



ESD.S43 - Green Supply Chain Management

Edgar Blanco
Tony Craig
Alexis Bateman

2nd Half Spring 2014

MIT Center for Transportation & Logistics



Learning Objectives

- Conduct a simple measurement of any organization's carbon footprint and identify "hot spots"
- Recommend the right measurement approach to fit the purpose and scope of more complex carbon measurement initiatives (e.g. supply chain)
- Be able to challenge other organization's carbon footprint declarations

WidgetCo Case Study

ESD.S43 - Spring 2014

© 2014 E. Blanco and T. Craig - MIT CTL

3

Case Study Recap - WidgetCo

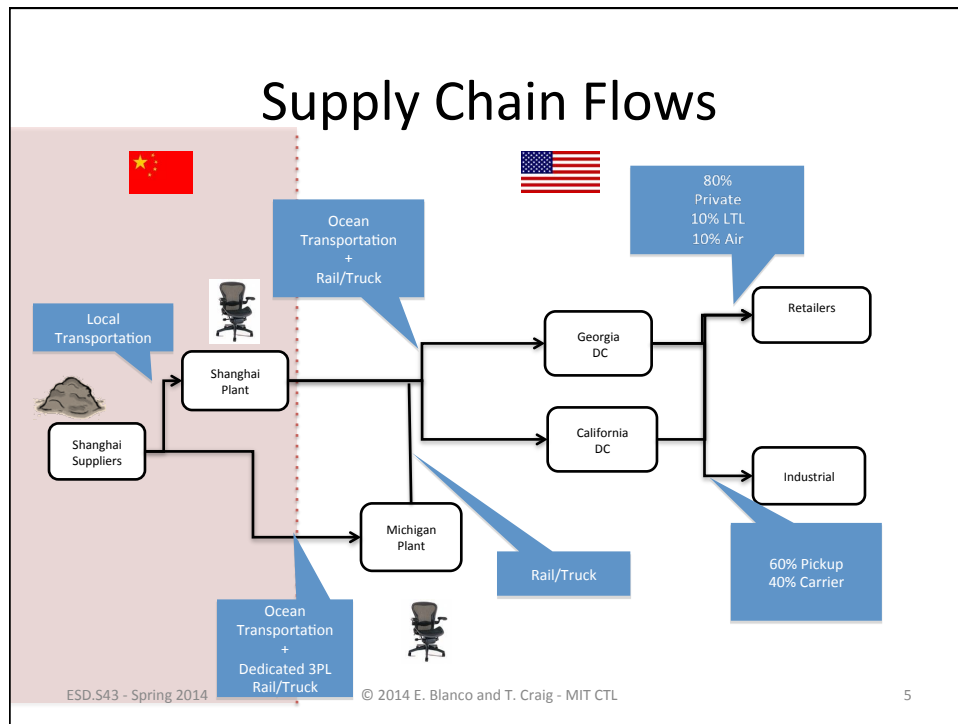
- Global Manufacturing
 - Chair manufacturing
 - Retail & Industrial customers in the US
- Facilities
 - Two manufacturing plants one in Shanghai, China (50% joint-venture) and one in Michigan, USA (fully owned)
 - Two USA DCs for finished good distribution (California & Georgia)
 - 250 sq.ft. dedicated showroom at 2,500 BigDepot retail locations, representing 40% of retail sales
- Transportation
 - Dedicated 3PL (for all imported materials)
 - Retail channel: 80% private truck fleet, 10% air, 10% LTL
 - Industrial channel: 40% deliveries, 60% pick-ups at DC

Source: E. Blanco, MIT CTL 2009

ESD.S43 - Spring 2014

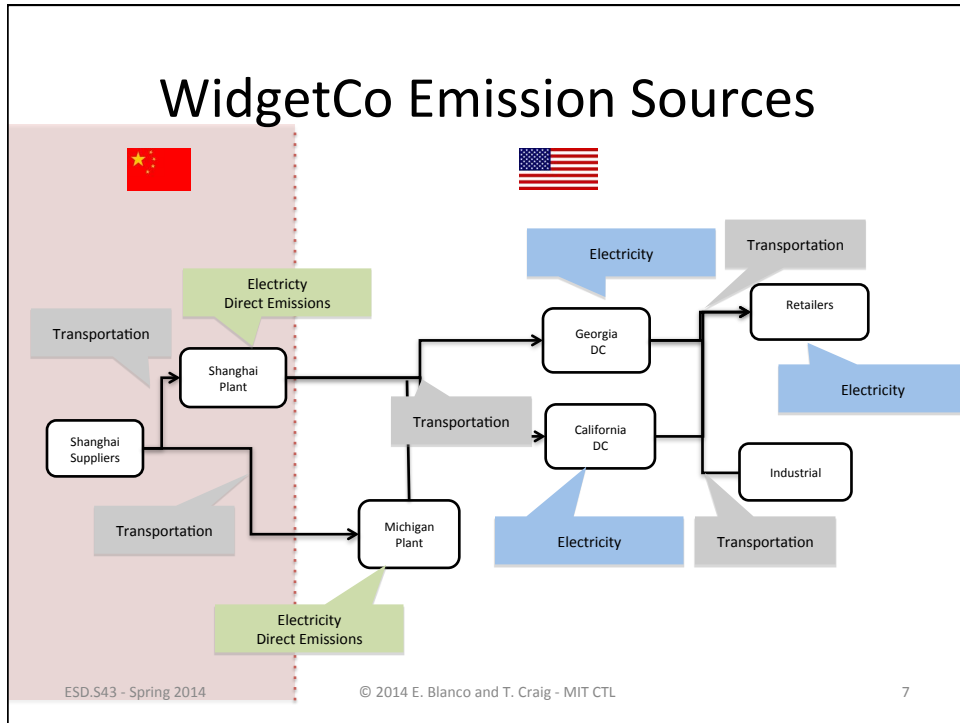
© 2014 E. Blanco and T. Craig - MIT CTL

4



Why is WidgetCo Interested in Carbon Footprint?

- Investors asking about it....
- Customers asking about it ...
 - CEO attention
- Competitor, FerretCo, reported emissions in Carbon Disclosure Project
 - 55,000 tons of CO₂
 - 1.1 kgs of CO₂ per kg of product
 - Wants to become carbon neutral
 - Possibly labeling retail products



WidgetCo Carbon Footprint Calculations

Facilities
 $Electricity\ Consumption * Electricity\ Factor + Direct\ CO2\ Emissions$

Transportation Method 1 (Ton-Miles)
 Used for shared transportation assets:
 $Number\ of\ Shipments * Distance * Weight * Mode\ Emission\ Factor$

Transportation Method 2 (Fuel Consumption)
 Used for dedicated transportation assets:
 $Fuel\ Consumed * Fuel\ Emission\ Factor$

ESD.S43 - Spring 2014 © 2014 E. Blanco and T. Craig - MIT CTL 8

GHG Emission Factors

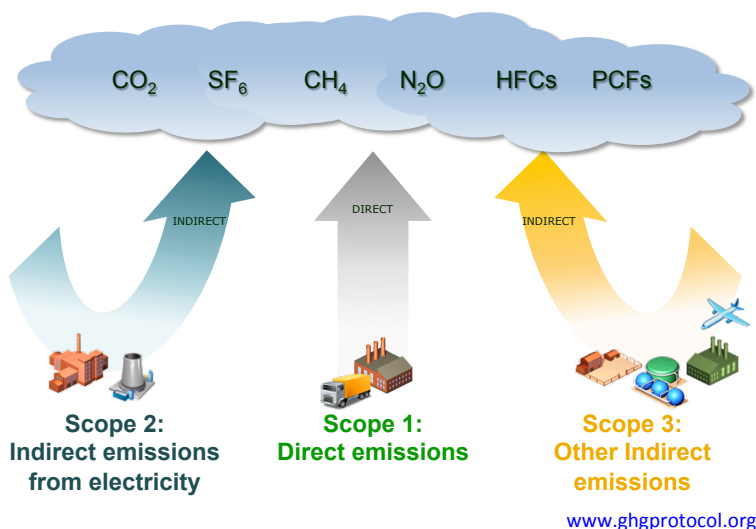
Category	Process	Emission Factor (kg CO2e)
Electricity	Electricity, USA (kWh)	0.596
Electricity	Electricity, Michigan (kWh)	0.703
Electricity	Electricity, China (kWh)	0.788
Transportation	Truck (ton-mile)	0.086
Transportation	Rail (ton-mile)	0.032
Transportation	Ocean (ton-mile)	0.016
Transportation	Air, Shorthaul (ton-mile)	2.528
Transportation	Air, Longhaul (ton-mile)	0.912
Fuel	Diesel (Gallon)	10.2

For most firms, cross sector tools that cover energy consumption and transportation are all that is needed

GHG Emission Factors

- Usually refers to the six greenhouse gases covered by the **Kyoto Protocol**
 - carbon dioxide (CO₂)
 - methane (CH₄)
 - nitrous oxide (N₂O)
 - hydrofluorocarbons (HFCs)
 - perfluorocarbons (PFCs)
 - sulfur hexafluoride (SF₆)
 - Other gases may need to be accounted for and reported separately
- Single unit of measure: CO₂-equivalents
 - Combined using 100-year “Global Warming Potential”
 - Regularly updated as part of the IPCC Assessment Reports
 - https://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml
- “Carbon” is common word

The GHG Protocol Emission Scopes



ESD.S43 - Spring 2014

© 2014 E. Blanco and T. Craig - MIT CTL

11

Case Study Questions

1. Calculate WidgetCo's carbon footprint (Excel File)
 1. Correct emission factor for each WidgetCo supply chain activity
 2. Share to include in WidgetCo footprint (0-100%)
 3. Identify the emissions by scope
2. What did you include in your calculation and why? Explain to CEO and Board...
3. Will you recommend publicly disclosing WidgetCo's carbon footprint? Why or why not? What about pledging to become carbon neutral or labeling your products?

ESD.S43 - Spring 2014

© 2014 E. Blanco and T. Craig - MIT CTL

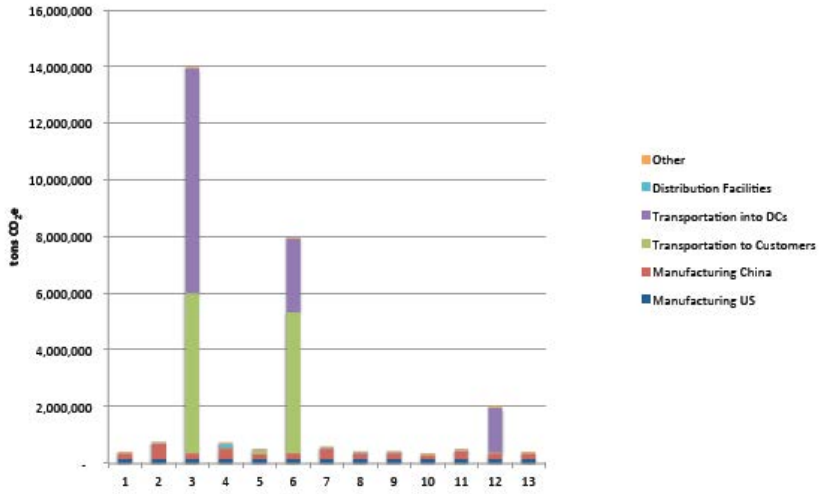
12

WidgetCo Case Study Discussion

- Breakout in groups of three
- Agree on WidgetCo Carbon Footprint
 - One computer ready with the XLS
 - Emission Factors, Scopes, and Contribution
- Prepare to share your answers to the questions to the larger group

What is WidgetCo's Carbon Footprint?

Your Individual Answers

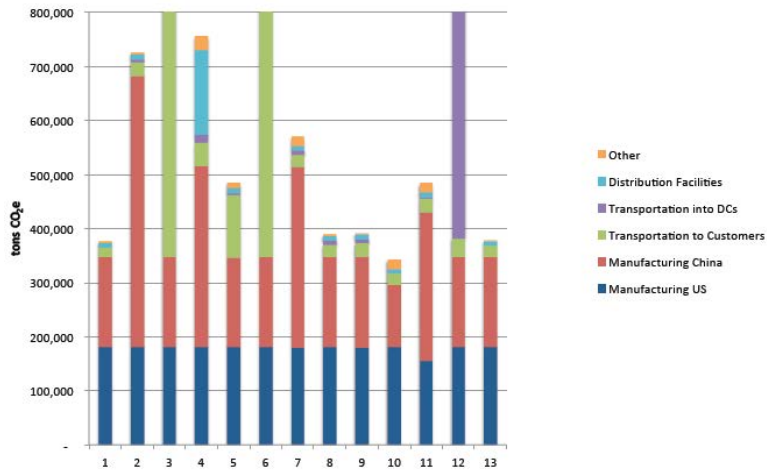


ESD.S43 - Spring 2014

© 2014 E. Blanco and T. Craig - MIT CTL

15

Your Individual Answers

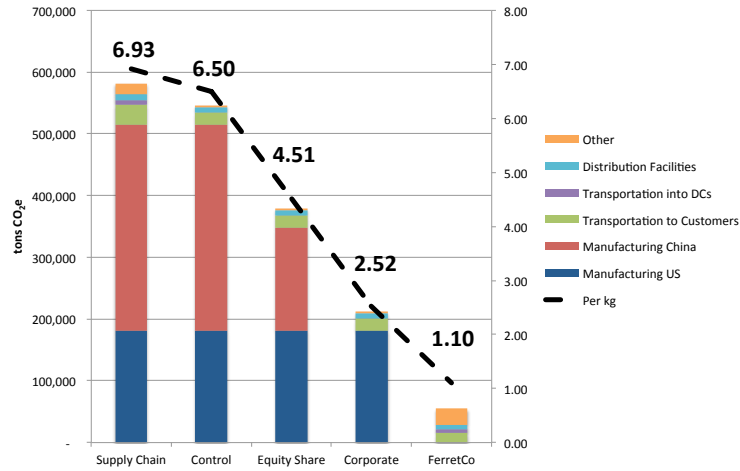


ESD.S43 - Spring 2014

© 2014 E. Blanco and T. Craig - MIT CTL

16

Which is the correct one?

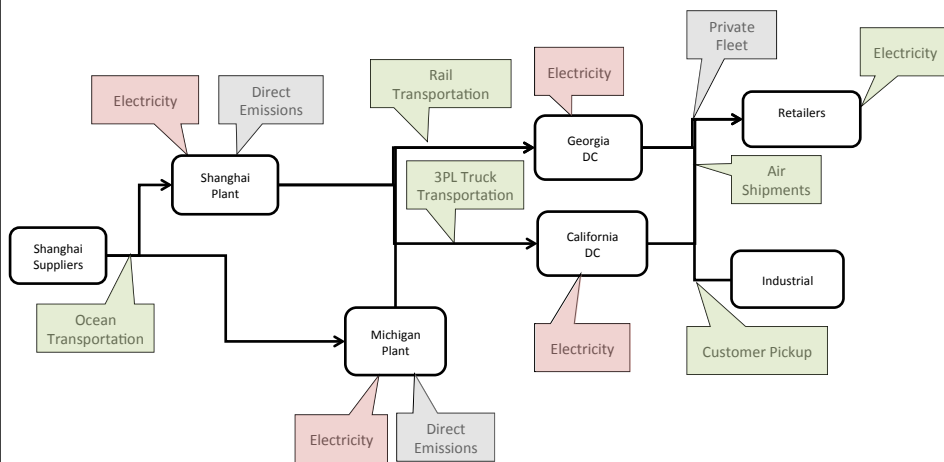


ESD.S43 - Spring 2014

© 2014 E. Blanco and T. Craig - MIT CTL

17

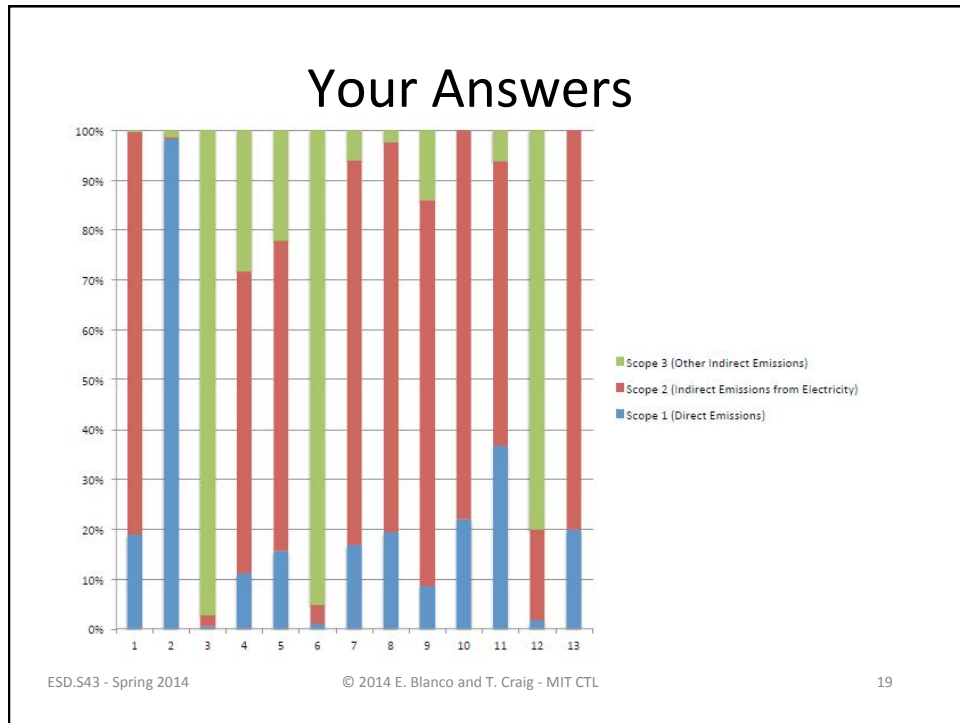
WidgetCo Emission Sources



ESD.S43 - Spring 2014

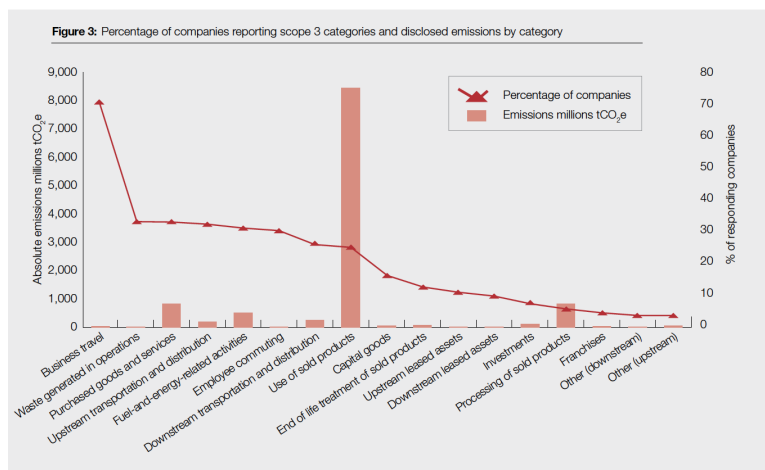
© 2014 E. Blanco and T. Craig - MIT CTL

18



Courtesy of CDP. Used with permission.

Scope 3 Emissions Reported in the CDP



Courtesy of CDP. Used with permission.

Mechanics of Carbon Footprints

- Determine your organization boundary
 - Equity share, Financial or operational control
- Determine your operational boundary
 - Calculate Scope 1 and Scope 2 emissions
 - Minimum requirements
 - Identify Scope 3 emissions to include
 - Generally not required, but often included
- Gather data on operations
 - Apply appropriate emissions factors

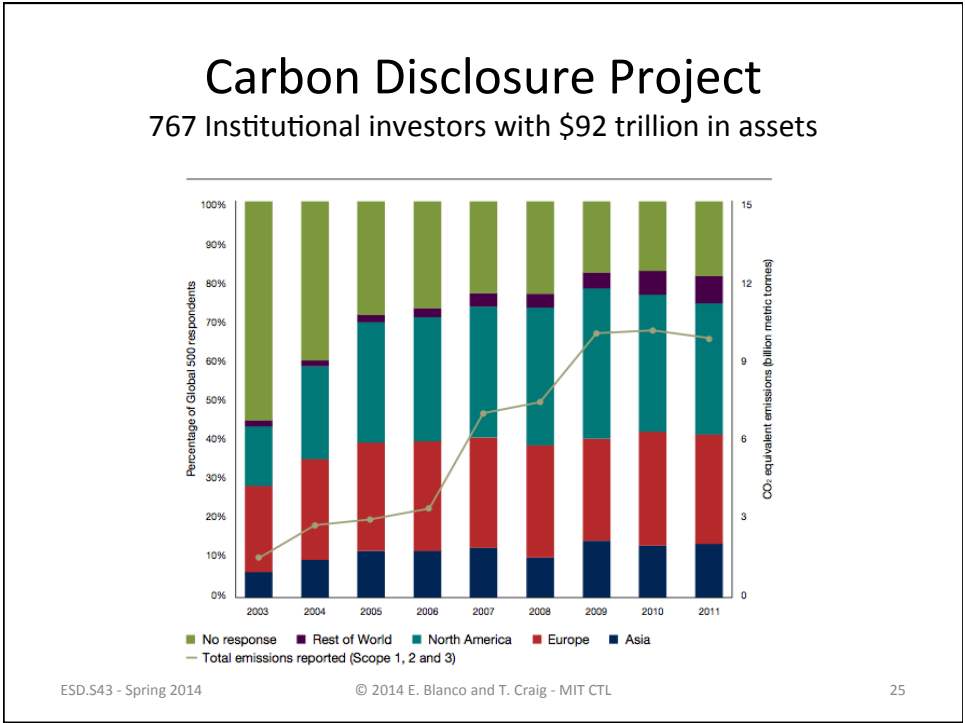
Issues with Carbon Footprints

- Merging data from many sources
 - Facilities, transportation, procurement, etc.
- Data integrity
 - Do the numbers make sense?
 - Are there missing values?
- Data aggregation issues
 - Do air shipments have the same average weight as truck shipments?
- Finding the right emissions factors
 - Pay attention to units
 - Apply consistently

Tricks & Traps for Corporate Carbon Footprint

- Carefully define corporate boundaries
 - Read the GHG Protocol and understand it
 - Scope 1, 2 and 3 are a good framework
 - Relationship between internal vs. external stakeholders may affect your calculation of the carbon footprint
- Use the right data and emissions factors
 - Preferred accounting methods
 - Consistent choices of factors
- Absolute vs. relative measures
- Expect the carbon footprint to be refined over time.
 - Keep in mind as you share outside your organization or make reduction commitments
 - The primary goal is year-on-year comparisons
 - May require occasional restatements

Would you disclose?



Courtesy of CDP. Used with permission.

Why measure environmental footprint?

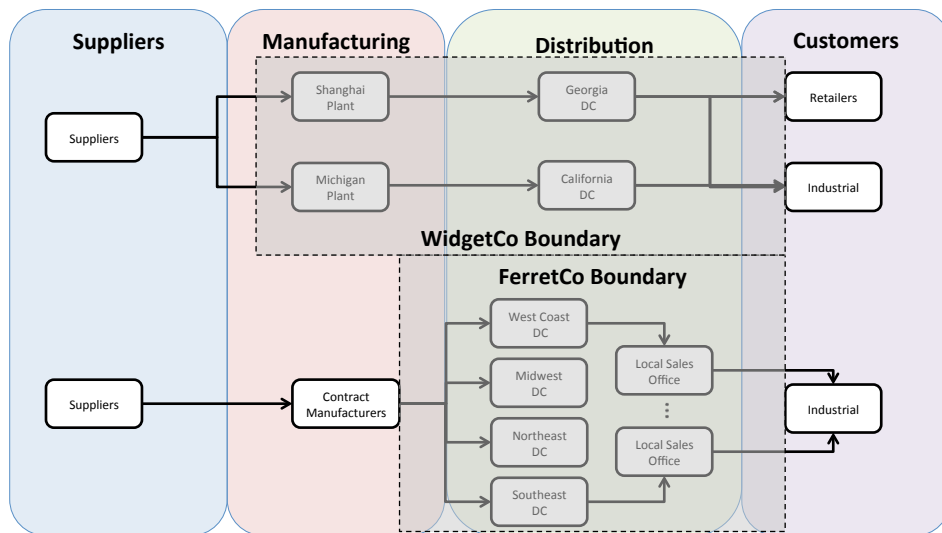
<i>Focus Driver</i>	Internal	External
Corporate	CSR Metrics Hotspot Analysis	CSR Report Regulators Investor/Customer Pressure

- Boundaries for internal may differ from external

ESD.S43 - Spring 2014 © 2014 E. Blanco and T. Craig - MIT CTL 26

Does it make sense to compare WidgetCo and FerretCo?

Supply Chain Flows



Supply chain and corporate comparison

Scope	WidgetCo	FerretCo
Corporate (Equity Share)	378,986	47,499
Per kg of sold product	4.51	0.95
Disclosed (Equity Share)	414,824	55,219
Per kg of sold product	4.94	1.10
Supply Chain	581,724	365,019
Per kg of sold product	6.93	7.30

Increasing need for a broader view of emissions

Figure removed due to copyright restrictions. See the lecture video for further details.

- Apple has been voted the best supply chain company for 6 years straight by Gartner Inc.

Many sectors would have less than 25% of their total GHG footprint represented by Scope 1 and 2 estimates



Huang, Y. A., C. L. Weber and H. S. Matthews (2000).

ESD.S43 - Spring 2014

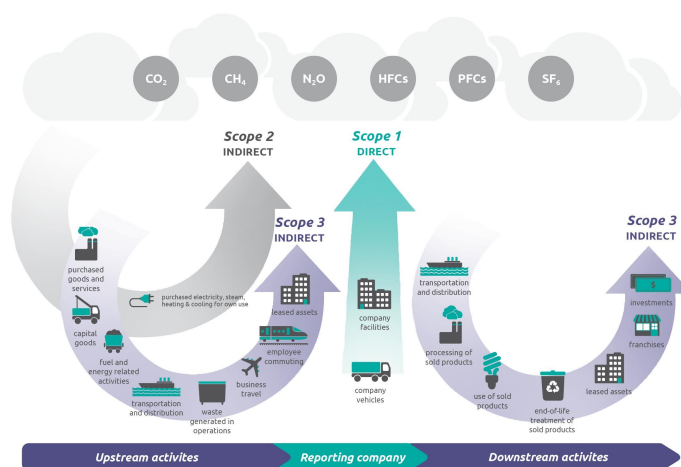
© 2014 E. Blanco and T. Craig - MIT CTL

31

© ACS. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <http://ocw.mit.edu/help/faq-fair-use/>.

Expanding the GHG Protocol

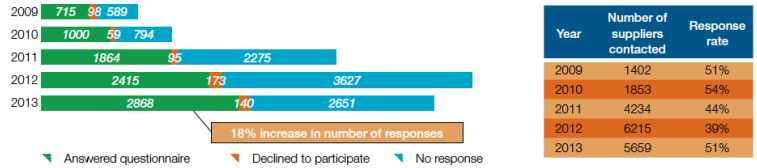
Figure [1.1] Overview of GHG Protocol scopes and emissions across the value chain



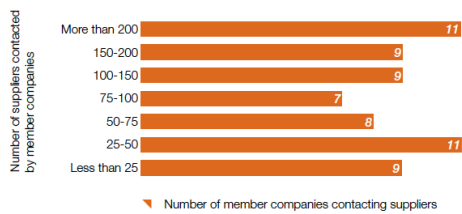
Courtesy of The Greenhouse Gas Protocol. Used with permission.

CDP Supply Chain Started in 2008

A. Response rate over the years



B. Number of supplier requests by each member



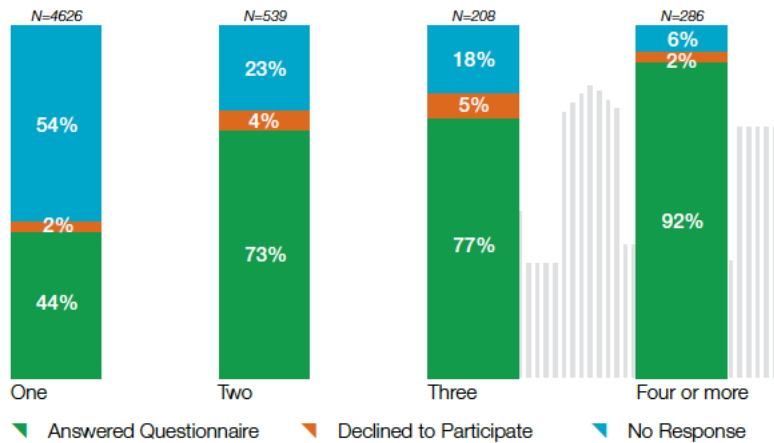
ESD.S43 - Spring 2014

© 2014 E. Blanco and T. Craig - MIT CTL

33

Courtesy of CDP. Used with permission.

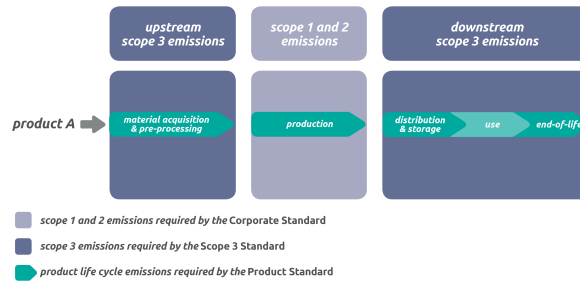
More pressure leads to more responses



Courtesy of CDP. Used with permission.

Value Chain vs. Product

- Aggregates emissions for the supply chain
 - Broad in scope, aggregated data
- Product standard
 - Specific to one product, measured per unit



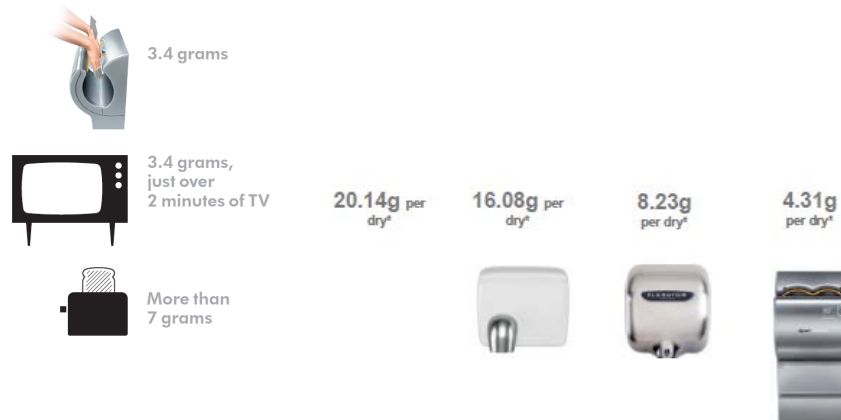
ESD.S43 - Spring 2014

© 2014 E. Blanco and T. Craig - MIT CTL

35

Courtesy of The Greenhouse Gas Protocol. Used with permission.

What about products?



* CO₂ per dry. Data from Gagnon and Panertos, 2009 report – Comparative Environmental Life Cycle Assessment of Hand Drying systems, prepared for Excel Dryer, Inc. Quantis.

© 2012 MIT MSL. Do not quote without author authorization

36

Courtesy of Gregory, J., R. Kirchain, and T. Montalbo, Materials Systems Laboratory, MIT. Used with permission.

Does it make sense to be carbon neutral?

- Ongoing expense to purchase offsets
 - 550,000 tons * \$10-15/ton = \$5.5-8.25 million
- Carbon footprint generally reported before factoring in offsets
- Fraud/Corruption/Misleading
 - Fiji Water sued over forward crediting

Carbon Offsets

- Voluntary market of \$569 million in 2011
 - World Bank Carbon Finance Report 2012
- Several certification schemes
 - Gold Standard, Voluntary Carbon Standard, etc.
- Voluntary Carbon Standard Principles
 - Additional
 - Real
 - Measurable
 - Permanent

Why measure environmental footprint?

<i>Focus Driver</i>	Internal	External
Corporate	CSR Metrics Hotspot Analysis	CSR Report Government Investor/Customer Pressure
SC / Product	Supplier Selection Sourcing/Process Decisions Supply Chain/Product Design	Brand Labeling

ESD.543 - Spring 2014

© 2014 E. Blanco and T. Craig - MIT CTL

39

MIT OpenCourseWare
<http://ocw.mit.edu>

ESD.S43 Green Supply Chain Management
Spring 2014

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.