?

If it is at board committee or other executive body level:
1.2 What is the mechanism by which the board committee or other executive body reviews the company's progress and status regarding climate change?

If it is at a lower level:
1.3 Please explain how overall responsibility for climate change is managed within your company.

Individual Performance: (CDP 2009 Q26)
1.4 Do you provide incentives for the management of climate change issues, including the attainment of greenhouse gas (GHG) targets?

If so,
1.5 Please complete the table.

Who is entitled to benefit from those incentives?	The type of incentives

Risks and Opportunities

2. Process to Identify Risks and Opportunities: (CDP 2009 Q1-6)

2.1 Describe your company's process for identifying significant risks and/or opportunities from climate change and assessing the degree to which they could affect your business, including the financial implications.

3. Regulatory Risks: (CDP 2009 Q1)

3.1 Do current and/or anticipated regulatory requirements related to climate change present significant risks to your company?

4. Physical Risks: (CDP 2009 Q2)

4.1 Do current and/or anticipated physical impacts of climate change present significant risks to your company?

5. Other Risks: (CDP 2009 Q3)

5.1 Does climate change present other significant risks – current and/or anticipated – for your company?

6. Regulatory Opportunities: (CDP 2009 Q4)

6.1 Do current and/or anticipated regulatory requirements related to climate change present significant opportunities for your company?

7. Physical Opportunities: (CDP 2009 Q5)

7.1 Do current and/or anticipated physical impacts of climate change present significant opportunities for your company?

8. Other Opportunities: (CDP 2009 Q6)

8.1 Does climate change present other significant opportunities – current and/or anticipated – for your company?

Where the answer to any of questions 3-8 is yes, please provide individual answers to the following questions, as you will be prompted to do so in the ORS.

- What are the current and/or anticipated significant risks/opportunities and their associated countries/regions and timescales?
- Describe the ways in which the identified risks / opportunities affect or could affect your business and your value chain.
- Are there financial implications associated with the identified risks/opportunities?
- If so, please describe them.
- In the case of risks: describe any actions the company has taken or plans to take to manage or adapt to the risks that have been identified, including the cost of those actions.
- In the case of opportunities: describe any actions the company has taken or plans to take to exploit the opportunities that have been identified, including the investment needed to take those actions.

Where the answer to any of questions 3-8 is no, please answer the following question:

- In the case of risks: explain why you do not consider your company to be exposed to significant risks – current or anticipated.
- In the case of opportunities: explain why you do not consider your company to be presented with significant opportunities – current or anticipated.

Where the answer to any of questions 3-8 is "Don't know", please explain why not.

Strategy

9. Strategy: (New for CDP 2010)
9.1 Please describe how your overall group business strategy links with actions taken on risks and opportunities (identified in questions 3 to 8), including any emissions reduction targets or achievements, public policy engagement and external communications.

Targets: (CDP 2009 Q23)
9.2 Do you have a current emissions reduction target?

If you do not have a target:
9.3 Please explain why not and forecast how your Scope 1 and Scope 2 emissions will change over the next 5 years.

If you are in the process of developing a target:
9.4 Please give details of the target(s) you are developing and when you expect to announce it/them.

If you have had a target and the date for completing it fell within your reporting year, please answer questions 9.5 and 9.6.
9.5 Please explain if you intend to set a new target.

If you have an emissions reduction target:
9.6 Please complete the table.

Target type	Value of the target	Unit	Base year	Emissions in base year (metric tonnes CO2-e)	Target year	GHGs and GHG sources to which the target applies	For recently completed targets only: was target met?

Emission Reduction Activities: (CDP 2009 Q23)
9.7 Please use the table below to describe your company's actions to reduce its GHG emissions. ¿(9.8)

Actions	Achieved or anticipated annual energy savings (if relevant)	Achieved or anticipated annual emissions reductions	Investment made or planned to enable actions (if relevant)	Achieved or anticipated annual monetary savings (if relevant)	Timescale of actions & associated investments (if relevant)

9.9 Please provide any other information you consider necessary to describe your emission reduction activities.

Engagement with Policy Makers: (CDP 2009 Q28)
9.10 Do you engage with policy makers on possible responses to climate change including taxation, regulation and carbon trading?

If so,
9.11 Please describe.

GHG Emissions Accounting, Energy and Fuel Use, and Trading

10. Reporting Boundary: (CDP 2009 Q8)

10.1 Please indicate the category that describes the company, entities, or group for which Scope 1 and Scope 2 GHG emissions are reported.

• Companies over which financial control is exercised – per consolidated audited financial statements;
• Companies over which operational control is exercised;
• Companies in which an equity share is held;
• Other – please provide details.

10.2 Are there are any sources (e.g. facilities, specific GHGs, activities, geographies, etc.) of Scope 1 and Scope 2 emissions within this boundary which are not included in your disclosure?

If so,
10.3 Please complete the following table.

Information about how to respond to this section may be found in "The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition)" developed by the World Resources Institute and the World Business Council for Sustainable Development ("the GHG Protocol"). For more information, see www.ghgprotocol.org and the CDP 2010 reporting guidance.

Please also provide CDP with responses to questions 10, 11, 12 and 13 for the three years prior to the current reporting year if you have not done so before or if this is the first time you have answered a CDP information request.

Source	Scope	Explain why the source is excluded

11. Methodology: (CDP 2009 Q9)
11.1 Please give the name of the standard, protocol or methodology you have used to collect activity data and calculate Scope 1 and Scope 2 emissions and/or describe the procedure you have used.

11.2 Please also provide the names of and links to any calculation tools used.

11.3 Please give the global warming potentials you have applied and their origin.

Gas	Reference	GWP

11.4 Please give the emission factors you have applied and their origin.

Fuel/material	Emission factor		Reference
	Number	Unit	

GHG Emissions Accounting, Energy and Fuel Use, and Trading

12. Scope 1 Direct GHG Emissions: (CDP 2009 Q10)
12.1 Please give your total gross global Scope 1 GHG emissions in metric tonnes of CO_2-e.

12.2 Please break down your total gross global Scope 1 emissions in metric tonnes CO_2-e by country/region. ¿(12.3)

Where it will facilitate a better understanding of your business, please also break down your total gross global Scope 1 emissions by business division and/or facility. (Only data for the current reporting year requested.)

12.4. Business division

12.5 Facility

12.6 Please break down your total gross global Scope 1 emissions by GHG type. (Only data for the current reporting year requested.) ¿(12.7)

When providing answers to questions 12 and 13, please do not deduct offset credits, Renewable Energy Certificates etc., or net off any estimated avoided emissions from the export of renewable energy, or from the use of goods and services. Opportunities are provided elsewhere in the information request to give details of activities that reduce or avoid emissions (please see guidance).

Carbon dioxide emissions from the combustion of biologically sequestered carbon i.e. carbon dioxide from burning biomass/biofuels should be reported separately from emission Scopes 1, 2 and 3. If relevant, please report these emissions under question 17. However, please do include any nitrous oxide or methane emissions from biomass/biofuels in your emissions under the three scopes.

GHG type	Scope 1 Emissions (Metric tonnes)	Scope 1 Emissions (Metric tonnes CO_2-e)

12.8 Fuel Consumption
Please use the table to give the total amount of fuel in MWh that your organization has consumed during the reporting year. ¿(12.9)

12.10 Please complete the table by breaking down the total figure by fuel type. ¿(12.11)

Fuels	MWh
Total	
Individual fuels	

12.12 Data Accuracy: (CDP 2009 Q19)
Please estimate the level of uncertainty of the total gross global Scope 1 figure that you have supplied in answer to question 12.1 and specify the sources of uncertainty in your data gathering, handling, and calculations.

	Scope 1
Uncertainty range	
Main sources of uncertainty in your data	
Expand on the main sources of uncertainty in your data	

GHG Emissions Accounting, Energy and Fuel Use, and Trading

13. Scope 2 Indirect GHG Emissions: (CDP 2009 Q11)

Important note about emission factors where zero or low carbon electricity is purchased:
The emissions factor you should use for calculating Scope 2 emissions depends upon whether the electricity you purchase is counted in calculating the grid average emissions factor or not – see below. You can find this out from your supplier.

Electricity that IS counted in calculating the grid average emissions factor:
Where electricity is sourced from the grid and that electricity has been counted in calculating the grid average emissions factor, Scope 2 emissions must be calculated using the grid average emissions factor, even if your company purchases electricity under a zero or low carbon electricity tariff.

Electricity that is NOT counted in calculating the grid average emissions factor:
Where zero or low carbon electricity is sourced from the grid or otherwise transmitted to the company and that electricity is not counted in calculating the grid average, the emissions factor specific to that method of generation can be used, provided that any certificates quantifying GHG-related environmental benefits claimed for the electricity are not sold or passed on separately from the electricity purchased. If certificates quantifying the GHG-related environmental benefits claimed for the electricity are sold or passed on separately from the electricity purchased, then you must report using the grid average emissions factor.

13.1 Please give your total gross global Scope 2 GHG emissions in metric tonnes of CO_2-e.

13.2 Please break down your total gross global Scope 2 emissions in metric tonnes of CO_2-e by country/region. ¿(13.3)

Where it will facilitate a better understanding of your business, please also break down your total gross global Scope 2 emissions by business division and/or facility. (Only data for the current reporting year requested.)

13.4 Business division

13.5 Facility

13.6 Purchased Energy
How much electricity, heat, steam, and cooling in MWh has your organization purchased for its own consumption during the reporting year? ¿(13.7)

Energy Type	MWh
Electricity	
Heat	
Steam	
Cooling	

13.8 Data Accuracy: (CDP 2009 Q19)
Please estimate the level of uncertainty of the total gross global Scope 2 figure that you have supplied in answer to question 13.1 and specify the sources of uncertainty in your data gathering, handling, and calculations.

	Scope 2
Uncertainty range	
Main sources of uncertainty in your data	
Expand on the main sources of uncertainty in your data	

GHG Emissions Accounting, Energy and Fuel Use, and Trading

14. Contractual Arrangements Supporting Particular Types of Electricity Generation: (CDP 2009 Q12)
14.1 Do you consider that the grid average factors used to report Scope 2 emissions in question 13 reflect the contractual arrangements you have with electricity suppliers?

If not,
14.2 You may report a total contractual Scope 2 figure in response to this question. Please provide your total global contractual Scope 2 GHG emissions figure in metric tonnes CO_2-e.

Please also,
14.3 Explain the origin of the alternative figure including information about the emission factors used and the tariffs.

14.4 Has your organization retired any certificates, e.g. Renewable Energy Certificates, associated with zero or low carbon electricity within the reporting year or has this been done on your behalf?

If so,
14.5 Please provide details including the number and type of certificates.

Type of certificate	Number of certificates	Comments

15. Scope 3 Other Indirect GHG Emissions: (CDP 2009 Q13)
15.1 Please provide data on sources of Scope 3 emissions that are relevant to your organization. ¿(15.2)

Sources of Scope 3 emissions	Emissions (in metric tonnes of CO_2-e)	Methodology	If you cannot provide a figure for a relevant source of Scope 3 emissions, please describe the emissions:

16. Emissions Avoided Through Use of Goods and Services: (CDP 2009 Q14)
16.1 Does the use of your goods and/or services enable GHG emissions to be avoided by a third party?

If so,
16.2 Please provide details including the anticipated timescale over which the emissions are avoided, in which sector of the economy they might help to avoid emissions and their potential to avoid emissions.

17. Carbon Dioxide Emissions from Biologically Sequestered Carbon: (CDP 2009 Q15)
17.1 Please provide your total carbon dioxide emissions in metric tonnes CO_2 from the combustion of biologically sequestered carbon i.e. carbon dioxide emissions from burning biomass/biofuels. ¿(17.2)

18. Emissions Intensity: (CDP 2009 Q16)
18.1 Please describe a financial and an activity-related intensity measurement for the reporting year for your gross combined Scope 1 and Scope 2 emissions.

Type of emissions intensity measurement	Units	The resulting figure for Scope 1 and Scope 2 emissions	Please explain if not relevant provide any contextual details that you consider relevant to understand the units or figures you have provided.
Financial			
Activity related			

GHG Emissions Accounting, Energy and Fuel Use, and Trading

19. Emissions History: (CDP 2009 Q17)
19.1 Do the absolute emissions (Scope 1 and Scope 2 combined) for the reporting year vary significantly compared to the previous year?

If so,
19.2 Please explain why they have varied and why the variation is significant.

20. External Verification/ Assurance: (CDP 2009 Q18)
20.1 Please complete the following table indicating the percentage of reported emissions that have been verified/assured and attach the relevant statement.

	Scope 1	Scope 2	Scope 3
Percentage of reported emissions that have been externally verified/assured			
Include the verification/assurance statement(s)			

21. Emissions Trading and Offsetting:(CDP 2009 Q21 and 22)
21.1 Do you participate in any emission trading schemes?

If so,
21.2 Please complete the following table for each of the emission trading schemes in which you participate.

Although some emission trading schemes may apply solely to the operators of facilities, the financial position of facility owners is also affected indirectly by the operation of the scheme. This question therefore applies to both owners and operators of facilities covered by trading schemes. Even if your company does not wholly own facilities, please give the total number of emissions and allowances.

Scheme name	Time Period		Allowances Allocated	Allowances Purchased	Verified emissions		Details of ownership i.e. owned/ operated/ or both
	Start date	End date			Numbers	Units	

21.3 What is your strategy for complying with the schemes in which you participate or anticipate participating?

21.4 Has your company originated any project-based carbon credits or purchased any within the reporting period?

If so,
21.5 Please complete the following table.

Credit origination/ credit purchase?	Project Identification	Project documentation URL	Verified to which standard?	Number of credits (metric tonnes CO2-e)	Credits retired?	Purpose e.g. compliance

Climate Change Communications

22. Climate Change Communications: (CDP 2009 Q27)
22.1 Have you published information about your company's response to climate change/GHG emissions in other places than in your CDP response?

If so,
22.2 In your Annual Reports or other mainstream filing? Please attach your latest publication(s).

22.3 Through voluntary communications such as CSR reports? Please attach your latest publication(s).

Supplier Module

SM 1. Allocating your Scope 1 and 2 emissions to your customers

Emissions from suppliers are often greater than the purchasing organization's own emissions and the Supply Chain / Public Procurement Member(s) requesting your GHG emissions data would like to better understand the entire impact of their organization on climate change – not just their own direct emissions. The questions below are designed to help you communicate the allocation of emissions from your company to your customer(s). For more information on allocation, how to do it, and why it is important, please review the Guidance document.

SM 1.1 Please allocate your Scope 1 and Scope 2 emissions by your customers listed below according to the goods or services you have sold them in this reporting period.

Please note that your customers will only be able to see the data relevant to them.

	Quantity in metric tonnes CO_2-e	**Do these represent emissions from Scope 1 only, Scope 2 only or both?**	**Major emission sources**	**Uncertainty (+/-%)[a]**	**Verified[b]**	**Please give details**
Name of requesting member						

[a]Give the degree of confidence that you have in the figures expressed as a percentage, e.g. you estimate that they are accurate to +/- 15%.
[b]Has the allocation of emissions to your customers been externally verified?

SM 1.2 Please explain how you have identified the GHG sources listed above (column 4), including major limitations to this process and assumptions made.

SM 1.3 Describe your system for allocating emissions to your customers. Where published information has been used, please provide a reference(s).

SM 1.4 What are the challenges in allocating emissions to different customers and what would help you to overcome these challenges? Please describe whether and how you plan to develop your capabilities to allocate your emissions in the future.

SM 2. Your engagement with your suppliers

Your customers want to engage with you to learn more about the emissions from their immediate suppliers. The purpose of this section is to find out what you in turn are doing to engage with your own suppliers.

SM 2.1 Do you have a strategy for engaging with your suppliers on their GHG emissions and the impacts of climate change on their business?

SM 2.2 If so, please provide details of this strategy.

SM 2.3 To give a sense of the scale of this engagement, please include the number of suppliers with whom you are engaging and the proportion of your total spending that they represent.

Number of suppliers	**Proportion of your total spending (%)**

SM 2.4 If not, please explain any plans you have to develop one in the future.

Supplier Module

SM 2.5. If you have data on your suppliers' GHG emissions and climate change strategies, please explain how you make use of that data (for example: identifying major GHG sources to prioritize emissions reduction actions, identifying physical risks in the supply chain, stimulating innovation, etc).

SM 3. Emissions over the lifecycle of goods and services
SM 3.1 Please list measures (completed or planned) to reduce GHG emissions in the lifecycle of groups of products or individual products, including an estimate of the possible reductions for each initiative.

Some suppliers may have customers who request that they provide estimates of GHG emissions over a particular product's lifecycle. Others may have estimated this information for their own purposes and wish to publicize it. If you fall into either group, please answer the following questions. You can supply data for more than one product.

SM 3.2 You can use this table to provide LCA data to all requesting CDP members or to selected members only. You can see below a list of all your requesting members. If you would like to limit the availability of this particular product information to a particular member, please select that member. You can select more than one member by holding the control key as you make your choice. You can repeat this process as you move to the next table if you have data for more than one product to input. If you do not select specific members, this data will be visible to all requesting members. If you choose to make your response public, it will then appear in your published response on our website.

SM 3.3 Lifecycle emissions table for a particular good or service

Name of good/service	
Description of good/service	
Lifecycle stage	**Emissions (kg CO_2-e) per unit at the lifecycle stage**
Please enter lifecycle stage	
Emissions total	

An example of the lifecycle stages of a service might be - in the case of a hotel stay - check in, use of room, check out, cleaning.

SM 3.4 Please give details of the method that you have used to estimate lifecycle emissions. State if you have followed a published procedure (e.g. ISO 14040 & 14044 or PAS 2050) or one that you have developed yourself. Give the boundary of your assessment. Please make it clear which GHGs and GHG sources are included in your assessment. If relevant GHGs and GHG sources are excluded, please describe them and give reasons for omissions. Give references to data sources used.

Important Information

This is the third time the Carbon Disclosure Project (CDP) has made an information request on behalf of corporate and public sector procuring organizations. Your company may be receiving the request for the first time because in 2010 our members have expanded further the number of suppliers to which the request is made. To find out more about CDP and the previous responses from other supplier companies, please refer to our website at www.cdproject.net.

Why is this request from a group of customers rather than from an individual customer?
(a) To facilitate ease of reporting for companies by providing one standardized request that requires one response to be delivered to numerous customers.
(b) To receive data in a common format from a number of key suppliers.

What are the financial implications of responding?
CDP has charitable status and seeks to use its limited funds effectively. As such, responses must be prepared and submitted at the expense of responding companies. CDP also reserves the right, where it deems it appropriate in view of its charitable aims and objectives, to charge for access to or use of data and/or reports it publishes or commissions.

What is the basis of participation and what will happen to the data received?
Companies responding to CDP 2010 make no claim of ownership in the data they submit and agree that CDP has an irrevocable license to use and copy the responses and their contents without restriction and to authorize others to do the same. Companies responding to CDP 2010 agree that CDP is free to make use of the data including as described below and with respect to public responses otherwise without restriction whatsoever in furtherance of its charitable mission. Companies also agree that CDP will own the databases in which that data is stored, as well as the contents of those databases.

When responding to CDP, you will be given a choice as to whether your response is made public or non-public. We strongly encourage companies to make their responses public which means that the response will be made publicly available from the CDP website as outlined below. Non-public responses will not be made publicly available and will only be used as outlined below.

For public responses
Companies agree that a public response to CDP 2010 will be used by CDP in furtherance of its charitable mission and that the response may be:

1. Made available as soon as it is received by CDP to its Supply Chain/Public Procurement members, signatory investors, partners, appointed report writers, selected rating agencies and any other parties that CDP deem appropriate,
2. Made publicly available at www.cdproject.net from the date of the report launch and stored and preserved on CDP's servers indefinitely thereafter,
3. Distributed through selected partners,
4. Compiled in CDP databases and made available in original, modified or adapted form (for a fee or otherwise) for use by commercial and non-commercial organizations,
5. Amalgamated with information about the responding company from other public sources including rating agencies and financial information distributors,
6. Used as a best practice example in CDP literature and research,
7. Used individually or as part of aggregate results in CDP's reports and in any other research conducted or commissioned by CDP,
8. Used in any other way that accords with CDP's charitable mission.

For non-public responses
Companies agree that a non-public response to CDP 2010 may be:

1. Made available as soon as it is received by CDP to its requesting Supply Chain/Public Procurement members, partners and appointed report writers but not to any other parties, and
2. Used in production of aggregate or anonymous statistics in any CDP report.

Important Information

For all responses
CDP will at no point divulge the relationship between requesting members and supplier companies.

NOTE: Some responses to CDP Public Procurement members may be shared between members where those members are individual representatives of a larger organization. The primary example where this may occur is when multiple departments (agencies) of a national government participate individually but share data between them. For 2010 this includes the central government of the United Kingdom and the Federal government of the United States of America. Additionally, it is possible that disclosures held by public authorities may be subject to a Freedom of Information (FOI) request. Please refer to the letter you originally received from the requesting member for more details or contact publicprocurement@cdproject.net

Scoring of response
Report writers will benchmark all supplier responses and this information will be shared with responding companies and requesting members only. Responses will be assessed for the comprehensiveness of the companies' disclosure and on performance factors. Companies agree that their response will not be eligible for benchmarking by report-writers unless it is submitted in the format prescribed by CDP.

What if a company wishes to change or update a response?
In order for responses and any revisions to be included in the annual reports CDP publishes each year, they must be received by 31 July 2010. Where responses are submitted via the Online Response System, they will become 'read-only' after submission and can then only be amended by CDP staff. CDP can accept revisions to responses in writing at any time and will aim to make these available from www.cdproject.net within five days of receipt.

How can a company confirm its participation?
On receipt of the emailed request, please register via the URL provided.

What is the legal status of CDP?
The Carbon Disclosure Project is a UK Registered Charity no. 1122330 and a company limited by guarantee registered in England no. 05013650. In the US, the Carbon Disclosure Project is a special project of Rockefeller Philanthropy Advisors with United States IRS 501(c)(3) charitable status.

The Carbon Disclosure Project is an independent not-for-profit organization holding the largest database of primary corporate climate change information in the world.

Thousands of organizations from across the world's major economies measure and disclose their greenhouse gas emissions and climate change strategies through CDP. CDP puts this information at the heart of financial and policy decision-making and its goal is to collect and distribute high quality information that motivates investors, corporations and governments to take action to prevent dangerous climate change.

Global Reporting Initiative
The CDP secretariat works with the Global Reporting Initiative (GRI) to ensure that this request and the GRI indicators are closely aligned and complementary.

APPENDIX E

Supplier Selection Criteria Matrix

			Environmental Considerations		Geography		Engagement Option	
Primary Business (Varies)	**ABF Supplier** (Y or N)	**AIAG GHG WG** (Y or N)	Measure Carbon Footprint (Y or Unclear)	Report Carbon (CDP, EPA, etc.)	Regions Supplied (EU, NA, APA, SA)	Supply Chain Operations (China, NA, EU)	CDP?	WRI Scope 3?
Automotive	Y	Y	Y	Not CDP or EPA	EU, SA	EU		X
Automotive	Y	N		Not CDP or EPA	*	*	X	
Automotive	Y	N		Not CDP or EPA	EU, NA, SA	EU, NA		X
Automotive	N	N		Not CDP or EPA	EU	EU		X
Automotive	N	N		CDP, details not public; Not EPA	EU, NA, SA	EU, NA, Brasil, Russia		X
Automotive	Y	N		CDP, details not public; Not EPA	EU, NA, SA	EU, NA, Brasil, South Africa		X
Automotive	Y	N		Not CDP or EPA	EU, NA	EU	X	
Automotive	Y	N		Not CDP or EPA	NA, SA	NA, Brasil	X	
Automotive	Y	N		Not CDP (CDP in 2006); Not EPA	EU, NA, SA	EU, NA, Korea		X
Automotive	Y	Y		CDP - no response; Not EPA	EU, NA, SA, APA	NA, Brasil, Australia, Japan		X
Automotive	N	N		Not CDP or EPA	EU, SA	Brasil	X	
Automotive	Y	N		Not CDP or EPA	EU	EU	X	
Automotive, Building Efficiency, Power Solutions	Y	Y	Y	CDP general and supply chain, EPA	EU, NA, SA, APA	EU, NA, Brasil, Argentina, Russia, S. Africa, India		X
Automotive	Y	Y		Not CDP or EPA	EU, NA, SA	EU, NA, Brasil, Argentina, Russia		X
Automotive	Y	N		CDP, details not public; Not EPA	EU, NA, SA, APA	EU, NA, India		X

			Environmental Considerations		Geography		Engagement Option	
Primary Business	**ABF Supplier**	**AIAG GHG WG**	Measure Carbon Footprint	Report Carbon	Regions Supplied	Supply Chain Operations	CDP?	WRI Scope 3?
Automotive	Y	N	Y	Not CDP (CDP in 2006); Not EPA	EU, NA, SA, APA	EU, NA		X
Automotive	N	N		Not CDP or EPA	NA, SA	NA		X
Automotive	N	N		Not CDP or EPA	EU, SA	EU, Brasil		X
Automotive	N	N		Not CDP or EPA	NA, SA	NA		X
Automotive	Y	N		Not CDP, Yes EPA	EU, NA, SA	EU, NA, Venezuela, Brasil		X
Chemical	Y	N	Y	CDP general and supply chain; Not EPA	EU, NA, SA, APA	EU, NA, Argentina, India	X	
Coatings	Y	N	Y	CDP general and EPA	EU, NA, APA	EU, NA, Australia	X	
Automotive	Y	Y		Not CDP or EPA	EU, NA, SA, APA	EU, NA, Argentina, Morocco, Honduras, Russia, Philippines, Tunisia		X
Automotive	Y	N		Not CDP or EPA	EU, NA, SA	EU, NA, Turkey, Indonesia		X
Automotive	Y	Y		Not CDP or EPA	EU, NA, SA, APA	EU, NA, India		X
Automotive	Y	N	Y	Not CDP or EPA	EU, NA	EU, NA		X
Automotive	Y	N		CDP, details not public; Not EPA	EU, NA, APA	EU, NA	X	
Automotive	N	N		Not CDP or EPA	EU, NA, SA	EU, NA, Brasil	X	
Automotive	N	N		Not CDP or EPA	NA, SA	NA		X
Automotive	Y	N		CDP - no response; Not EPA	EU, NA, SA	EU, NA		X
Automotive	N	N	Y	CDP general and EPA	EU, SA	EU, SA		X
Automotive	N	N	Y	CDP, details not public; Not EPA	EU, APA	EU, Russia, India		X

			Environmental Considerations		Geography		Engagement Option	
Primary Business	**ABF Supplier**	**AIAG GHG WG**	Measure Carbon Footprint	Report Carbon	Regions Supplied	Supply Chain Operations	CDP?	WRI Scope 3?
Automotive	N	N	Y	CDP general and supply chain, EPA	NA	NA	X	
Automotive	N	N		Not CDP; Yes EPA	NA	NA	X	
Automotive	N	N		Not CDP or EPA	NA	NA		X
Automotive	Y	N		Not CDP or EPA	EU, SA	EU		X
Automotive	Y	N		Not CDP or EPA	*	*		X
Steel	N	N		CDP general; Not EPA	EU, NA	EU, NA		X
Automotive	N	N		Not CDP or EPA	EU	EU		X
Steel	N	N	Y	CDP general; Not EPA	EU, SA	EU		X
Steel	N	N	Y	CDP general; Not EPA	*	*		X

APPENDIX F

Communication from Ford Purchasing Department regarding Road Test

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Dear [Supplier],

Ford Motor Company is participating in the road testing process for the Greenhouse Gas Protocol's DRAFT Scope 3 (Corporate Value Chain) Accounting & Reporting Standard. The Greenhouse Gas (GHG) Protocol is a global collaboration of businesses, governments, and non-governmental organizations, convened by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), to develop credible methods for measuring and reporting corporate greenhouse gas emissions.*

The new Scope 3 Standard will provide a standardized method for measuring the greenhouse gas emissions associated with corporate value chains, taking into account impacts both upstream and downstream of the company's operations. We see this standard as a critical tool in assessing the overall environmental impact of Ford Motor Company.

Ford Motor Company, along with more than 30 other companies, is working with WRI and WBCSD from January through June 2010 to complete a Scope 3 greenhouse gas inventory in accordance with the draft Scope 3 Standard to assess the functionality and practicality of the draft standard. At the end of the road testing process in June 2010, we will provide detailed feedback that will be incorporated into the final version of the standard.

Gathering greenhouse gas emissions data from our suppliers is an important goal of the standard and will allow our company to accurately measure our value chain impacts. Your company is receiving this survey based, in part, on the relative carbon intensity of commodities it is supplying to Ford.

To complete a Scope 3 inventory, we need to collect greenhouse gas emissions data and/or energy consumption data related to the products and services we purchase from your company. **Submission of your data is requested by May 15th, 2010** so that we can complete our inventory within the given timeline. To facilitate the data collection process, we are providing a data collection form and supporting guidance documentation (attached) that can be used to calculate and submit your emissions information.

Ford will plan to hold a series of Webex/ Conference calls during the months of April and May to answer questions on this data collection process. More information on these calls will be sent out to survey recipients in April 2010.

We appreciate your participation in this important initiative. If you have any questions about the data collection process, please contact Ford Supply Chain Sustainability at fwcp@ford.com.

For more information on the road testing process and to review the draft standard, visit http://www.ghgprotocol.org/standards/product-and-supply-chain-standard.

Thank you for your participation in this important initiative.

Sincerely,

Tony Brown
Group Vice President
Global Purchasing
Ford Motor Company

* For more information, visit: http//www.ghgprotocol.org/

APPENDIX G

Press Release Announcing Ford's Supply Chain Carbon Emissions Work

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Ford Aims to Help Reduce the Carbon Footprint of Its Global Supply Chain

DEARBORN, Mich., May 20 /PRNewswire-FirstCall/ --

- Ford is surveying 35 top global suppliers to gain a better understanding of their greenhouse gas emissions footprint as part of a broader effort to reduce carbon emissions within the auto industry
- Ford's supply chain approach builds on its success in measuring and reducing its greenhouse gases
- Ford is working with World Resources Institute, World Business Council for Sustainable Development and the Carbon Disclosure Project in an effort to identify appropriate data fromSuppliers
- Ford intends to share lessons learned and lead collaboration with other automotive companies through the Automotive Industry Action Group

Ford Motor Company (NYSE: F), building on its success in measuring and reducing its own carbon footprint, today announced plans to survey 35 top global suppliers on their energy use and estimated greenhouse gas emissions.

Ford's goal is to better understand the carbon footprint of its supply chain and use the data to eventually create a broad-based carbon management approach for its supply chain. The 35 suppliers represent close to 30 percent of Ford's $65 billion in annual procurement spending.

"Suppliers play an important role as we look to reduce our overall carbon footprint and drive more efficiency in an energy constrained world," said Tony Brown, Ford group vice president, Global Purchasing. "This initiative builds on our leadership in collaborating with suppliers and gives them a way to participate in solving an issue that faces our entire industry."

The suppliers in the initial request include companies that make commodities such as seats, steering systems, tires and metal components, which require more energy to produce and thus have a larger carbon footprint. While many of these suppliers already measure their greenhouse gas emissions, the project would facilitate collaboration and sharing of processes and practices that can drive significant emissions reductions and help meet future regulatory requirements.

"Climate change has the potential to affect all parts of our business, and is connected to other important issues – from water availability and energy security to human rights," said Susan Cischke, group vice president, Sustainability, Environment and Safety Engineering. "Understanding the carbon footprint of our supply chain is a crucial part of our comprehensive global strategy to reduce greenhouse gases."

The data gathered from suppliers will be evaluated using modeling software from PTC InSight. Preliminary work Ford has done with PTC has indicated there are opportunities for both Ford and suppliers to reduce carbon emissions. Any reductions by suppliers would be in addition to Ford's own goal of reducing greenhouse gases 30 percent by 2020 from the company's 2006 model year baseline.

Several of Ford's top suppliers are already working to better understand their carbon emissions, including DuPont, TRW Automotive Holdings Corp., Bosch and Johnson Controls.

Johnson Controls, which supplies seats, interiors, electronics and batteries to Ford, is also working with the Carbon Disclosure Project and has goals in place to reduce greenhouse gas emissions.

"As a company, we are committed to reducing greenhouse gas emissions by 30 percent by 2018, and are doing so through efficient manufacturing processes and the development of eco-friendly products," said Randy Leslie, vice president and general manager of the Ford Business Unit for Johnson Controls.

Johnson Controls also has a rating system that enables it to measure the sustainability activity of its own supply base.

As part of Ford's efforts to create a broad-based carbon management approach for its supply chain, they will share feedback from their data collection process with World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD).

The two organizations are leading a global collaboration of businesses, governments and non-governmental organizations to develop credible methods for measuring and reporting corporate greenhouse gas emissions. They are currently drafting a new standard to be used to measure indirect or Scope 3 emissions. In tandem, Ford is participating in the Carbon Disclosure Project Supply Chain Program. Ford is the only automaker participating in both initiatives.

Ford is also working with the Automotive Industry Action Group in developing guidelines for measuring supplier emissions. It is the intent of Ford to share their experience in measurement and reporting of corporate and supply chain emissions with the industry group in order to lead the industry to consistent and comparable emissions estimation methods.
For additional information on Ford's near-, mid- and long-term product actions to deliver increased fuel efficiency and decreased CO2 to help address climate change and energy security issues, see the company's "Blueprint for Sustainability" at www.ford.com/go/sustainability.

About Ford Motor Company
Ford Motor Company, a global automotive industry leader based in Dearborn, Mich., manufactures or distributes automobiles across six continents. With about 176,000 employees and about 90 plants worldwide, the company's automotive brands include Ford, Lincoln, Mercury and, until its sale, Volvo. The company provides financial services through Ford Motor Credit Company. For more information regarding Ford's products, please visit www.ford.com.

APPENDIX H

Crosswalk Questions

MATURITY	Components/Indicators	SCOPE 3 SURVEY Question	CDP SURVEY Question
ASSESS RISK AND OPPORTUNITIES	Physical Regulatory Reputational Business	1 Does your company perceive itself to be at risk from: legislation, reductions, energy prices 3 Does your company perceive any opportunities from: legislation, reductions, energy prices	2 Describe your company's process for identifying significant risks and/or opportunities from climate change and assessing the degree to which they could affect your business, including the financial implications. 3 Regulatory Risks 4 Physical Risks 5 Other Risks 6 Regulatory Opportunities 7 Physical Opportunities 8 Other Opportunities
MEASUREMENT	Inventory (scopes 1, 2, 3) Allocation	Data Form Data Description	10 Emissions Boundary 11 Methodology 12 Scope 1 13 Scope 2 14 Scope 2 Contractual 15 Scope 3 16 Avoidance of emissions for 3rd party 17 Biomass/Biofuel use 18 Financial intensity measure 19 Emissions change over time? 20 Verification/Assurance coverage 21 Emissions Trading SM 1 Allocation to customer
MANAGEMENT	Reduction Target Reduce Emissions Meet Reduction Target Data Infrastructure	4 GHG Emission Tracking: Aside from this data request, has your company tracked its GHG emissions and/or set benchmarks for reduction?	9.2 Target 9.7 Reductions
REPORTING	Public	5 GHG emissions reporting	22 Communications
GOVERNANCE	Strategy or Policy High-Level Commitment	2 Has your company developed a strategy or policy for:	1 Level of responsibility 9.1 business strategy links with actions taken on risks and opportunities (identified in questions 3 to 8), including any emissions reduction targets or achievements, public policy engagement and external communications.
ENGAGEMENT BEYOND OPERATIONAL CONTROL	Supplier Engagement Use of LCA Scope 3 work	7 Carbon measurement at the product-level 8 Relationship with your suppliers	SM 2 Supplier Engagement SM 3 Supplier-Product LCA

Maturity Spectrum

Assess Risks and Opportunities	Measurement	Management	Reporting	Advanced Governance	Measurement beyond Operational Control
- Financial - Physical - Regulatory	- Baseline GHG inventory - Scopes measured - Allocation of emissions	- Set reduction goal - Reduce emissions - Meet reduction goal - Set new reduction goal	- Report to financial community and value chain partners	- Internal structure - Senior level participant - Policy advocacy - Industry leadership	- Use of LCA - Engage-ment of supply chain partners