This article provides a basic understanding of the GLEC Framework, a method to harmonize existing, well-respected, and commonly used approaches to calculate greenhouse gas emissions in the freight transport sector, and how it can be applied by companies and used as a basis for policy development.
Freight transport forms the backbone of today’s global economy. Materials and products manufactured in one region are transported to another region along increasingly lengthy and complex transport chains—and with increasing total greenhouse gas (GHG) emissions. Transport chains are dynamic and changing systems—often involving more than one mode of transport as the product travels to its destination, stopping at warehouses, ports, and terminals along the way. Ever-changing fleets of vehicles or vessels with varying levels of fuel efficiency are powered by different fuels. When a company wants to report their transport chain GHG emissions, finding information on these details is a challenge, one that tends to vary depending on its role in the transport chain.\(^1\)

For companies that conduct their own transportation activities (i.e., direct, or scope 1, emissions\(^1\)), visibility of the elements of the transport chain can be more straightforward; the fuel used, routes traveled amount of goods transported and other information useful for emissions estimates may be readily available. However, for those that subcontract transport (i.e., value chain, or scope 3, emissions\(^1\)), as is often the case for shippers (i.e., the companies that require their goods to be moved) and some logistics service providers (i.e., companies that organize logistics activities), these data can be much more challenging to obtain, leading to a reliance on default data that may or may not accurately represent actual transportation activities.

**The GLEC Framework for Logistics Emissions Methodologies**

The Global Logistics Emissions Council (GLEC), led by the Smart Freight Centre, has assembled a broad coalition of companies, industry associations, and experts to build a harmonized framework for estimating transport chain emissions. Building on a range of existing best practices, GLEC has blended elements from mode- and region-specific methodologies to create the GLEC Framework for Logistics Emissions Methodologies—the first GHG accounting methodology to be recognized as the logistics sector guidance by the Greenhouse Gas Protocol Corporate Standard, the most widely-accepted GHG accounting practice.\(^2\)

The GLEC Framework, designed to be useful for industry, strikes a balance between accuracy, simplicity, flexibility, and transparency. Such a consistent method can provide a basis for setting and meeting realistic and measurable GHG reduction goals.\(^3\) Extending the science-based approach to the logistics sector is increasingly being discussed. This topic was explored in the 2015 GLEC Validation Case Study,\(^6\) which demonstrated the need for additional data to be made available and a common approach to calculation of GHG emissions from the full range of logistics operations that comprise modern supply chains.

**Key Elements of the GLEC Framework**

GHGs are difficult to measure directly; thus, they are commonly calculated according to accepted standards. The GLEC Framework is a bottom-up, fuel-based methodology that addresses the multi-modal transport chain; emissions from each leg of a transport chain, whether air, inland waterways, rail, road, sea or transhipment centers, are totaled to understand the full transport chain impact (see Figure 1). The full methodology can be viewed online at www.smartfreightcentre.org; this article provides an overview of highlights and unique elements within the GLEC Framework.

**Base Methodologies**

The GLEC Framework is based on leading industry and government standards, ensuring consistency with higher-level or mode-specific practices, while addressing issues specific to the logistics sector. Building on international protocols from the Intergovernmental Panel on Climate Change and Greenhouse Gas Protocol Corporate and Value Chain standards, the framework systematically addresses the similarities and differences between best practices to build a consensus approach appropriate for this sector.

**Transport Service Categories**

For companies or industry groups that have ample emissions data, breaking data into meaningful subsets can be a challenge, especially when reporting emissions to clients. Yet, averaging emissions data at a high level, without differentiating between operations, can reduce the ability to understand the actual emissions [e.g., to detect [and reward] sustainability upgrades in fleets or regions; to differentiate the impact of temperature-controlled vs. ambient goods; or to understand how emissions may differ by geographic area]. The GLEC Framework puts forth guidance for arranging emissions data into meaningful subsets that can be then individually targeted for reduction, or reported up the supply chain to shippers who can then gather more accurate results.

**Tonne–Kilometer**

The primary allocation factor for emissions calculated using the GLEC Framework is the tonne–kilometer—the amount of GHG emitted to move one metric tonne of freight one kilometer (or the imperial unit ton/mile). This measurement allows the user to recognize the GHG intensity of the actual work done. Further, knowing the tonne–kilometer allows one to decouple the information to other meaningful metrics such as the emissions per tonne of a product.
Calculating GHGs from Freight Transportation by Suzanne Greene and Alan Lewis

Fuel Consumption Factor
Expressed as the fuel use per tonne–kilometer, the consumption factor is essentially a fuel efficiency metric for the freight industry (think miles per gallon). Companies that transport goods more efficiently, with a lower fuel per tonne–kilometer, will have lower emissions. Consumption factors form the backbone of the Framework, which can be calculated separately for each transport service category.

GHG Emission Factors
To reach GHG emissions, the fuel component of the consumption factor must be converted. Various conversion factors, known as emission factors, exist for different fuels, regions, and life cycle phases. The GLEC Framework recommends using well-to-wheel fuel emissions, meaning that the production and distribution phase of fuel production is included in addition to its combustion. Furthermore, emission factors should be selected that are appropriate for the region in which the fuel is procured; for example, fuel produced in China may have higher emissions associated with production than fuels produced for European markets.

Reliable and Informed Reporting
The GLEC Framework provides a structure through which the logistics industry can effectively calculate and communicate their GHG emissions. A significant impediment to increased accuracy in logistics carbon footprinting is the availability of data, or the willingness to share among supply chain partners, leading many companies to rely on default data which may or may not represent actual conditions. Moving away from default data will provide companies with better resolution on the impact of their activities, minimizing risk related to unknown data, and allowing for more transparency with shareholders and stakeholders.

The information gathered using the GLEC Framework can be used for a variety of industry and government needs. First, results can be used for GHG reporting, including corporate and value chain emissions reporting, product carbon footprints, eco-labels, and carbon trading programs. GLEC's recognition by the Greenhouse Gas Protocol allows companies to maintain agreement with this widely-used standard, as well as other methodologies. Second, reported emissions can be used to inform logistics business decisions, such as emissions reduction strategies, logistics chain design (modal or route choices, location of transfer facilities), carrier selection, and fuel efficiency monitoring. This wide range of uses underlines the importance of moving toward greater accuracy.

As the Paris Agreement shifts responsibility for reaching GHG reduction goals to individual countries, companies may be required to account for the impact of their activities on an international basis. However, introduction of different approaches in different geographical locations would lead to fragmentation in reporting given the global nature of current supply chains.
The logistics industry will certainly be an interesting test for these policies, as the transportation of goods can cross many countries on vessels that may bundle the goods of multiple companies at once. This challenge also presents an opportunity for companies to collaborate to streamline data collection and reporting. As more companies adopt the GLEC Framework, redundant data collection efforts can be eliminated and resources can be put towards improving accuracy and implementing sustainability goals.

Conclusions
Consistency, transparency, and assurance about the reality and reliability of the data and approach to GHG measurement and reporting are crucial if all stakeholders are to maintain confidence in the calculation outputs. The GLEC Framework provides the basis to produce results that can be used successfully in the crucial process of driving down emissions from logistics activities.

Suzanne Greene is an environmental scientist at the Massachusetts Institute of Technology, Cambridge, MA, and works as a technical advisor for the Smart Freight Centre. Alan Lewis is director of the Global Logistics Emissions Council (GLEC) with the Smart Freight Centre, Amsterdam, The Netherlands. E-mail: alan.lewis@smartfreightcentre.org.

References
3. Corporate Value Chain (Scope 3) Accounting and Reporting Standard; World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), 2011.
8. CEN. EN 16258: Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers); 2012.