

International Case Studies on Goods Movement Strategies

FINAL REPORT

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- International Council on Clean Transportation

Executive Summary

Introduction, Objective and Methodology

The transportation sector in Canada accounted for 24% of national greenhouse gas (GHG) emissions in 2016. In order to reduce GHG emissions, the Government of Canada has adopted several measures to improve energy efficiency, especially for on-road transportation, which accounts for 80% of energy consumption in the sector.

In 2016, the Government introduced the Pan-Canadian Framework (PCF) on Clean Growth and Climate Change. The PCF articulates Canada's plan to meet its climate change commitments and grow the economy. Four key areas were identified for concerted action with the Provinces and Territories on transportation including:

1. Setting emissions standards and improving efficiency
2. Putting more zero-emission vehicles on the road
3. Shifting from higher- to lower-emitting modes and investing in infrastructure
4. Using cleaner fuels

Several transportation-related PCF measures are underway in Canada.

A number of countries have implemented policies and measures to reduce GHG emissions from heavy duty vehicles (HDVs), as well as more comprehensive strategies for sustainably moving goods across their regions. Canada stands to benefit through learning from policies and strategies implemented in other regions, including the results achieved and lessons learned. Case studies of sustainable goods movement strategies in other regions can inform a more comprehensive approach to reducing GHG emissions from on-road freight in Canada.

The purpose of this project was to deliver a report with case studies on international sustainable and low-carbon goods movement strategies, with a focus on on-road freight carried by HDVs. This study was conducted in two phases, research and analysis. The project team conducted a preliminary desktop literature review to identify a list of potential countries to be included in the case studies. Case study selection criteria were used to narrow down the list to six case studies. An assessment framework was developed to focus the case studies to several key elements. A further literature review followed by seven phone interviews and one interview by email correspondence were conducted to complete the case studies. The case studies were analyzed to identify best practices, lessons learned, and recommendations regarding applicability to Canada.

Selection of Goods Movement Strategies

Based on the initial review of literature, criteria were proposed for the selection of case studies on international sustainable and low-carbon goods movement strategies. These criteria helped to ensure that selected case studies provide distinctive insight relevant to key aspects of the Canadian context. Selection criteria included:

- Comparability to Canada
- Geography and climate
- History and experience
- Leadership and success
- Stage of development

Based on these criteria, six countries were selected for case studies:

- | | |
|-------------------|-----------|
| 1. United States | 4. Sweden |
| 2. United Kingdom | 5. China |
| 3. Germany | 6. Brazil |

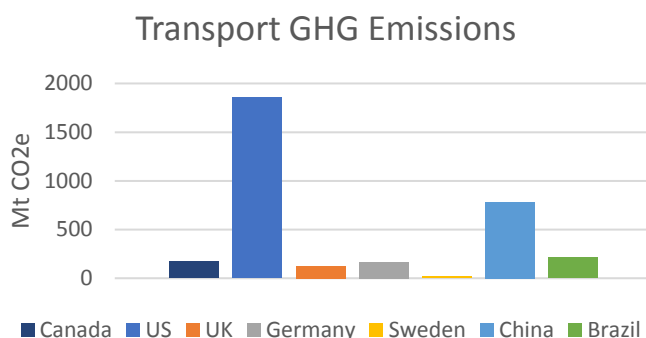
The assessment focused on the collective impact of strategies, i.e., the suite of strategies in each jurisdiction was assessed as a whole in recognition of the fact that similar outcomes could be achieved in different ways. The assessment framework for the case studies included:

- Objective
- Comprehensiveness
- Coverage
- Effectiveness
- Enforcement and compliance
- Impact
- Incentives for innovation

Case Study Overview

The countries selected for case studies vary in many ways, such as population, gross domestic product (GDP), geographic size, and GHG emissions profile. China is the largest in terms of population and total GHG emissions. The US has the highest GDP and the highest transport sector GHG emissions. Brazil follows in each category after the US and China. United Kingdom and Germany are similar with smaller populations, GDP, and GHG emissions. While, Sweden is the smallest in population, GDP, and GHG emissions. All six countries selected committed to economy wide GHG reduction targets under the Paris Agreement in their nationally determined contributions (NDCs). United Kingdom, Germany, and Sweden are part of the European Union

(EU) and its Member States NDC target. The US NDC is legally in place until November 4, 2019, after which the US may withdraw from the Paris Agreement. The figure below is provided to illustrate the magnitude of difference between the transport sector GHG emissions in each of the countries.



Policies and Measures

The study considered different types of policy tools for:

- Measures to improve fuel consumption
- Emission standards
- Alternative fuels and technologies
- Clean technologies
- Green freight programs
- Operational practices
- Traffic demand management

All six case study countries currently use a combination of policy tools, as illustrated in the table below.

Country	Voluntary	Regulatory	Fiscal	R&D	Overarching	Other
US	✓	✓	✓	✓	✓	✓
UK	✓	✓	✓	✓	✓	✓
Germany		✓	✓	✓	✓	
Sweden		✓		✓	✓	
China	✓	✓	✓		✓	
Brazil	✓	✓				✓

The motivation for and design of each measure varies from country to country. Some were designed to directly support GHG emission reduction targets, others to encourage and facilitate research, development and deployment (RD&D) of commercial ready clean technologies, and

still others to train drivers and operators on efficient driving practices. Coverage varied from country to country, but the suite of policies generally covered a combination of the following:

- HDV engines/fuels (OEMs)
- HDV operations (drivers, owners)
- Fuels (refiners, importers, producers, suppliers)
- Aftermarket equipment
- Industry associations

Many of the policies and measures identified in this study involved high levels of domestic collaboration while some measures also involved international collaboration.

Targets, Results, and Investments

In addition to economy wide targets, committed to under the Paris Agreement, some countries established additional GHG reduction targets related to individual policies or on a per sector basis. The US and UK both had voluntary policies with stated emission reduction targets. While Germany and Sweden both had transport sector targets.

It was found during this study that specific quantitative results were difficult to obtain for individual policies and at the sector level with respect to GHG emission reductions from on-road freight. A number of the more interesting or progressive policies identified in this study, such as UK’s industry-supported GHG reduction commitment or Sweden’s Freight Transport Strategy, have only recently been implemented and there are therefore no results to date.

In terms of HDVs as a specific target for overarching strategies, the table below shows that typically HDVs are only one component of overall plans. This is because the key to these types of strategies is to bring all freight-related activities together into one comprehensive approach.

Country	Overarching Strategy	Level	HDV Focus
United States	• Draft National Freight Strategic Plan	• Freight Sector	• HDVs are one component
United Kingdom	• The Road to Zero	• Transport Sector	• HDVs are one component
Germany	• National Platform on Future of Mobility	• Transport Sector	• Unknown at this time, but focus will likely be on LDVs
Sweden	• Freight Transport Strategy • SOFT	• Freight Sector • Transport Sector	• HDVs are one component • Focus is on fuels, as a result HDVs will be included
China	• 13 th Five-Year Plan	• Economy Wide	• Low carbon transport is one component and will include HDVs
Brazil	• N/A	•	•

In terms of government investment, again specific details were difficult to obtain for all of the policies and measures identified. However, data for a selection of policies from US, UK, Germany,

and Sweden were obtained. The range of funds provided to R&D programs was from approximately \$40 million to \$270 million. The range of funds for fiscal policies (grants) was approximately \$7 million to \$53 million. The range of funding for operational practices and knowledge sharing platforms was approximately \$75,000 to \$2 million.

Best Practices and Lessons Learned

The following best practices and lessons learned were assembled from the six case studies.

- **Overarching transport or freight strategy** – There is a trend toward development of multi-departmental, comprehensive, long-term strategies.
- **Industry engagement** – Industry stakeholders are involved in a meaningful way through the entire process to ensure that strategies, policies, RD&D, etc. remain relevant to industry.
- **Small adaptations** – Where possible, the combination of small adaptations can serve to address the issue being considered.
- **Goals** – It does not appear to be common practice to develop policies with specific GHG reduction targets.
- **Data availability** – Data transparency and availability is required to inform policy development and enable effective evaluation.
- **Monitoring and evaluation** – The success of policies often depends on continued and effective monitoring and evaluation. However, some policy tools are more difficult to monitor than others (e.g., voluntary programs, overarching goals, etc.).
- **Enforcement** – Strong enforcement and compliance are required to make policies effective.
- **Collaboration** – Some measures are inherently suited to international cooperation (e.g., green freight programs, RD&D, vehicle weight/length standards, etc.).
- **Long lead time** – Long lead time can benefit and improve the success rate of some policies and programs, from both the stakeholder perspective and the policy development perspective.

Applicability to Canada

The six case studies were reviewed to identify recommendations regarding applicability to Canada.

One of the key policies, identified by the case study countries, to reduce emissions in HDVs is fuel consumption or GHG emission standards. Canada is one of only four countries that already has this type of policy in place. The other countries are China, Japan, and the US. The European Union is currently developing fuel consumption standards and India has also developed standards, but they are not yet in place. In terms of new policies for Canada, there was no one policy or policy tool that stood out to reduce GHG emissions from on-road freight that would be

most applicable to Canada moving forward. Instead, a combination of policies and measures under one overarching strategy could be considered.

Key Considerations

- **Transport sector or freight strategy** – To meet the challenges of future transport (including freight) needs, all modes of transport must be developed in a single transport system, rather than separately and linked afterwards. There is a need for one comprehensive, holistic, long-term approach, covering all aspects of (freight) transport.
- **Industry engagement and commitment** – It is considered to be best practice for all strategies, policies, and measures to be developed in dialogue with key stakeholders, as success depends on continued collaboration, support, and shared responsibility.
- **Evidence-based approach** – An evidence-based approach is key to policy development with stretching, but achievable goals.
- **Competitiveness, environment, and innovation** – These are the three pillars to consider in developing a sector level strategy.
- **Collaboration** – Domestic and international collaboration is considered to be a key success factor in policy development and implementation.

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1. Introduction

The transportation sector in Canada accounted for 24% of national greenhouse gas (GHG) emissions in 2016. In order to reduce GHG emissions, the Government of Canada has adopted several measures to improve energy efficiency, especially for on-road transportation, which accounts for 80% of energy consumption in the sector. On-road freight is a rapidly growing source of transportation related emissions in Canada.

In 2016, the Government introduced the Pan-Canadian Framework (PCF) on Clean Growth and Climate Change. The PCF articulates Canada's plan to meet its climate change commitments and grow the economy. Four key areas were identified for concerted action with the Provinces and Territories on transportation including:

1. Setting emissions standards and improving efficiency
2. Putting more zero-emission vehicles on the road
3. Shifting from higher- to lower-emitting modes and investing in infrastructure
4. Using cleaner fuels

Transportation-related PCF measures underway include the development of the Clean Fuel Standard, carbon pricing, the Electric Vehicle and Alternative Fuel Infrastructure Deployment Initiative, and efficiency retrofit measures in coordination with the Provinces and Territories. Regulations were initially established for limiting GHG emissions from light-duty vehicles beginning in 2011 and subsequently for heavy duty vehicles beginning in 2014. Canada is now one of a select few countries in the world to have implemented standards to improve the efficiency and emissions intensity of heavy duty trucks. Other countries with emissions standards include Japan, China, and the United States. India has also developed emissions standards, but they have not yet been implemented. The European Union is also in the process of developing heavy duty vehicle emissions standards.

A number of countries and regions have also implemented more comprehensive strategies for sustainably moving goods across their regions including the European Union, the United Kingdom, Finland, Denmark, and Germany. These goods movement strategies have identified measures to reduce GHGs, improve local air quality, decrease road congestion and increase productivity through the efficient movement of goods.

Canada stands to benefit through learning from strategies implemented in other regions, including the results achieved and lessons learned. Case studies of sustainable goods movement strategies in other regions can inform a more comprehensive approach to reducing GHG emissions from on-road freight in Canada.

Objective and Methodology

The purpose of this project was to deliver a report with case studies on international sustainable and low-carbon goods movement strategies, with a focus on on-road freight carried by heavy duty vehicles (HDVs). The case studies include an analysis on the measures adopted by countries, as well as the results achieved to date, where this information was available. This report also highlights best practices and lessons learned from the international case studies. Recommendations are provided related to which international measures would be most applicable to Canada.

This study was conducted in two phases: research and analysis. The project team conducted preliminary desktop research and information gathering on sustainable goods movements strategies implemented around the world. This preliminary research identified a list of potential countries (and strategies) to be included as case studies in this report. Criteria were developed for selecting which case studies from the preliminary list to explore in further detail.

A framework for assessing the final selected countries (and strategies) was developed. This framework was used to develop a case study template (Appendix B: Case Study Template) as well as interview questions (Appendix A: Interview Questions). Each case study was completed using a combination of further desktop research and interviews with key stakeholders and government officials.

Once the research phase was complete, an analysis was conducted to identify best practices, lessons learned, and recommendations regarding applicability to Canada.

2. Selection of Goods Movement Strategies

Case Study Selection Criteria

Jurisdictions differ in terms of many characteristics, including governance structures, legislation, transportation systems and priorities, population density, etc. The degree to which a suite of strategies is suitable for or contributes to the sustainability of a goods movement system in a given country is, therefore, very case specific.

Based on the initial review of literature, a number of criteria were proposed for the selection of case studies on international sustainable and low-carbon goods movement strategies. These criteria helped to ensure that selected case studies provide distinctive insight relevant to key aspects of the Canadian context.

Selection criteria include:

1. Comparability to Canada with respect to contextual factors, such as governance structures, industrial and political institutions, level of development and affluence, energy production and

consumption trends, jurisdictional arrangements, similar industrial base, HDV markets, adherence to environmental and social standards

- This helps to understand the applicability of international best practices and approaches to the Canadian political and economic context
2. Geography and climate
 - This highlights practices that are relevant to Canadian geography and climate and challenges for freight movement
 3. History and experience with implementing sustainable and low-carbon goods movement strategies and technologies
 - This enables a thorough understanding of impacts and lessons learned from the implementation of relevant strategies
 4. Leadership and successes in implementing world-class and innovative policies, strategies and technologies
 - This enables a focus on countries that have earned an international reputation as world leaders in sustainable and low-carbon goods movement strategies
 5. Case studies that demonstrate the development stage of relevant policies
 - A cross-section of cases could be valuable to understand aspects involved in the development of relevant strategies and take into account modern trends

Assessment Framework

This assessment focused on the collective impact of strategies, i.e., the suite of strategies in each jurisdiction was assessed as a whole in recognition of the fact that similar outcomes could be achieved in different ways. Relevant information about sustainable goods movement strategies, policies and programs were collected via interviews and literature review. The interview questions are found in Appendix A: Interview Questions. The list of literature review references is found for each country within the individual case studies (Appendix C: Case Studies).

The assessment focused on several key elements, subject to publicly available information:

- **Objective:** This criterion was used to capture what is a jurisdiction trying to accomplish through the suite of policies that have been implemented or are under development.
- **Comprehensiveness:** The assessment aimed to understand how a country is trying to achieve its goals. The study examined whether a policy mix considers all or majority of possible aspects of the issue, as opposed to focusing on a single factor, and which policy interventions form the key focus of a jurisdictional approach.
- **Coverage:** This criterion was used to assess the target groups of the policies, i.e., whose actions the policies are intended to influence, and understand which groups that are excluded (e.g., technology developers vs. drivers, new vehicles vs. legacy fleet owners).
- **Effectiveness:** This criterion was used to assess how integrated and effective policy measures are and how do they work together as an overall strategy. In addition, the possible effects and/or interactions of different policies were considered.

- **Enforcement and Compliance:** Policies are effective when they are enforced. These criteria were used to assess how enforcement of and compliance with the strategies are to be achieved in each jurisdiction. Examples of relevant provisions include monitoring and compliance requirements and sanctioning provisions. Where participation has been made voluntary, incentives were also assessed.
- **Impact:** This criterion was used to assess the extent to which policy outcomes have been achieved, as set out by the government. The assessment focused on significant environmental, economic and social impacts of a policy mix, both positive and negative.
- **Incentives for Innovation:** This criterion was used to assess whether a policy mix provides a strong incentive for target groups to find new, innovative ways of reducing their GHG impacts and stimulate technological progress in goods movement.

Selected Case Studies

The criteria were applied understanding that full alignment was likely to be impossible within a single country. The initial case studies, listed below, were based on ensuring that each criterion was prioritized in the selection of at least one country, and then effort was made for further alignment. The following countries were initially selected:

- | | |
|-------------------|--------------|
| 1. United States | 6. Brazil |
| 2. United Kingdom | 7. Australia |
| 3. Germany | 8. Japan |
| 4. Sweden | 9. India |
| 5. China | |

After initiating further research and conducting preliminary interviews and communications, it became apparent that India, Australia, and Japan would not be suitable for complete case studies. The focus for India to date has been on air quality and reducing air pollutant emissions through policies and regulations. Australia's focus to date on GHG reductions in the transport sector has been on light duty vehicles. However, the government is currently in the process of developing a comprehensive freight strategy, which is intended to be implemented mid-2019. There is no publicly available information on the strategy at the time of this report. Japan was found to have an interesting mix of policies and programs related to transport, and some specifically directed at freight. However, there was not enough information publicly

Overview of Key Policies in Japan:

- Basic Act on Transport Policy – Overarching policy for the transport sector with provisions to reduce the environmental load associated with traffic.
- Energy Saving Act – Fuel efficiency standards for HDVs based on a top runner approach.
- Tax Benefits – Environmental performance discount tax rate (until March 2019); Eco-car tax reductions and green tax provisions (until December 2018).
- Green Logistics Partnership Conference – To promote truck transport efficiency with freight owners and logistics operators.
- Green Management Certification – Third party certification used in government measures.
- Subsidies for compressed natural gas trucks, hybrid trucks, advanced diesel trucks, fuel cell vehicles, and on-board eco-driving equipment.

available (in English) to complete a case study and analyse their strategic approach to greening freight. See call out box for overview of relevant policies in Japan.

3. Case Studies

The case study template is presented in Appendix B: Case Study Template. The complete case studies are found in Appendix C: Case Studies. This section provides an overview of the case studies, including best practices and lessons learned.

Case Study Overview

Country Profile

This report presents case studies for six countries (United States, United Kingdom, Germany, Sweden, China, and Brazil) that currently have sustainable, low-carbon goods movement strategies in place. For context, Table 1 presents background information on the six countries, as well as Canada. The population and gross domestic product (GDP) of each country are provided to illustrate the setting under which each country is operating with respect to GHG emissions and targets. All six countries committed to economy wide GHG reduction targets under the Paris Agreement in their nationally determined contributions (NDCs). United Kingdom, Germany, and Sweden are part of the European Union (EU) and its Member States NDC target.

Table 1 Case Study Country Profile

Country	Population 2017 ¹	GDP 2017 (current USD)	Emissions Profile ²	Paris Agreement NDC Target (Economy Wide) ³
Canada	36.708 million	1.653 trillion	Total: 704 Mt CO ₂ e Transport: 173 Mt CO ₂ e Freight Trucks: 60 Mt CO ₂ e ⁴	30% below 2005 levels by 2030
United States	325.719 million	19.391 trillion	Total: 6,511 Mt CO ₂ e Transport: 1,857 Mt CO ₂ e Freight (MDV+HDV): 425.9 Mt CO ₂ e ⁵	26-28% below 2005 levels by 2025 ⁶

¹ All population and GDP data were obtained from The World Bank, Countries and Economies (<https://data.worldbank.org/country/>).

² Canada, US, UK, Germany, and Sweden emissions are for year 2016. China and Brazil are for 2014.

³ Paris Agreement NDC target for Canada, US, China, and Brazil obtained from Climate Action Tracker (<https://climateactiontracker.org/>)

⁴ Government of Canada, Greenhouse gas emissions (<https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html>)

⁵ US EPA, Inventory of Greenhouse Gas Emissions and Sinks 1990-2016 (https://www.epa.gov/sites/production/files/2018-01/documents/2018_complete_report.pdf)

⁶ This is the US NDC that is legally in place until November 4, 2019. After which, the Trump Administration has indicated it will withdraw from the Paris Agreement and stop implementation of the NDC. Climate Action Tracker, USA (<https://climateactiontracker.org/countries/usa/pledges-and-targets/>)

Country	Population 2017 ¹	GDP 2017 (current USD)	Emissions Profile ²	Paris Agreement NDC Target (Economy Wide) ³
United Kingdom	66.022 million	2.622 trillion	Total: 468 Mt CO ₂ e Transport: 125.8 Mt CO ₂ e HDVs: 20.3 Mt CO ₂ e ⁷	40% below 1990 levels by 2030 ⁸
Germany	82.695 million	3.677 trillion	Total: 909 Mt CO ₂ e Transport: 167 Mt CO ₂ e ⁹ Heavy Duty Trucks + Buses: 51 Mt CO ₂ e ¹⁰	
Sweden	10.067 million	538.04 billion	Total: 52.893 Mt CO ₂ e Transport: 16.855 Mt CO ₂ e HDVs: 3.333 Mt CO ₂ e ¹¹	
China	1.386 billion	12.238 trillion	Total: 11,911 Mt CO ₂ e Transport: 781.36 Mt CO ₂ e ¹²	To peak CO ₂ emissions by 2030 at the latest; Lower carbon intensity of GDP by 60-65% below 2005 levels by 2030
Brazil	209.288 million	2.056 trillion	Total: 1,051 Mt CO ₂ e Transport: 213.03 Mt CO ₂ e ¹³	1.2 GtCO ₂ e (equivalent to 43%) below 2005 levels by 2030

Figure 1 is provided to illustrate the magnitude of difference between the transport sector GHG emissions in each of the countries. Note that this graph presents the most recent year of data available, which was 2016 emissions for Canada, US, UK, Germany, and Sweden and 2014 emissions for China and Brazil.

⁷ Department for Business, Energy & Industrial Strategy, Final UK greenhouse gas emissions national statistics 1990-2016 (<https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-2016>)

⁸ This is the EU (and its Member States) NDC target, Latvian Presidency of the Council of the European Union, Submission by Latvia and the European Commission on Behalf of the European Union and its Member States, March 6, 2015 (<http://www4.unfccc.int/ndcregistry/PublishedDocuments/United%20Kingdom%20of%20Great%20Britain%20and%20Northern%20Ireland%20First/LV-03-06-EU%20INDC.pdf>)

⁹ German Environment Agency (UBA), Indicator: Greenhouse gas emissions (<https://www.umweltbundesamt.de/en/indicator-greenhouse-gas-emissions#textpart-1>)

¹⁰ European Environment Agency, EEA greenhouse gas – data viewer (<https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>)

¹¹ Statistics Sweden, Statistical database, Greenhouse gas emissions and removals (http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_MI_MI0107/?rxid=edaab3b7-7f3e-448a-8e89-84c9e346bbf5)

¹² CAIT Climate Data Explorer, 2017. World Resources Institute (<http://cait.wri.org/profile/China>)

¹³ CAIT Climate Data Explorer, 2017. World Resources Institute (<http://cait.wri.org/profile/Brazil>)

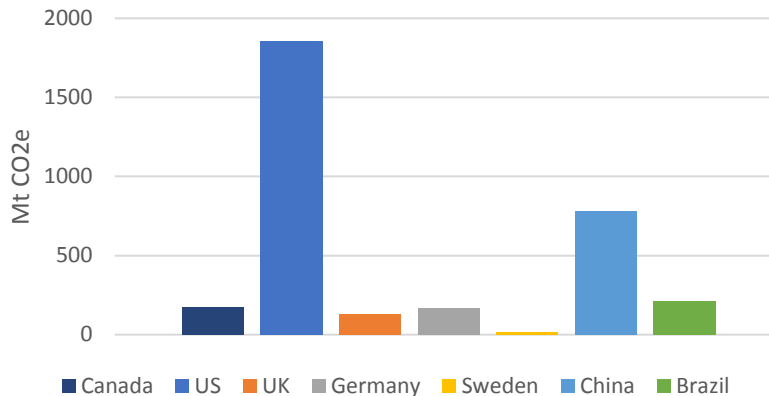


Figure 1 Transport Sector GHG Emissions

Key Policies and Measures

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Many of the policies and measures identified in this study involved high levels of collaboration. In addition to federal, state, and local governments, collaborators included industry (individual companies), associations, unions, research institutes, academia, consulting firms, environmental groups/NGOs, and others. International collaboration, particularly with direct neighbours, was also highlighted for several key measures.

Table 2 presents the key measures and tools used in the goods movement strategies for each of the six case study countries. Types of policies reviewed in this study include

- Measures to improve fuel consumption
- Emission standards
- Alternative fuels and technologies
- Clean technologies
- Green freight programs
- Operational practices
- Traffic demand management

In terms of policy tools, the study focused on voluntary, regulatory, and fiscal policies, along with R&D, overarching strategies, and any measures identified that did not fall into the other categories. As exhibited in Table 2, all six case study countries currently use a combination of policy tools.

The motivation for and design of each measure varies from country to country. Some were designed to directly support GHG emission reduction or fuel consumption reduction targets, others to encourage and facilitate the research, development and deployment (RD&D) of commercial ready clean technologies, and still others to train drivers and operators on efficient driving practices. Coverage varied from country to country, but the suite of policies generally covered a combination of the following:

- HDV engines/fuels (OEMs)
- HDV operations (drivers, owners)
- Fuels (refiners, importers, producers, suppliers)
- Aftermarket equipment
- Industry associations

Many of the policies and measures identified in this study involved high levels of collaboration. In addition to federal, state, and local governments, collaborators included industry (individual companies), associations, unions, research institutes, academia, consulting firms, environmental groups/NGOs, and others. International collaboration, particularly with direct neighbours, was also highlighted for several key measures.

Table 2 Key HDV Policies and Measures

Country	Voluntary	Regulatory	Fiscal	R&D ¹⁴	Overarching	Other
United States	<ul style="list-style-type: none"> SmartWay Transport Clean Cities Program 	<ul style="list-style-type: none"> Fuel Economy and GHG Emissions Standards Renewable Fuel Standard 	<ul style="list-style-type: none"> Clean Diesel Program Idle Reduction Equipment Excise Tax Exemption Qualified Heavy-Duty Alternative Fuel Vehicle Tax Credit 	<ul style="list-style-type: none"> SuperTruck Co-Optima NG HDV Research 	<ul style="list-style-type: none"> Draft National Freight Strategic Plan 	<ul style="list-style-type: none"> Alternative Fuel Corridors Model Idling Reduction Law and Auxiliary Power Weight Exemption
United Kingdom	<ul style="list-style-type: none"> Industry-supported GHG reduction commitment Ultra low emission standard 	<ul style="list-style-type: none"> Extra tonne payload 	<ul style="list-style-type: none"> Plug-in van grant 	<ul style="list-style-type: none"> Zero emission technologies for HDVs Longer semi-trailer trial NG HDV emissions testing Various other R&D programs (e.g., LEFT, IDP14, F4C) 	<ul style="list-style-type: none"> The Road to Zero 	<ul style="list-style-type: none"> Road investment strategy
Germany		<ul style="list-style-type: none"> Federal Truck Road Toll Act Longer goods vehicles 	<ul style="list-style-type: none"> Efficient and low-carbon engine freight funding Energy Tax Act – incentives for NG and LPG 	<ul style="list-style-type: none"> Electrified road trials Mobility and Fuel Strategy 	<ul style="list-style-type: none"> National Platform on Future of Mobility 	
Sweden		<ul style="list-style-type: none"> Longer heavier vehicles Biofuel law (emissions reduction obligation system) 		<ul style="list-style-type: none"> Electrified road trials CLOSER 	<ul style="list-style-type: none"> Freight Transport Strategy SOFT 	
China	<ul style="list-style-type: none"> China Green Freight Initiative 	<ul style="list-style-type: none"> Fuel consumption standard 	<ul style="list-style-type: none"> NG favourable price 		<ul style="list-style-type: none"> 13th Five-Year Plan 	
Brazil	<ul style="list-style-type: none"> Green freight program (in development) 	<ul style="list-style-type: none"> Biofuel standards 				<ul style="list-style-type: none"> Load-sharing program (National Logistics Plan)

¹⁴ R&D is often funded by government that provides grants to participants/proponents. For simplicity, R&D programs have not also been included in the fiscal policy category, despite proponents receiving fiscal incentives for conducting R&D.

Targets and Results

- Table 1 presented the economy-wide GHG reduction targets of each case study country. In addition to economy wide targets, committed to under the Paris Agreement, some countries have established additional GHG reduction targets related to the individual policies presented in

Many of the policies and measures identified in this study involved high levels of collaboration. In addition to federal, state, and local governments, collaborators included industry (individual companies), associations, unions, research institutes, academia, consulting firms, environmental groups/NGOs, and others. International collaboration, particularly with direct neighbours, was also highlighted for several key measures.

Table 2 or on a per sector basis. These are presented in Table 3.

Table 3 Transport Related GHG Reduction Targets

Country	Sector or Policy/Program	GHG Reduction Target
United States	• SmartWay Transport (Voluntary)	• 60 Mt CO ₂ e from HDVs
United Kingdom ¹⁵	• Industry-supported GHG reduction commitment (Voluntary)	• 15% below 2015 levels by 2025
Germany	• Transport sector target	• 40-42% below 2005 levels by 2030 (equivalent to 97 Mt CO ₂ e)
Sweden	• Transport sector target (excluding aviation)	• Fossil fuel independent transport sector by 2030 (equivalent to 70% below 2010 levels)
China	• No sector or policy specific GHG reduction targets identified. ¹⁶	
Brazil	• No sector or policy specific GHG reduction targets identified.	

Specific quantitative results were difficult to obtain for individual policies and at the sector level with respect to GHG emission reductions from on-road freight. The following results were identified:

- United States
 - SmartWay Transport (US/Canada combined) has met its GHG reduction target and has helped reduce carbon emissions by over 70 million tonnes since inception and has over 3,000 participants.
- Germany
 - Longer goods vehicles field trial resulted in efficiency gains and fuel savings of 15-25% (though not explicitly stated, this would represent GHG reductions of the same).
- Sweden
 - Longer heavier vehicles show a 16-20% GHG reduction on a tonne-km basis.
- China
 - Phase I of the fuel consumption standards were estimated to have reduced CO₂ emissions by 2 Mt in 2015.

A number of the more interesting or progressive policies identified in this study, such as UK's industry-supported GHG reduction commitment or Sweden's Freight Transport Strategy, have only recently been implemented and there are therefore no results to date.

In terms of HDVs as a specific target for overarching strategies, Table 4 shows that typically HDVs are one only component of overall plans. This is because the key to these types of strategies is to bring all freight-related activities (e.g., all modes, all departments, all stakeholders) together into one comprehensive approach.

Table 4 HDVs as a Target

¹⁵ The UK also has a long-term goal to develop and deploy zero emission HDVs.

¹⁶ Note that low carbon development of the transport sector was mentioned for the first time in China's 13th FYP. In addition, the heavy duty vehicle fuel consumption standards target fuel consumption reductions, which would directly lead to GHG reductions.

Country	Overarching Strategy	Level	HDV Focus
United States	<ul style="list-style-type: none"> Draft National Freight Strategic Plan 	<ul style="list-style-type: none"> Freight Sector 	<ul style="list-style-type: none"> HDVs are one component
United Kingdom	<ul style="list-style-type: none"> The Road to Zero 	<ul style="list-style-type: none"> Transport Sector 	<ul style="list-style-type: none"> HDVs are one component
Germany	<ul style="list-style-type: none"> National Platform on Future of Mobility 	<ul style="list-style-type: none"> Transport Sector 	<ul style="list-style-type: none"> Unknown at this time, but focus will likely be on LDVs
Sweden	<ul style="list-style-type: none"> Freight Transport Strategy SOFT 	<ul style="list-style-type: none"> Freight Sector Transport Sector 	<ul style="list-style-type: none"> HDVs are one component Focus is on fuels, as a result HDVs will be included
China	<ul style="list-style-type: none"> 13th Five-Year Plan 	<ul style="list-style-type: none"> Economy Wide 	<ul style="list-style-type: none"> Low carbon transport is one component and will include HDVs
Brazil	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">

Government Investments

The following are examples of government investments in RD&D. For all investments in this section, the dollar amount is presented in Canadian dollars; for the original country values please see the individual case studies.

- United States
 - SuperTruck I received approximately \$268 million CAD; SuperTruck II received \$105 million CAD.
- United Kingdom
 - Combined \$103 million CAD funding for three R&D programs (Low Emissions Freight and Logistics Trial (LEFT), Integrated Delivery Programme 14 (IDP14), Future Fuels for Flight and Freight Competition (F4C)).
- Germany
 - Electrified road trials, demonstrations, and research have received approximately \$105 million CAD.
- Sweden
 - One of the electrified road trials (eHighway) received approximately \$115.5 million CAD.
 - Triple F (Fossil Free Freight), recently launched under the Freight Transport Strategy will receive \$42 million CAD over 12 years from the Swedish Transport Administration with additional funding from other agencies.

The following are examples of government investments in fiscal policies.

- United States
 - In 2018, approximately \$52.5 million CAD was available for clean diesel grants.
- United Kingdom
 - Plug-in van grant provides up to \$34,400 CAD for the first 200 HDVs to apply.
- Germany
 - Efficient and low-carbon freight funding is \$45 million CAD over 3 years.

The following are examples of government investments in HDV operation programs and knowledge sharing platforms.

- United States
 - SmartWay funding varies year to year but has received approximately \$1.3 million CAD to \$1.8-1.9 million CAD in the past.
- United Kingdom
 - Department for Transport funds a freight knowledge portal for HDV operators with \$74,800 CAD.

Best Practices and Lessons Learned

The following best practices and lessons learned were gleaned from the six case studies.

Overarching Transport or Freight Strategy

There appears to be a trend towards developing an overarching transport sector or freight specific strategy. The United Kingdom and Germany both have recently developed transport sector strategies. In addition, China has included low carbon transport as a specific target area in its 13th Five-Year Plan (economy wide strategy for social, political, and economic development). Sweden recently launched a national freight transport strategy. The United States developed a draft national freight strategic plan in 2016 and Australia is currently developing a national freight and supply chain strategy for release in 2019.

The idea is that to meet the challenges of future transport (including freight), all modes of transport must be developed in a single transport system, rather than separately and linked afterwards. The various aspects of freight transport are handled by many different departments. The motivation behind developing a multi-departmental, overarching strategy is to bring all freight-related activities together into one comprehensive approach.

An overarching strategy also facilitates the development of integrated, comprehensive policies. To see substantial impact, the bigger picture should be taken into consideration and more comprehensive measures put in place. Considering policies and measures from a holistic, long-term perspective helps to ensure that policies are designed to work together to serve one major goal.

Industry Engagement

Industry stakeholders need to be directly engaged in a meaningful way through the entire strategy, policy, etc. development process, from initiation to implementation, monitoring, and follow up. This is to ensure that strategies, policies, RD&D needs/direction, etc. (all types of policy tools) remain relevant to industry and effective for their purpose. In other words, industry involvement is required to ensure that intended benefits are possible in real-world implementation.

For example, Sweden's Freight Transport Strategy, which is intended to be a platform for cooperation, was developed in dialogue with stakeholders in the freight and logistics sectors. The government firmly believes that the success of the strategy depends on continued collaboration with industry stakeholders and shared responsibility. Similarly, the UK government considers the voluntary commitment and support from UK industry under the Road to Zero framework to be one of the key policies to meeting their overarching goals of reducing emissions from the truck freight sector.

The US SmartWay program experience has also shown that it is important to work with industry, including associations that already have well-established working relationships, trust, and good channels with industry. For SmartWay, building trust with partners was key. This can be achieved by developing good working relationships with members, by listening and learning from them about their challenges and concerns, bringing them into the development of the program so that they can provide input on what they need and thus ensure that the program is designed in a way that helps them achieve their goals.

Small Adaptations

Where possible, the combination of small adaptations can serve to address the issue being considered. This is in fact one of the guiding principles in all policy development in Sweden – to make small adaptations. For instance, when considering congestion, redoing or building new infrastructure to expand capacity is not a priority. Instead, small adaptations are made to address the congestion, such as investing in and deploying new technologies, changing licensing systems, etc. Major conventional infrastructure projects are not considered to be best practice.

Goals and Targets

It does not appear to be common practice to develop policies with specific GHG reduction targets. There may be overarching goals that individual policies and programs serve to support. For example, the United Kingdom's long-term goal is to develop and deploy zero emission HDVs. United Kingdom has taken an evidence-based approach to policy development to support this long-term goal, which they believe is stretching, but achievable. Except for the voluntary, industry-supported commitment to reduce HDV GHG emissions by 15% by 2025 (from 2015 levels), the other policy tools do not have specific targets, though they would have general goals. For instance, regarding R&D, there are no ceiling or floor limits, but the government asks for significant reductions, mostly measured on potential for technology to be commercialized or inward investment into UK.

Data Availability

Data transparency and availability are required to inform policy development and enable effective evaluation. In this way, data availability also impacts the ability to modify on-going policies, as needed, in a timely manner. For example, data transparency and accessibility are issues in the public domain in Brazil. Private agencies often collect data for use in their own internal studies

and subsequently keep the data private. Lack of publicly available data in Brazil results in implementation difficulties with respect to policy development and on-going modifications. Another example where data may be playing a role is in China's green freight initiative. Policies in China are very dynamic, they change very quickly, and the incentives for participation in the green freight initiative are not reflecting these changes. Lack of data or data analysis may be playing a role in limiting the required evolution of the green freight initiative.

Associated with data availability is technical capacity, which can impact the ability to identify, collect, analyse, and understand data and its relevance to policy development and impact. There can be a barrier to effective policy development if the regulating bodies lack technical capacity.

Monitoring and Evaluation

The success of policies and measures often depends on continued and effective monitoring and evaluation. This includes the need to modify policies over time to make them more effective and ensure continued relevance to the key stakeholders and goals. However, some policy tools are more difficult to monitor and evaluate than others.

Voluntary programs are difficult to monitor and evaluate, unless there is a simple and enforced reporting process. For example, SmartWay Transport has a successful reporting process in place, which includes key elements such as a simple reporting tool, automatic flags to indicate data anomalies, and partner account managers who review and validate all data that is submitted.

Overarching goals are also difficult to monitor and evaluate. Different policies that support the overarching goal are led by different departments, so there is typically no one authority responsible for overall monitoring.

Enforcement and Compliance

No matter what the policy tool, strong enforcement and compliance, including the legal basis to do so, is required to make it effective. To facilitate this, a good monitoring system needs to be put into place, including resources, data, etc. The successful implementation and high compliance rate of the German Federal Truck Road Toll Act has been partially attributed to the emphasis on enforcement.

As another example, China's enforcement of the fuel consumption standards is conducted at the prototype or pre-production vehicle model stage. The government reviews these vehicles to provide certification. There is no enforcement/compliance at the in-use stage. Once the vehicle is in production and sold into market, the government has no way to track them for efficiency standards. In addition, there are only 4 to 5 staff in charge of all motor vehicles in China. As a result, there is a severe lack of institutional capacity, technical capacity, technical tools, etc. to conduct in-use enforcement for efficiency standards.

Collaboration

In addition to domestic collaboration with all levels of government, industry stakeholders, academics, etc., international collaboration can be a key success factor to strategy or policy development and implementation. Some measures are inherently suited to international cooperation (e.g., green freight programs, RD&D, vehicle weight/length standards, etc.). Canada and United States have cooperated on the successful SmartWay Transport program. China has cooperated with the US and holds annual seminars to learn from other countries and promote China's success in green freight. Brazil is in discussions with other countries in Latin America (e.g., Chile, Argentina) to align green freight programs. Green freight is currently a strong area of international collaboration and the Global Green Freight action plan has a goal to expand and align green freight programs globally.

Other types of policies and measures can also benefit from international collaboration. For example, internationally aligned vehicle length and weight restrictions would allow for freedom of movement for on-road freight that travels through international borders. Research, development and demonstration can also benefit from international collaboration, particularly when similar goals are shared. For example, Sweden and Germany have collaborated on several electrified road demonstration trials.

Long Lead Time

Long lead time can benefit some policies and programs in a variety of ways. For example, for regulations that impact OEMs (e.g., fuel consumption standards), a long lead time allows the OEMs to make incremental changes to work toward the new standards. In another way, long lead times allow policies themselves to be developed and implemented in a staged approach. The successful implementation of the German Federal Truck Road Toll Act has been partially attributed to the emphasis on keeping it simple to begin with. It was initially only implemented on autobahns and larger vehicles, phasing in changes over time, such as more roads and smaller vehicles. Similarly, SmartWay adapted the program over time to expand and include other parts of industry as a comprehensive supply chain analysis was completed.

Resources

Key Contacts

Table 5 presents the key organizations and contacts that were identified during this study. Except for Australia (please refer to footnote), either a phone interview (7 in total) or email correspondence (1) was conducted to complete the case studies. The contacts are provided below to facilitate future collaboration on goods movement strategies.

Table 5 Study Key Contact List

Country	Organization	Name	Position	Email
United States	Environmental Protection Agency	Buddy Polovick	Team Leader, SmartWay Transport Partnership	polovick.buddy@epa.gov
United Kingdom	Department for Transport	Bob Moran	Deputy Director, Head of Environment Strategy	bob.moran@olev.gsi.gov.uk
Germany	Federal Ministry for the Environment, Nature Conservancy and Nuclear Safety	Markus Becker	Advisor, Division Environment, Traffic and Transport, Electric Mobility	Markus.Becker@bmu.bund.de
Sweden	Swedish Transport Administration	Rein Juriado	Strategist	rein.juriado@trafikverket.se
China	ICCT	Hui He	Senior Researcher / Regional Lead	hui@theicct.org
Brazil	ICCT	Cristiano Façanha	Program and Regional Lead	cristiano@theicct.org
Australia	Infrastructure Australia	Freight Strategy Team ¹⁷		freightstrategy@infrastructure.gov.au
India	ICCT	Ben Sharpe	Senior Researcher / Regional Lead	ben@theicct.org
India	KPMG	Anurag Gupta	Partner, Global Sector Head, Power, Infrastructure	anuraggupta@kpmg.ca

As noted, the questions used for the phone interviews are found in Appendix A: Interview Questions.

Literature Review Resources

As noted, the list of literature review references is found within each case study (Appendix C: Case Studies).

4. Applicability to Canada

The six case studies were reviewed to identify recommendations regarding applicability to Canada with respect to strengthening the government approach to reducing GHG emissions from on-road freight, while also fostering innovation.

¹⁷ On May 18, 2018, the Council of Australian Governments' Transport and Infrastructure Council agreed to develop a 20-year national freight and supply chain strategy. This is currently underway to be completed in 2019. No interview was conducted for Australia or this strategy. The general contact is included only for future reference.

One of the **key policies**, identified by the case study countries, to reduce emissions in HDVs is fuel consumption or GHG emission standards. Canada is one of only four countries that already has this type of policy in place. The other countries are China, Japan, and the US. The European Union is currently developing fuel consumption standards and India has also developed standards, but they are not yet in place. See call out box for further details on India's standards. In terms of new policies for Canada, there was no one policy or policy tool that stood out to reduce GHG emissions from on-road freight that would be most applicable to Canada moving forward. Instead, a combination of policies and measures under one overarching strategy could be considered. That is, a **transport sector or freight specific strategy**.

To meet the challenges of future transport and freight needs, all modes of transport (i.e., road, rail, sea, air) must be developed in a single transport system. To do this, one comprehensive, holistic, long-term approach, covering all aspects of transport is required.

The development and implementation of such a strategy would involve, at minimum, all government departments responsible for different aspects of freight and the stakeholders that would be impacted.

One of the **key processes**, identified by the case study countries, in developing and implementing successful strategies and policies for HDVs is meaningful **industry engagement and commitment**. Success of measures related to the freight sector depend on collaboration, support, and shared responsibility between the government and industry. As a result, it is best practice for all strategies, policies, and measures to be developed in dialogue with key stakeholders through the entire lifecycle, from initiation to implementation to monitoring and evaluation. This ensures relevance to industry, increases the extent of industry support, and improves the likelihood of reaching goals and targets.

Additional key processes for Canada to consider applying or strengthening moving forward include:

Note on India's fuel efficiency standard and collaboration: The government of India developed fuel efficiency standards for commercial HDVs. The standards were designed such that every vehicle is required to meet a minimum standard, as opposed to similar standards in the US and Canada, where a corporate fleet average approach is taken. The standards were meant to be effective as of April 1, 2018. At the same time, OEMs are facing big technical challenges on the air pollutant side, as they are being required to leapfrog from Bharat Stage IV (based on Euro IV standards) to Bharat Stage VI (based on Euro VI standards). Leapfrogging this type of standard has never been done before, anywhere in the world.

There was a lack of coordination between ministries dealing with the air pollutant standards and those dealing with the fuel efficiency standards.

Given the design of the fuel efficiency standard, along with the aggressive air pollutant emission standards that were required to be met in the same time period, there has been considerable industry pushback. The industry is currently in negotiations with the government and there is no indication of when or how this will be resolved.

- Taking an **evidence-based approach** to policy development, with stretching, but achievable goals. The UK has taken an evidence-based approach to policy development and believe their ambition is stretching, but achievable.
- Framing comprehensive policies or overarching strategies on **competitiveness, environment, and innovation**. Sweden has built its progressive freight strategy on these three pillars, each of which were mentioned individually by other countries as well.
- Ongoing **collaboration**, both domestically, and internationally. Five of the six case study countries identified current policies and measures that have benefited from international collaboration, sharing best practices and fostering harmonization across jurisdictions.

Appendix A: Interview Questions

Survey/Interview Questions

- **General:**
 - Please provide a brief description of the suite of policies related to sustainable and low-carbon goods movement (e.g., emissions standards, fiscal policies, green freight programs, etc.), particularly for on-road freight.
 - What are the key goods movement strategies/policies/programs in place? (i.e., 1 to 2 key policies that do most of the work toward reaching any established targets/goals)
 - What are the total funds allocated to the suite of policies? To individual policies? What is the annual breakdown in funding?
 - Is there a detailed breakdown available in funds invested per capita or funds invested per truck?
 - What is the timeline for the suite of policies? For individual policies?
 - Who leads the policies? Which departments/agencies leading/involved? Is PMO approval required?
 - Does the private sector lead any of the policies? Are there private sector partners?
- **Objective:**
 - In relation to the suite of policies, is there an overarching environmental goal? If so, what is the governments overarching goal? (e.g., % GHG reduction, % fuel consumption reduction, congestion reduction in specific areas, fuel switch of certain amount, uptake of alternative/clean technologies to a certain level, promoting/facilitating the advancement and uptake of emerging technologies, etc.)
 - How are the goals being measured? (e.g., mandatory/voluntary reporting, spot checks, surveys, etc.)
 - If there is not an overarching goal of the suite of policies, same questions would apply to each individual policy or the key policies.
 - Are there any specific economic or social goals related to the suite of or individual policies? If so, what are they and how are they being measured?
- **Comprehensiveness:**
 - To what degree is the target covered by the suite of policies? For example, if the goal of a suite of policies is to reduce CAC emissions, are all sources of transport CACs covered by the suite of policies?
 - Which policy or which policy type does the government rely on most for reaching the goal? (e.g., fiscal measures, regulations, etc.)
 - What factors determined timing/phasing? (i.e., prioritization of certain measures)
 - What regions/sectors targeted?
 - Other countries/international partners included?

- **Coverage:**
 - Who is the intended target group of the suite of policies? (e.g., government fleets, private fleets, fleet owners/operators, drivers, OEMs, tech companies (after market), etc.) Are all players that significantly contribute to the identified issue (e.g., CAC emissions) covered by the suite of policies?
 - If the target audience varies by policy/is not uniform across the suite of policies, same question would apply to each individual policy or the key policies.
 - What are the participation levels for each policy/program within the suite of policies? How is this being measured? Is the policy/program effectively reaching the intended audience?
 - Ease of implementation – were there any major challenges with implementing the suite of policies? How do you think the ease/difficulty in implementation affected the participation levels?
- **Effectiveness:**
 - Were any of the policies/programs within the suite specifically designed to complement each other or interact in any specific way?
 - Was this suite of policies rolled out together or sequentially?
- **Enforcement and Compliance:**
 - As applicable, what enforcement/compliance measures are in place for the suite of policies?
 - Who is responsible for executing enforcement/compliance?
 - Who is responsible for monitoring enforcement/compliance?
 - What are the consequences of non-compliance?
 - If there are any voluntary policies within the suite of policies, have these been incentivized to increase participation? If so, in what way? What has been the uptake of the incentive?
- **Impact:**
 - In direct relation to the goals, as previously described, what are the results? These could be quantitative (e.g., Mt GHG reduction, % reduction in congestion in a certain corridor, ML of diesel fuel switch to GJ of natural gas, fiscal rebate of \$/ t GHG reduced, etc.) or could be qualitative assessments (e.g., funds granted in the RD&D/commercialization/market study of certain emerging technologies, pilot demonstrations completed, driver training sessions completed for a certain number of drivers with expected GHG reductions if lessons put into practice, etc.)
 - What are the data sources for the results? (i.e., how robust are the results?)
- **Incentives for Innovation:**
 - Was the suite of policies designed to incent innovation? If so, in what way?
- **Closing:**
 - Were there any key lessons learned in developing, implementing, monitoring or enforcing this suite of policies?

Appendix B: Case Study Template

General Overview

Country	Name
Policy Suite	Name
Policy Type(s)	<i>i.e., measures for improving the fuel consumption of vehicles, emissions standards, fiscal policies, alternative fuels and technologies, green freight programs, operational practices, clean technologies, research and development, traffic demand management</i>
Policy Suite Description	<i>Brief description of the suite of policies related to sustainable and low-carbon goods movement, particularly for on-road freight.</i>
Policy Funding	<i>What are the total funds allocated to the suite of policies? To individual policies? What is the annual breakdown in funding? Is there a detailed breakdown available in funds invested per capita or funds invested per truck?</i>
Timeline(s)	<i>What is the timeline for the suite of policies? For individual policies?</i>
Government Leads	<i>Who leads the policies? Which departments/agencies leading/involved? Is PMO approval required?</i>
Private Sector Involvement	<i>Does the private sector lead any of the policies? Are there private sector partners?</i>
Key Policies	<i>What are the key goods movement strategies/policies/programs in place? (i.e., 1 to 2 key policies that do most of the work toward reaching any established targets/goals)</i>
Incentives for Innovation	<i>Was the suite of policies designed to incent innovation? If so, in what way?</i>
Best Practices and Lessons Learned	<i>Were there any key lessons learned in developing, implementing, monitoring or enforcing this suite of policies?</i>

Policy Objective and Impact

Environmental Goal	<i>In relation to the suite of policies, is there an overarching environmental goal? If so, what is the governments overarching goal? (e.g., % GHG reduction, % fuel consumption reduction, congestion reduction in specific areas, fuel switch of certain amount, uptake of alternative/clean technologies to a certain level, promoting/facilitating the advancement and uptake of emerging technologies, etc.)</i>
Environmental Performance Measure	<i>How are the goals being measured? (e.g., mandatory/voluntary reporting, spot checks, surveys, etc.)</i>
Environmental Benefits (Results)	<i>In direct relation to the goals, as previously described, what are the results? These could be quantitative (e.g., Mt GHG reduction, % reduction in congestion in a certain corridor, ML of diesel fuel switch to GJ of natural gas, fiscal rebate of \$/ t GHG reduced, etc.) or could be qualitative assessments (e.g., funds granted in the RD&D/commercialization/market study of certain emerging technologies, pilot demonstrations completed, driver training sessions completed for a certain number of drivers with expected GHG reductions if lessons put into practice, etc.)</i>
Environmental Results Data Sources	<i>What are the data sources for the results? (i.e., how robust are the results?)</i>

Other Goals	<i>Are there any specific economic or social goals related to the suite of or individual policies? If so, what are they and how are they being measured?</i>
Other Benefits (Results)	<i>What are the results related to economic and social goals?</i>
Other Results Data Sources	<i>What are the data sources for the results? (i.e., how robust are the results?)</i>

Comprehensiveness, Coverage, and Effectiveness

Regional/Sector Coverage	<i>What regions/sectors targeted?</i>
Goal Coverage	<i>To what degree is the target covered by the suite of policies? For example, if the goal of a suite of policies is to reduce CAC emissions, are all sources of transport CACs covered by the suite of policies?</i>
Target Audience Coverage	<i>Who is the intended target group of the suite of policies? (e.g., government fleets, private fleets, fleet owners/operators, drivers, OEMs, tech companies (after market), etc.) Are all players that significantly contribute to the identified issue (e.g., CAC emissions) covered by the suite of policies?</i>
Participation	<i>What are the participation levels for each policy/program within the suite of policies? How is this being measured? Is the policy/program effectively reaching the intended audience?</i>
Implementation	<i>Ease of implementation – were there any major challenges with implementing the suite of policies? How do you think the ease/difficulty in implementation affected the participation levels?</i>
Policy Preference	<i>Which policy or which policy type does the government rely on most for reaching the goal? (e.g., fiscal measures, regulations, etc.)</i>
Policy Interaction	<i>Were any of the policies/programs within the suite specifically designed to complement each other or interact in any specific way?</i>
Selection of Timeline(s)	<i>What factors determined timing/phasing? (i.e., prioritization of certain measures) Was this suite of policies rolled out together or sequentially?</i>
Partnerships	<i>Other countries/international partners included?</i>

Enforcement and Compliance

Enforcement/ Compliance Measures	<i>As applicable, what enforcement/compliance measures are in place for the suite of policies?</i>
Responsible Party(ies)	<i>Who is responsible for executing enforcement/compliance? Who is responsible for monitoring enforcement/compliance?</i>
Non-compliance	<i>What are the consequences of non-compliance?</i>
Incentives for Participation	<i>If there are any voluntary policies within the suite of policies, have these been incentivized to increase participation? If so, in what way? What has been the uptake of the incentive?</i>

References

Appendix C: Case Studies



United States

General Overview

Country	United States
Policy Suite	Draft National Freight Strategic Plan
Policy Type(s)	<ol style="list-style-type: none"> 1. Green freight program (SmartWay Transport) 2. Research and development (SuperTruck) 3. Research and development (Co-Optima) 4. Emissions standards 5. Regulation (Renewable Fuel Standard) 6. Alternative fuels and technologies (Alternative Fuel Corridors) 7. Clean technologies (Clean Diesel Program) 8. Fiscal policies 9. Regulation (Model Idling Reduction Law and Auxiliary Power Weight Exemption) 10. Overarching (Draft National Freight Strategic Plan) 11. Operational practices (Clean Cities Program)
Policy Suite Description	<p>1. The SmartWay Transport program aims to improve fuel efficiency and reduce greenhouse gas (GHG) emissions and air pollution from the transportation supply chain with a focus on optimizing transportation networks. SmartWay Transport comprises public private partnerships, and policy, technical, research, and evaluation projects. Core components include:</p> <ul style="list-style-type: none"> • SmartWay Transport Partnership: registered participants use sustainability accounting and tracking tools to measure, benchmark, and report on emissions from across their supply chain. Freight activity data collected varies by the type of partner and includes such information as fuel use and type, mileage, vehicle weight class distribution and fleet composition, speed and idle hours, etc. The results are used to identify inefficiencies in the operations, equipment, and supply chains and help companies make informed decisions with respect to freight efficiency and environmental performance. • The SmartWay Technology Program is a testing and verification program that focuses on quantifying fuel use and emissions reductions from available technologies, such as tractor and trailer aerodynamics, idle reduction devices, low rolling resistance tires, auxiliary power units, retrofits and others. The program is designed to help participating companies identify technologies and strategies that could help save fuel and reduce emissions. • SmartWay also develops case studies, fact sheets and educational materials related to fuel-efficient and low-emission technologies, fleet movement and modal shift. <p>2. SuperTruck is an R&D and technology program that aims to accelerate the development of advanced efficiency technologies for heavy-duty trucks. Under the second iteration of the program, SuperTruck II, five multi-year industry projects were awarded to develop and demonstrate technologies that improve overall heavy-truck freight efficiency by more than 100%. The first iteration of the</p>

program, SuperTruck I was launched in 2010 with the aim to increase overall tractor-trailer freight efficiency by 50%, relative to a manufacturer's "best-in-class" 2009 model year baseline truck. The SuperTruck projects are an extension of previous R&D activities conducted under The 21st Century Truck Partnership (21CTP), which was launched in 2001 to reduce fuel consumption and emissions from heavy-duty vehicles and engines.

3. Various RD&D programs. The Co-Optimization of Fuels & Engines (Co-Optima) is a collaborative R&D effort that aims to promote the development and co-optimization of low-carbon fuels and efficient engine designs for on-road vehicles, including HDVs to achieve performance improvements while reducing costs and emissions. Vehicle Technologies Office (VTO) has also supported research into natural gas engines and technologies for HDVs, including a recently announced funding opportunity of up to \$11 million for projects that focus on reducing the cost, increasing efficiency, and advancing innovative medium- and heavy-duty natural gas engine designs.

4. Phase I fuel economy and GHG emissions standards cover medium and heavy duty trucks manufactured in model years 2014-2018. Phase II standards apply to model years 2021-2027. The standards are mandatory, increasing in stringency over time. An exception is fuel consumption standards for MYs 2014 and 2015, which were voluntary. For combination tractors, Phase 1 standards phased-in starting in MY 2014 and helped reduce CO₂ emissions and fuel consumption by 7-20% by MY 2017, relative to 2010 baselines. Phase 2 standards for combination tractors will start in MY 2021 and are expected to reduce CO₂ emissions by 15-27% by MY 2027, relative to the 2017 baselines. The Phase 2 standards also cover a new category - trailers. The standards for trailers begin in MY 2018 and are expected to reduce fuel use and CO₂ emissions by 6-10% by MY 2027, relative to the 2017 baselines.

5. The Renewable Fuel Standard (RFS) requires blending of increasing amounts of renewable fuels into transportation fuels that are sold in the US. The first RFS1 regulation required the blending of 4 billion gallons of renewable fuel in 2006, with the required levels reaching 36 billion gallons by 2022 under RFS2. Within the overall RFS, sub-mandates have been established for advanced biofuels, such as cellulosic biofuel and biomass-based diesel. The biofuels must meet a specified life-cycle GHG reduction threshold, which ranges from 20% (for conventional biofuel) to 60% (for cellulosic biofuel), relative to the fuel it replaces.

6. Alternative Fuel Corridors are being established for vehicles that are fueled with compressed natural gas, electricity, hydrogen, liquefied natural gas, and liquefied petroleum gas. These corridors have alternative refueling sites along a designated route on the National Highway System. The rounds 1 and 2 (2016 and 2017) of FHWA's Alternative Fuel Corridor Designations, have included

58 Nominations, and portions/segments of 84 Interstates, along with 43 US highways/state roads; comprises 44 states plus D.C.; and covers over 100,000 miles of the National Highway System (all fuels combined).

7. The Clean Diesel Program includes grants and rebates funded under the Diesel Emissions Reduction Act (DERA). Approximately \$40 million will be awarded in 2018, with a focus on projects that reduce emissions from existing diesel engines and vehicles, including Class 5 – Class 8 heavy-duty highway vehicles. Eligible projects include verified exhaust control technologies, engine upgrades, cleaner fuels, idle reduction technologies, aerodynamic technologies and low rolling resistance tire, clean alternative fuel conversions and others.

8. Tax related incentives for investment in alternative-fuels refueling infrastructure and adoption of natural gas, including renewable natural gas, as fuel, have included:

- Idle Reduction Equipment Excise Tax Exemption: On-board idle reduction technologies and advanced insulation are exempt from the excise tax which is levied on heavy-duty trucks and trailers. The exemption also applies to the installation of qualified equipment on vehicles which are in service.
- Qualified Heavy-Duty Alternative Fuel Vehicle (AFV) Tax Credit: Tax credit is available for the purchase of a qualified heavy-duty vehicle fuelled by natural gas, electricity or hydrogen. Tax credit amounts are as follows: \$25,000 (2017); \$20,000 (2018); \$18,000 (2019); \$15,000 (2020). Tax credits are limited to 10 AFVs or a total of \$500,000 per year.

9. The US EPA developed Model State Idling Law which applies to commercial diesel vehicles and can be used by states in the development of state vehicle idle restriction legislation. Auxiliary Power Weight Exemption is a national weight exemption for HDVs equipped with idling reduction technology, such as auxiliary power units to compensate for the additional weight of the technology. In 2012, the weight exemption was increased from 400 lb to 550 lb. The adoption of the exemption by states is discretionary.

10. Draft National Freight Strategic Plan outlines strategies to address the infrastructure, institutional, and financial barriers that hinder efficient movement of freight. Relevant strategies include improving multimodal transportation connectivity, strategies to relieve congestion, such as off-hours delivery of goods and promoting the use of the Intelligent Transportation Systems (ITS) technologies, and funding projects such as diesel retrofits, more efficient engines and cleaner fuels.

11. Clean Cities Program comprises nearly 100 coalitions of public- and private-sector transportation stakeholders. The initiative exists to accelerate the adoption of advanced vehicle technologies and alternative fuels in fleets through sharing of

	<p>data, tools, resources and best practices, providing technical assistance and other means.</p>
Policy Funding	<p>1. The program is funded by US EPA and Natural Resources Canada. The US funding for SmartWay varied from approximately 1 million US dollars a year to 1.4-1.5 million.</p> <p>2. US DOE provided \$80 million in federal funding for SuperTruck II, which was shared between four SuperTruck II teams. Each developer received \$20 million and matched that amount on a dollar-for-dollar basis. In addition, \$8 million was provided to and matched by a fifth team led by Paccar Inc., which joined SuperTruck II in 2017. The total funding for SuperTruck I program is estimated at \$284 million. This includes \$115 million in DOE funding, \$89 million in American Recovery and Reinvestment Act of 2009 (ARRA) funds, and industry contributions.</p> <p>3. US DOE provided \$50,5 million in funding for Co-Optima in FY 2015-2017, with Bioenergy Technologies Office (BETO) contributing \$26 million and Vehicle Technologies Office (VTO) providing \$24,500. In 2018, the U.S. DOE announced up to \$12 million to support the program.</p> <p>7. The Clean Diesel Program has included grants of up to \$200 million per year in 2007- 2011; up to \$100 million per year in 2012-2016; \$34 million in 2017 and \$40 million in 2018.</p>
Timeline(s)	<p>1. The concept for the SmartWay program was developed in 2001-2002. SmartWay was launched in 2004, following a pilot with the initial set of companies who helped develop the program.</p> <p>2. Four SuperTruck II teams were selected in 2016 and a fifth team joined in 2017. The program will run through 2021. SuperTruck I began in 2010 and ended in 2016.</p> <p>3. Co-Optima was launched in 2015 and is an ongoing initiative.</p> <p>5. RFS1 was established by the Energy Policy Act of 2005. RFS2 was established by the Energy Independence and Security Act of 2007 (EISA), which expanded the program and extended it to 2022.</p> <p>6. The first two rounds of Alternative Fuel Corridor designations were established in fiscal years 2016 and 2017.</p>
Government Leads	<p>1. US EPA leads the SmartWay program</p> <p>2. SuperTruck program is run by the Vehicle Technologies Office, US Department of Energy.</p> <p>3. Co-Optima is led by the DOE's Office of Energy Efficiency & Renewable Energy's Bioenergy Technologies Office and Vehicle Technologies Office.</p>

	<p>4. The U.S. Department of Transportation's (DOT) National Highway Traffic Safety Administration (NHTSA) regulates fuel economy standards. The U.S. Environmental Protection Agency (EPA) regulates GHG emissions. The standards are harmonized.</p> <p>5. The U.S. Environmental Protection Agency (EPA) administers the RFS program.</p> <p>6. The Federal Highway Administration (FHWA) is establishing Alternative Fuel Corridors.</p> <p>7. US EPA manages Clean Diesel Funding Assistance Program.</p> <p>8. EPA and the Departments of Energy and Transportation determines qualified idle reduction devices.</p>
Private Sector Involvement	<p>1. SmartWay program was launched as a public-private initiative. Partners include industry stakeholders, environmental groups, American Trucking Association, state trucking associations, and Business for Social Responsibility.</p> <p>2. SuperTruck program has 15 industry partners, including major truck and engine manufacturers in the US market.</p> <p>3. Co-Optima initiative is a collaborative effort involving DOE, nine national laboratories, 13 universities and industry stakeholders.</p>
Key Policies	<p>Key policies include:</p> <p>1. SmartWay, a voluntary program that aims to reduce emissions and improve fuel efficiency in the freight and shipping sector by using an innovative and collaborative approach.</p> <p>4. Ambitious fuel economy and GHG emission standards</p> <p>5. RFS</p>
Incentives for Innovation	<p>2. SuperTruck program incents innovation by encouraging truck manufacturers to invest in the development of advanced, high-risk/high-payoff technologies.</p> <p>3. Co-Optima program leverages expertise and facilities of the Vehicle and Bioenergy technologies offices, national laboratories, universities and industry to promote disruptive engine and fuel innovations.</p>
Best Practices and Lessons Learned	<p>1. SmartWay program experience has shown that it is important to work with industry associations and professional trade associations that already have well-established working relationships, trust and good channels with industry. Building trust with partners is key. This can be achieved by developing good working relationships with members, by listening and learning from them about their challenges and concerns, bringing them into the development of the program so that they can provide input on what they need and thus ensure that the program is designed in a way that helps them achieve their goals. The need to identify a good value proposition and provide benefits for the participants are other key success factors. This includes ensuring that there is a strong brand and that it is protected and preserved in a way that there is strong brand equity and it doesn't become</p>

	greenwashed. Leveraging market mechanisms is another important factor. For example, shippers can have very powerful effect on pressuring or incentivizing their carriers to participate in the program. Many shippers now put SmartWay as a requirement or preference in their contracting process, which speaks to the power of market mechanisms. SmartWay Affiliates can play an important role by facilitating positive working relationships with members, helping promote the program and keeping their stakeholders interested in being involved.
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Policy Objective and Impact

Environmental Goal	<p>1. The goal established for the SmartWay program was to reduce emissions by 60 million metric tons of CO₂. This target is specific to heavy-duty trucking.</p> <p>7. The Clean Diesel Program provides support for projects that improve air quality by reducing emissions from diesel engines and vehicles.</p>
Environmental Performance Measure	
Environmental Benefits (Results)	<p>1. The SmartWay program helped reduce carbon emissions by over 60 million metric tons since its inception.</p> <p>2. All industry teams met or exceeded the objectives of SuperTruck I. As of 2016, Approximately 21 SuperTruck fuel saving technologies have been successfully commercialized; around 26 technologies could be on the market in the next 2-4 years, and 13 technologies within the next 5-10 years.</p>
Environmental Results Data Sources	
Other Goals	<p>1. SmartWay program aims to reduce fuel consumption and air pollution.</p> <p>2. The goals for the SuperTruck II included the following:</p> <ul style="list-style-type: none"> • to improve freight efficiency by more than 100%, measured in ton miles per gallon, over 2009 baseline; • to reach a 55% or greater engine brake thermal efficiency in real-world operation. • To foster a more rapid market uptake of energy efficient technologies by demonstrating a payback period of less than 3 years. <p>The goals for SuperTruck I included the following:</p> <ul style="list-style-type: none"> • to increase freight efficiency for a heavy-duty Class 8 tractor-trailer by 50%, measured in ton miles per gallon, relative to a manufacturer's "best-in-class" 2009 model year baseline truck • to improve engine brake thermal efficiency by 50%

	<p>3. Co-Optima aims to achieve an improvement in heavy-duty fuel economy of up to 4%, and thus reduce fuel costs of HDVs by 5 billion per year. In addition, the initiative aims to increase the supply of domestically sourced fuel by up to 25 billion gallons per year and map lower-cost pathways to reducing emissions</p> <p>5. The RFS program has a long-term goal of 36 billion gallons of renewable fuels to be blended into transportation fuels that are sold in the US by 2022.</p>
Other Benefits (Results)	1. Between 2004 and 2017, SmartWay program helped achieve \$29.7 billion in fuel cost savings and avoid 103 million tons of air polluting emissions, such as NOx, PM, and CO ₂ .
Other Results Data Sources	

Comprehensiveness, Coverage, and Effectiveness

Regional/Sector Coverage	<p>1. The SmartWay program covers domestic trucks (as well as other freight sectors, such as rail, marine, multimodal, barge, and air freight).</p> <p>2. SuperTruck targets heavy-duty Class 8 tractor-trailers</p> <p>3. Co-Optima is focused on biofuels and combustion engines.</p> <p>4. Fuel Economy and GHG emissions standards are applicable to all on-road vehicles rated at a GVW\geq8,500 lbs. Phase 1 regulation covers model years (MY) 2014-2018. Phase 2 regulation applies to MY 2021-2027 vehicles.</p> <p>5. RFS program targets petroleum-based transportation fuels used on motor on-road vehicles (as well as non-road engines).</p> <p>8. Idle Reduction Equipment Excise Tax Exemption: The exemption is only available for idling reduction devices installed on tractors. Qualifying fuels for Heavy-Duty Alternative Fuel Vehicle (AFV) Tax Credit include natural gas, electricity, and hydrogen</p>
Goal Coverage	2. Class 8 tractor trucks account for a significant share of freight shipments in the US, carrying 80% of the total quantity of goods. These trucks consume approximately 28 billion gallons of diesel fuel annually, which represents 22% of total transportation energy use in the US. Significant fuel savings and efficiency gains can thus be achieved through the adoption of advanced SuperTruck technologies in this marketplace.
Target Audience Coverage	<p>1. SmartWay program targets companies that ship, manage, or carry freight, aiming to engage all stakeholders across the supply chain. Partners include:</p> <ul style="list-style-type: none"> • Shippers, such as Fortune 500® companies; small and medium sized enterprises; governments; colleges and universities; • Carriers, such as truck and multimodal carriers

	<ul style="list-style-type: none"> • Logistics companies <p>Organizations that do not belong to any of the categories above but are interested in joining the program can become SmartWay Affiliates</p> <p>2. SuperTruck focuses on major engine and truck equipment manufacturers operating in the US.</p> <p>5. Under the RFS program, obligated parties are oil refiners and importers of gasoline and diesel fuel. The volume requirements for each obligated entity are calculated based on the percentage of its sales of petroleum products.</p> <p>8. Up to 25% of the tax credits are reserved for taxpayers with small fleets of less than 40 vehicles.</p>
<p>Participation</p>	<p>1. SmartWay participation has increased from less than 20 partners during the inception to more than 3,000 partners today. Members include 247 freight shippers, 2,442 carriers and 500 logistics companies. Canadian companies have joined the program since 2012. Almost all of the nation’s largest trucking fleets participate in the program, including almost all top 100 carriers by fleet size. This represents a major portion of the trucking operation in the US. Several hundred medium size firms (trucking fleets that have anywhere between 50 to a couple of hundred trucks) also participate in the program. Thousands of owner-operators – that is a more challenging aspect of the market for program to tap into. Some owner-operators, single truck owners or owners who have a few trucks also participate but this is a more challenging market segment to engage. They represent a major proportion of the total freight hauled in the US and is the last part of the market that is currently being targeted by SmartWay program.</p> <p>2. The five projects selected under the SuperTruck II program are led by Cummins Inc., Daimler Trucks North America, Navistar Inc., and Volvo Technology of America Inc. and Paccar Inc. Together, these companies accounted for 100% of the market for Class 8 trucks in the US in 2017. SuperTruck teams also included other industry partners, such as suppliers, fleet owners, universities, and DOE laboratories.</p> <p>4. Vehicle manufacturers must meet fuel economy and GHG emissions standards for vehicles sold in the United States</p>
<p>Implementation</p>	<p>1. The SmartWay team was initially on a steep learning curve with implementing the program, assessing and dealing with the market needs and challenges. The latter have varied depending on what was going on in the market. For instance, when the program was initially created, the challenge was creating awareness and visibility around the program. Market trends, relatively low fuel prices, and economic recession have created other challenges as the business case for trucking companies to participate was not that strong. As SmartWay team learned how the industry functioned, they adapted the program to expand and include other parts of industry. Comprehensive supply chain analysis was key in making this happen. One of the challenges that remains is engaging owner-operators in</p>

	<p>the program. Many owner-operators are hired directly by logistics companies or freight brokers and they don't have strong market leverage with the owner-operators. The market mechanism to bring them into the program is not that powerful. There are also cultural differences. Owner-operators tend to be more independent, conservative and often resistant to working with the government. There is also a perception that the benefits from participating in the program are not significant. Work is underway to create new incentives and benefits for owner operators, adjust the reporting methodology and create a more streamlined way for this market segment to participate and benefit from the program.</p>
Policy Preference	
Policy Interaction	
Selection of Timeline(s)	
Partnerships	<p>1. US EPA and Natural Resources Canada (NRCan) jointly administer the SmartWay program since 2012.</p>

Enforcement and Compliance

Enforcement/ Compliance Measures	<p>1. The SmartWay partners are self-certifying their data submissions to the EPA when they submit the data on an annual basis. Under the partnership agreement, they agree to truthfully report accurate data. This is the first step in ensuring that companies self-certify correctly accurate data. Other measures are built into the program, such as flags in reporting tools, which will be triggered if data values are put in the tools which are out of what has been determined to be a normal range. If a company has exceptionally high or low values, these flags will be triggered and then the company will have to explain as part of data reporting process why that is such an unusual value. The third part of the process is the involvement of partner account managers who review and validate the data that the partners submit. Each submittal is reviewed closely by a manager to make sure that there are no any odd or unusual values and that the reporting fits within normal industry ranges, or that they are not duplicating or submitting the same data as in prior years. This extra step goes on before data is ultimately approved and updated to the database. Partner account managers will routinely call back a company to talk through any questions or issues with the data to make sure that it is as legitimate as it should be. Third party audits are not required; however, the partnership agreement allow for audits to be conducted if requested by the EPA.</p> <p>5. The Renewable Identification Number (RIN) system is used to track compliance with the RFS requirements. Renewable Identification Numbers (RIN) are assigned to each gallon of qualifying renewable fuel that is produced or imported in the US. Obligated parties must demonstrate compliance with the standard annually by</p>
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	purchasing the renewable fuel with the RIN or by obtaining credits on the RIN market.
Responsible Party(ies)	1. US EPA is responsible for the administration of SmartWay program. 5. US EPA is responsible for executing and monitoring compliance with the RFS program.
Non-compliance	1. Failure to submit data or provide inaccurate data can lead to participation in the program being terminated. 5. Failure to comply with the RFS program leads to a fine of up to \$32,500 per day, plus the amount of economic benefits associated with the violation.
Incentives for Participation	1. SmartWay program has an incentive and rewards system. SmartWay members can gain access to events that enable them to showcase achievements and share best practices. The program has developed a recognizable SmartWay logo that participating companies can use in their communication materials. Excellence Awards are conducted recognize top performing partners.

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United Kingdom

General Overview

Country	United Kingdom
Policy Suite	The Road to Zero
Policy Type(s)	<ol style="list-style-type: none"> 1. Measures for improving the fuel consumption of vehicles; Operational practices 2. Research and development; Clean technologies 3. GHG emissions standards 4. Alternative fuels and technologies 5. Traffic demand management 6. Regulation 7. Fiscal policies
Policy Suite Description	<p>The Road to Zero involves complementary measures including:</p> <ol style="list-style-type: none"> 1. Voluntary industry-supported commitment to reduce HDV GHG emissions by 15% by 2025 (from 2015 levels). HDVs comprise trucks, buses and coaches. HDVs are defined as freight vehicles of more than 3.5 tonnes (trucks) or passenger transport vehicles of more than 8 seats (buses and coaches). 2. Various RD&D programs. Including, a joint research project with Highways England to identify and assess zero emission technologies for HDVs. The focus for the research is on large, long-haul HDVs, operating on the strategic road network. The research aims to evaluate the costs, benefits, and opportunities for each technology, ultimately resulting in demonstration trials. UK is also undertaking a longer semi-trailer trial. 3. Develop an ultra low emission standard for trucks (ULET standard). 4. Emissions testing for natural gas HDVs to inform government policy (including duty rates for alternative fuels) on the use of natural gas as a near-term, lower emission fuel. 5. DfT, working with Highways England, to understand and respond to freight needs in reducing congestion and travelling efficiently through funding road and network improvements. The government developed a national framework to provide a consistent approach to Clean Air Zones for local authorities. The framework includes measures to reduce emissions from HDVs in Clean Air Zones. It also looks at upgrading Transport Refrigeration Units (TRUs) to the least polluting options. 6. Allow up to one extra tonne for certain vehicle categories using certain alternative fuels.

	<p>7. HDV levy 10% rebate for trucks that meet the latest Euro VI emissions standards and a 20% increase for those that do not meet the standard. Note: this policy is included here for comprehensiveness, but as it is related to CACs will not be included in the rest of the case study.</p>
Policy Funding	<p>1. DfT funds (£43,500) the Energy Saving Trust to develop a freight knowledge portal for HDV operators to provide access to independent, reliable information on cost-effective measures for short-term fuel and operational efficiency improvements.</p> <p>2. and 4. UK's Office for Low Emission Vehicles (OLEV) and Innovate UK provided £20 million in grant funding through the Low Emissions Freight and Logistics Trial (LEFT), which funded 20 projects and leveraged another £12 million in private investment. LEFT supports industry-led trials for commercial fleets using electricity, hydrogen, and gas. It also supports emissions testing for natural gas HDVs.</p> <p>2. The Integrated Delivery Programme 14 (IDP14) provides £18.1 million through OLEV and Innovate UK via the Faraday Battery Challenge (part of the Industrial Strategy Challenge Fund), for projects focused on innovative low emission HDV technologies.</p> <p>2. Zero emission research project and dynamic charging is a research project for various zero emission HDV technologies, including dynamic charging (vehicles receive electricity as they travel). (Note, no further details were found for this activity).</p> <p>2. Plug-in van grant has been extended to include HDVs (over 3.5 tonnes). Grant provides up to £20,000 for the first 200 HDVs to apply.</p> <p>2. Department for Transport's Future Fuels for Flight and Freight Competition (the F4C) provides £22 million (from the National Productivity Investment Fund) to projects for the production of low carbon waste-based fuels.</p> <p>5. Road Investment Strategy funds (£15billion over period 2015-2020) strategic road network improvements to reduce congestion. Considering creating a Major Road Network to improve the busiest and most economically important roads.</p>
Timeline(s)	<p>1. Voluntary target to reduce HDV GHG emissions by 15% by 2025 (from 2015 levels) with an interim target of 5% by 2020.</p> <p>2. LEFT trials started in 2017, with all participants launched by mid 2018. It is a 12 month trial program, ending in mid 2019, with a final project report and workshop planned for early 2020.</p> <p>2. This is the 14th round of IDP funding, successful bidders were announced in July 2018.</p>

	<p>2. The plug-in van grant was extended to HDVs in October 2016. The grant will be available until October 2018.</p> <p>2. The F4C competition was launched in April 2017. The first stage winners were announced in June 2018.</p> <p>2. Longer semi-trailer trial began in 2012 with 1,800 vehicles, increased to 2,800 vehicles in 2017/2018 and runs to 2027.</p> <p>3. DfT working through 2018 to develop an ultra-low emission truck (ULET) standard. The scope may include emissions from TRUs in the ULET standard.</p> <p>4. Results from LEFT funded tests on natural gas HDVs will inform the government's review of duty rates for alternative fuels for Budget 2018.</p> <p>5. Road investment strategy is 2015 to 2020.</p> <p>6. Extra weight policy enacted in March 2018.</p>
Government Leads	<p>Department for Transport works with a variety of agencies and organizations, such as Highways England, Innovate UK, Energy Saving Trust, Low Carbon Vehicle Partnership, and the Society of Motor Manufacturers and Traders (SMMT).</p>
Private Sector Involvement	<p>1. The industry-wide voluntary target is supported by industry organizations, including the major trade bodies, the Freight Transport Association (FTA) and Road Haulage Association (RHA). To support this, the FTA has launched the Logistics Emissions Reduction Scheme (LERS) to help companies meet and track their performance against the target. The RHA supports the DfT and Energy Saving Trust through developing and promoting good practice advice for HDV operators.</p> <p>2. Outputs of the DfT/Highways England study on zero emission technologies will be used to work with industry to accelerate RD&D in this area as part of the Industrial Strategy Future of Mobility Grand Challenge.</p> <p>2. TRL, a private consulting firm, is carrying out data collection and analysis on the LEFT program.</p> <p>2. All successful projects in the IDP14 competition were required to have a collaboration with at least 2 industry partners.</p> <p>2. Risk Solutions, an independent third party, is conducting the evaluation of the longer semi-trailer trial.</p> <p>3. DfT working with industry to develop ULET standard. The standard is meant to promote increased R&D and testing of technologies, as well as facilitating possible future incentives for cleaner or alternatively fuelled HDVs.</p>

	4. Private industry is involved in emissions testing for natural gas HDVs under the LEFT program funding.
Key Policies	The key UK policy within the Road to Zero is the voluntary commitment from UK industry. The other policy that the UK considers to be key in reducing emissions from the truck freight sector is the upcoming EU CO ₂ regulation.
Incentives for Innovation	2. All of the funding for RD&D could be considered to incent innovation. 3. Development of ULET standard is designed to incent innovation, as it is expected to promote further R&D, and uptake of clean technologies or alternative fuels.
Best Practices and Lessons Learned	No key lessons learned to date. But the UK has taken an evidence-based approach to the policy development and believe their ambition is stretching, but achievable.

Policy Objective and Impact

Environmental Goal	The long-term goal for the government is to develop and deploy zero emission HDVs. 1. The voluntary, industry -supported commitment is to reduce HDV GHG emissions by 15% by 2025 (from 2015 levels). 2. There are no ceiling or floor limits, but the government asks for significant reductions, mostly measured on potential for technology to be commercialized or inward investment into UK.
Environmental Performance Measure	1. How this will be measured has not yet been identified. 2. Self-reporting data collection. Operators submit detailed journey logs with information such as start/end location, time, type of goods moved, and how much of the available truck space was used.
Environmental Benefits (Results)	1. No studies done to date. 2. 2016 Annual Report of the longer semi-trailer trial estimated between 15.1 and 17.8 million vehicle km saved, which would result in emissions reductions. Actual GHG emission reductions are not quantified at this time. An assessment of environmental impacts has been recommended for the next phase of work.
Environmental Results Data Sources	1. Industry will self report. The government will verify. 2. Risk Solutions, an independent third party, is conducting the evaluation of the longer semi-trailer trial. 2. TRL, a private consultancy, is conducting the evaluation of the LEFT program.
Other Goals	None identified.

Other Benefits (Results)	N/A
Other Results Data Sources	N/A

Comprehensiveness, Coverage, and Effectiveness

Regional/Sector Coverage	The suite of policies provides UK-wide coverage. Specific policies and strategies within the suite of policies focus on certain areas, such as a focus on the strategic road network or municipal clean air zones.
Goal Coverage	GHG emissions are covered by this suite of policies through measures related to fuel and operational efficiencies, as well as technologies, all specific to HDVs.
Target Audience Coverage	The policy suite covers a multitude of players, from operators and drivers, to OEMs and tech companies. The government works directly with the key freight industry stakeholders in developing and implementing a number of the policies.
Participation	<ol style="list-style-type: none"> 1. The two associations are the Freight Transport Association and the Road Haulage Association. 2. There were 20 projects selected for the LEFT program. 2. There were 23 projects selected for IDP14. 2. There were 7 projects selected for F4C. 6. No data yet on extra tonne usage.
Implementation	No major challenges to date.
Policy Preference	The UK government has been pushing for regulation at an EU level.
Policy Interaction	No policies within the Road to Zero were specifically designed to interact/complement each other.
Selection of Timeline(s)	
International Partnerships	No international partnerships identified.

Enforcement and Compliance

Enforcement/ Compliance Measures	
Responsible Party(ies)	6. Driver and Vehicle Standards Agency
Non-compliance	6. Subject to Civil penalties.

Incentives for Participation	Some Local Authorities run incentives scheme such as London to drive best practice (Fleet Operator Recognition Scheme).
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Germany

General Overview

Country	Germany
Policy Suite	No overarching policy strategy identified.
Policy Type(s)	<ol style="list-style-type: none"> 1. Fiscal policy; Alternative fuels and technologies 2. Fiscal policy; Traffic demand management; Regulation 3. Clean technologies; Research and development 4. Regulation 5. Fiscal policy 6. Measures for improving the fuel consumption of vehicles 7. Measures for improving the fuel consumption of vehicles
Policy Suite Description	<p>1. Funding program for freight vehicles that run on more efficient and low-carbon engines. Companies in the road haulage sector receive subsidies to purchase heavy commercial vehicles with energy efficient and low-CO2 drive technologies, including CNG, LNG, battery electric, and fuel cell vehicles. The vehicle must go beyond the level of current environmental standards and be at least 7.5t. This measure was developed under the Climate Action Programme 2020.</p> <p>2. Federal Truck Road Toll Act. A nationwide distance-based road toll for freight trucks was first introduced in 2005 on approximately 15,000 km of highways and federal roads. It was extended in July 2018 to include all federal roads in Germany, approximately 55,000 km of roads. The tolls initially applied to trucks over 12t, but this was reduced to include all trucks over 7.5t in October 2015. The toll is based on distance travelled, number of axles, and emissions class (e.g., Euro IV, V, VI standards). It should be noted that one of the drivers for the introduction of a heavy goods road toll was infrastructure cost recovery, as Germany became the main drive-through country since EU enlargement, increasing road wear and tear, and congestion. A toll ensured that foreign trucks also paid their fair share. Alleviating congestion and reducing emissions were secondary. The road toll undergoes regular reviews. Under the current review, there will be an exemption for electric vehicles. There is also an incentive for natural gas vehicles.</p> <p>3. ELISA (electrified, innovative heavy goods transport on autobahns). The eHighway concept is being tested in the state of Hesse in Germany to test electric drives in heavy commercial vehicles. With two additional test sites to come. It is being financed under the framework of the country's 2020 Climate Action Programme. The trial is designed and operated by Siemens, the Technical University of Darmstadt, and five haulage companies. It will cover a 10km stretch of road between Langen/Morfelden and Weiterstadt junctions and uses overhead contact line systems. The line will supply electricity for a hybrid truck equipped with an intelligent pantograph. The truck operates in hybrid mode without the</p>

lines and with electricity with the overhead lines, also charging while in motion. Scania trucks will be used in the trial.

The electrified roadways project started as two early R&D projects, which laid the foundation for three demonstration projects. There are currently three large demonstration projects, between Hamburg and Lübeck, between Frankfurt and Hesse, and near Stuttgart. In early 2019, all three will be fitted with catenary lines for hauliers to test in their every day business. Catenary systems should be viewed as a fast charging system for trucks. Trucks can charge in motion, which eliminates the barrier of stopping to charge, which would impact the bottom line.

4. A 5 year long longer goods vehicle trial resulted in the Federal Ministry of Transport and Digital Infrastructure amending regulations to allow longer goods vehicles (up to 25.25m) into regular operation on an approved network of roads. Note that under EU law, longer articulated vehicles can only operate on an experimental basis. As a result, the longer goods vehicles are currently approved for seven years, until December 31, 2022, and will continue to be studied.

5. Energy Tax Act – fiscal incentives for use of natural gas (to 2026) and LPG (to 2023).

6. The Mobility and Fuel Strategy is a research focused measure. Most R&D under this program is given to research institutions with the output being reports and papers. There is no on-road impact. It includes studies on:

- Zukunft Lkw (truck future) innovative initiative - studies for a technical assessment of goods vehicles for the use of natural gas and dual-fuel vehicles, plus a long-term look at electrification, hydrogen, power-to-gas/liquid, and bio potential
- Development of the LNG for heavy goods vehicles task force
- Pilot projects by the government for alternative fuels and drivechains
- Look into differentiating the tolls on a CO2 basis is possible as well – would have to occur after the EU methodology for measuring CO2 in commercial vehicles is completed. It would also require the EU directive on eurovignettes to be amended.
- Continue to study “mega trucks” in terms of energy and environmental impact

7. National Platform on Future of Mobility. This task force will develop proposals on how to reach the national target of emission reductions in the transport sector. Two thirds of GHG emissions in the transport sector are from passenger vehicles, so it is likely that much of the focus will be on passenger transport. The platform and working groups are currently being established, however the working group focused on meeting the GHG target (AG 1) has already begun its work and will be making its first suggestions to government at the end of 2018/early 2019.

Policy Funding	<p>1. The total funding is 30 million Euros over 3 years. Freight companies receive up to 40% of the additional investment costs (compared to a comparable diesel truck) or fixed rates for specific technologies. The fixed subsidies are as follows: CNG 8,000 €/vehicle; LNG 12,000 €/vehicle; electric drive up to 12t 12,000 €/vehicle; electric drive over 12t 40,000 €/vehicle. The maximum funding per company per calendar year is 500,000€. There is additional funding for RD&D projects (involving low carbon HDVs).</p> <p>2. The road toll finances transport infrastructure operation, maintenance, and expansion for roads, rail, and inland waterways. Capital cost to install was €2.2 billion, operating costs are €620 million. In addition, the Government committed to compensating hauliers because of the implementation of the toll in 2005. Hauliers are compensated in the following ways:</p> <ul style="list-style-type: none"> - motor vehicle tax for heavy goods vehicles was reduced in 2007 (totalling around 150 million € per year) - three financial assistance programs (total up to 450 million € per year) - financial assistance programme (known as the innovation programme) was put in place to incent the purchase of low-emission HDVs (this is referring to CACs) in 2007, and was suspended in 2014 - the de minimis aid programme was put in place in 2009 - the financial assistance programme for training and skills started in 2009 (the de minimis programme and training program return around 600 million € per year to road haulage companies) <p>3. Financed under the framework of the country's 2020 Climate Action Programme. The electric road between Hamburg and Lübeck is funded by the Environment Ministry with approximately 19 million Euros. The electric road near Stuttgart is funded with approximately 16.8 million Euros from the Environment Ministry. The ELISA project was funded by the Environment Ministry with approximately 14.6 million Euros. The 3 projects add up to about 50 million Euros support. Adding in the earlier trial projects and the overarching research, this adds to about 70 million Euros total.</p>
Timeline(s)	<p>1. Funding program started in June 2018.</p> <p>2. Initial toll in 2005. Expanded toll put into place in July 2018.</p> <p>3. Construction in Hesse began in March 2018 with the pilot set to start in 2019. The other two pilots will start by 2020.</p> <p>4. The field trial took place from January 1, 2012 to December 31, 2016, and the regulation for continued operation of longer goods vehicles was enacted in January 2017. It is in effect for seven years until December 31, 2022.</p>
Government Leads	<p>1. Federal Office for Goods Transport (German acronym is BAG) is the responsible granting authority.</p>

	<p>2. BAG</p> <p>3. Hessen Mobil led joint project funded by Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB).</p> <p>4. The federal states decide whether a route is suitable for use by longer goods vehicles.</p> <p>5. Ministry for Economic Affairs and Energy (BMWi)</p> <p>6. Ministry of Transport and Digital Infrastructure</p> <p>7. Ministry of Transport overall. For Working Group 1, it is the Ministry of Transport and Environment Ministry.</p>
Private Sector Involvement	<p>2. PPP. Collection of the tolls is a public-private enterprise. Consortium Toll Collect (Daimler Chrysler, Deutsche Telekom, and Cofiroute) operates the toll system.</p> <p>3. Siemens is planning and constructing the eHighway trial. Volkswagen Group Research is managing the project. Scania is providing the trucks. Participation from hauliers as well. It is interesting to note that before Scania's interest, OEMs were not interested in participating in this technology, as they have invested heavily in diesel technologies. Daimler has joined the research and will be testing a light electric truck.</p> <p>ELISA is managed by the Hessian State Authority for Road and Traffic Management Hessen Mobil. The research is being conducted by the Institute of Transport Planning and Traffic Engineering of the TU Darmstadt The field trial also involved ENTEGA and Siemens AG, as well as associated partners HEAG mobilo AG, Ludwig Meyer GmbH & Co. KG, Raiffeisen Waren-Zentrale Rhein-Main eG, forwarding Hans Adam Schanz GmbH & Co KG , Contargo AG, Hegro Eichler GmbH.</p> <p>Forwarding companies Fahrner Logistics and Huettemann Logistics will use the lines near Stuttgart in their every day business starting in 2020.</p> <p>In the pilot project near Stuttgart, the Ministry of Transport in Stuttgart is cooperating with the Südwestdeutsche Verkehrs-Aktiengesellschaft (SWEG), the Regierungspräsidium Karlsruhe, the district of Rastatt and the consortium research e-WayBW, the Fraunhofer Institute for Systems and Innovation Research Fraunhofer ISI (PTV Transport Consult GmbH, the FZI Research Center for Computer Science and the Fraunhofer Institute for Chemical Technology). In addition to these project partners, other project participants involved include Spedition Fahrner GmbH, Huettemann Logistics GmbH, Casimir Kast Verpackung and Display GmbH, and Mayr-Melnhof Gernsbach GmbH, Smurfit Kappa Baden Board GmbH, the Netze BW GmbH, and the Federal Highway Research Institute.</p>

	<p>6. Most R&D is given to research institutes to conduct. Also include stakeholder dialogues when considering what research to undertake.</p> <p>7. In addition to federal, state, and local governments, the commission includes businesses, unions, and transport and environmental NGOs.</p>
Key Policies	None of the policies in place at the moment would be considered to be key policies in terms of helping to achieve established GHG reduction targets.
Incentives for Innovation	
Best Practices and Lessons Learned	<p>In general, more comprehensive measures should be considered. For instance, the politically popular choice is to lower prices for users to effect change, however, these types of measures don't take into account rebound effect. For example, rail users pay fees to use the rail infrastructure. This fee is halved for cargo trains to try to incentive a switch from road to rail. Though this may help, it would be more beneficial/impactful to also include increased costs to the road users, such as through a higher diesel tax. To see substantial impact, the bigger picture needs to be taken into consideration and more comprehensive measures put in place.</p> <p>2. Proposing road pricing on the grounds of improving fairness (e.g., having foreign trucks contribute to road maintenance costs), rather than marketing it as a way to improve efficiency or reduce emissions, may have made the toll more palatable to those impacted. The emphasis on enforcement and keeping it simple (e.g., only on autobahns to start) also helped a successful implementation with phasing in changes over time, such as more roads and smaller vehicles. An unrealistic schedule and lack of experience in the German transport ministry (particularly with respect to project management needs for PPPs) caused problems. The contract also left the government vulnerable to extra costs and did not minimize risk through charging penalties.</p>

Policy Objective and Impact

Environmental Goal	Not related to any one specific policy, but in October 2014, EU heads of state set a 30% reduction target below 2005 levels by 2030 for emissions not included in the EU Emissions Trading System. This includes transport emissions. The reduction target for Germany for the non-ETS sectors is 39% (40-42% for the transport sector), resulting in a need to decrease transport emissions by 97 Mt CO ₂ e by 2030.
Environmental Performance Measure	Ministry of Environment and Ministry of Economics is monitoring results of measures implemented under Climate Action Programme 2020.
Environmental Benefits (Results)	3. An eHighway is said to cut energy consumption in half and reduce local air pollution.

	4. Longer goods vehicles reduce the number of truck trips overall. The final report of the field trial states that on average 2 trips of longer goods vehicles replace 3 trips by conventional trucks. Resulting in efficiency gains and fuel savings of 15 to 25%.
Environmental Results Data Sources	3. eHighways are currently under construction. No results to date. 4. The Federal Highway Research Institute (BASt) carried out the study on the field trial.
Other Goals	2. Revenue generation. Congestion relief. Air pollutant emission reductions. Modal shift.
Other Benefits (Results)	2. HDV trips are increasing overall. Despite the tolls for HDVs, traffic volume growth has outpaced economic growth since the tolls went into effect in 2005. With the increase in tolls in 2018, it is expected that the increased costs for the transport and logistics industry will just be passed along to the consumer, as carriers will increase freight rates, but it will not reduce road freight traffic. The German Federal Environmental Agency (UBA) believes that the toll system needs to be entirely reformed to a polluter pays principle to reveal the true cost of road haulage. For example, include vehicles below 7.5t, include CO2 emission levels in the toll system, or stagger the tolls according to efficiency criteria. This type of reform may result in a decrease of roads competitive advantage over rail, resulting in modal shift and decreased road freight traffic. After the toll was first introduced, there was a reduction in empty return trips. Air emissions have been reduced, as trucks are being replaced that meet higher standards. Modal shift did not occur at the beginning, possibly hindered by rail capacity limitations. 4. If road freight becomes less expensive with the use of longer goods vehicles, there could be a modal shift from rail to road, which would result in increased emissions.
Other Results Data Sources	

Comprehensiveness, Coverage, and Effectiveness

Regional/Sector Coverage	1. German registered heavy goods vehicles of minimum 7.5t. 2. Tolls apply to HDVs over 7.5t. 3. Trial over one 10 km stretch of autobahn near Frankfurt.
Goal Coverage	
Target Audience Coverage	1. Private fleet owners/operators. 2. All operators travelling German roadways.

Participation	2. Mandatory tolls. System compliance was 99% in 2006.
Implementation	2. The “Toll Collect Disaster” – The launch of the toll collect system was delayed for nearly 2 years due to a legal challenge from another consortium and due to technical difficulties in the development of the process. Toll Collect was accused of delaying the launch because of technical issues with value added functions, not regarding the core functionality. This resulted in their contract being cancelled and renegotiated. The delay cost the German government more than €3 billion (it is attempting to recover this through legal arbitration).
Policy Preference	
Policy Interaction	The government tries to take a holistic, long-term perspective when developing and establishing policies and measures.
Selection of Timeline(s)	
Partnerships	3. Sweden and Germany are working together on the electrified highways demonstrations. In addition, Germany is starting to collaborate with France, and will likely be collaborating on transport related measures with Italy and Denmark as well.

Enforcement and Compliance

Enforcement/ Compliance Measures	2. German distance-based toll system combines the use of onboard GPS with satellite and mobile communications technology. Payment is monitored by stationary automatic enforcement gantries. In addition, Federal Office for Goods Transport has mobile enforcement vehicles and portable enforcement gantries. Roadside stationary checks are conducted on approximately every 10 th journey.
Responsible Party(ies)	2. Federal Office for Goods Transport (BAG)
Non-compliance	2. Penalty charge or fine is administered to users who pay no toll or the incorrect toll. The fines seem to be in the range of 40 € to 250 € (details unknown as the information is in German only).
Incentives for Participation	

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Sweden

General Overview

Country	Sweden
Policy Suite	No overarching policy strategy identified for all measures implemented until 2018. However, the Freight Transport Strategy has just been launched in June 2018 and will be the overarching strategy moving forward.
Policy Type(s)	<ol style="list-style-type: none"> 1. Clean technologies; Research and development 2. Clean technologies; Research and development 3. Regulation 4. Research and development; Clean technologies 5. Measures for improving the fuel consumption of vehicles; Alternative fuels and technologies; Clean technologies; Research and development 6. Measures for improving the fuel consumption of vehicles; Alternative fuels and technologies 7. Alternative fuels and technologies 8. Measures for improving the fuel consumption of vehicles; Alternative fuels and technologies
Policy Suite Description	<p>1. Partnership for Innovation. Including a joint study of eHighways and electrification of roads carried out by the German and Swedish governments. Siemens overhead catenary system for trucks will be tested on a 2km stretch of highway north of Stockholm over 2 years. The trial is using two Scania diesel hybrid vehicles.</p> <p>2. eRoadArlanda trial. Electrified road trial using conductive feeds from a rail in the road that transfers energy to a moveable arm on the vehicle. The rail recharges vehicle batteries while the vehicle is in motion. The trial vehicle is an 18 ton goods truck. The road can bill the driver for the electricity pulled from the rail.</p> <p>The two electric road trials (catenary and rail) will lead to further stretches of electric roads. The government is currently looking at further links of interest and public procurement.</p> <p>3. Increased maximum lengths and weights of heavy duty vehicles. Sweden has carried out several regulation amendments to increase the maximum vehicle dimensions allowed, increasing the weight in 1974, 1990, 1993, 2015, and 2018 (to 74t) and the length in 1996 (to 25.25m).</p> <p>4. CLOSER is a platform for collaboration, knowledge, and innovation between businesses, industry, academics, cities, regions, and government agencies. CLOSER works toward increased transport efficiency from the R&D stage to demonstration projects. There are six focus areas – urban mobility, high capacity transport, digitized and connected logistics, energy supply and logistics, multimodal solutions, and horizontal cooperation.</p>

	<p>5. Freight Transport Strategy was launched in June 2018, adopted by the Cabinet of Ministers. The strategy is the first of its kind in Sweden. This strategy covers all modes and elements related to freight transport, with a focus on renewables, research and innovation, biofuels, and energy-efficient vehicles. It currently involves approximately 100 activities, including horizontal collaboration and better planning tools. It is intended to be a platform for cooperation and was developed in dialogue with stakeholders in the freight and logistics sectors. The success of the strategy depends on continued collaboration and shared responsibility. The idea is that to meet the challenges of future freight transport, all modes of transport must be developed in a single transport system, rather than separately and linked afterwards.</p> <p>6. Strategic plan for how the transport sector will become fossil free (SOFT) was developed in 2017 by the Swedish Energy Agency with the involvement of the Transport Administration and 4 other authorities. It pinpoints all of the different elements related to energy, including the goal of an independent transport sector. The focus is on fuels and efficiency and on the path to a fossil free transport sector. The plan contains basic principles for the conversion of the transport sector, as well as proposed instruments and actions, and commitments that the six authorities will implement.</p> <p>7. Biofuel law, effective July 1, 2018. Reduction of fossil fuel content in all transport fuels. Minimum level of blending for diesel starts at 19.3% in 2018. This will be increased every year, with 20% in 2019, and 21% in 2020. The ambition is to get to 50% by 2030. As part of this emissions reduction obligation system, high-blended and pure biofuels will be eligible for complete energy and CO₂ tax exemptions.</p> <p>8. KNEG is a network of Swedish companies that jointly work with reducing their emissions. Their focus is on more efficient transport, more efficient vehicles, and increased use of renewable fuels. The cooperation was launched at the end of 2006 and currently has 12 members. The cooperation carries out studies and projects in order to learn from each other and contribute to reducing emissions in the transport sector. This is a privately run organization, but the Swedish Transport Administration is a sponsor of the network. The description is included here only for interest. No further details are presented in the case study.</p>
Policy Funding	<p>1. The eHighway near Gavle is funded in part by the Swedish Government (approximately \$88 million) and the private sector and Gavleborg regional authority (combined approximately \$50 million).</p> <p>4. CLOSER received base funding from the Transport Administration and further funding from an innovation fund.</p>

	7. The overall budget for the scheme is approximately 8.5 billion SEK (or 3.4 billion SEK annually).
Timeline(s)	<p>1. The first eHighway system opened in June 2016.</p> <p>2. eRoadArlanda rail installed in October 2017. The 2km stretch of road opened in April 2018.</p> <p>3. The latest amendment to the regulation allowing for heavier vehicles was put in place in 2018. The last amendment for increased length was put in place in 1996.</p> <p>5. Freight Transport Strategy launched in June 2018.</p> <p>6. The strategic plan was launched in 2017 and the implementation of the plan will take place until at least 2019.</p> <p>7. Emissions reduction obligation system (biofuel law) effective July 1, 2018. It will remain in force until December 31, 2020.</p>
Government Leads	<p>1. and 2. Swedish Transport Administration</p> <p>3. Government of Sweden, Cabinet of Ministers. This regulation is lead by the Government because EU approval was required.</p> <p>4. Swedish Transport Administration</p> <p>5. Swedish Government</p> <p>6. Swedish Energy Agency, with the Boverket, Swedish Environmental Protection Agency, Transport Analysis, Swedish Transport Administration, and the Transport Agency.</p>
Private Sector Involvement	<p>1. Siemens and Scania</p> <p>2. eRoadArlanda is being managed by a consortium comprising the following members: Elways, NCC, PostNord, ABT-bolagen, Vattenfall, DAF, KTH, Kilenkrysset, VTI, E-traction, GCT, KTH, Bilprovningen, Airport City Stockholm, Sigtuna Municipality, Swedavia, Arlanda Stad Holding, TraningPartner, FirstHotel, Frost Produktion, SMM Dulevo and Sandströms Elfirma.</p> <p>4. In addition to national, regional, and local governments, CLOSER partners include Coop, DHL, Koucky & Partners, Ramboll Sverige AB, Scania, Schenker, Skanska, SSPA, Sweco, Toyota Material Handling, Tyrens, Volvo, WSP, Chalmers, IVL Swedish Environmental Research Institute, Jönköping University, KTH Royal Institute of Technology, Linköping University, Lulea University of Technology, Lunds Tekniska Universitet, RISE, University of Boras, University of Gothenburg, VTI, and Orebro University.</p>

	5. In addition to state authorities, municipalities and county councils, the National Freight Transport Council involves industry, associations, research institutes, universities and colleges, and others.
Key Policies	The key policy moving forward for Sweden will be the Freight Transport Strategy. This is the first time Sweden has developed this type of strategy that brings together all of the different aspects and stakeholders of freight transport. The various aspects of freight transport are handled by many different departments. The motivation behind the Freight Strategy is to bring all of the activities together into one comprehensive approach.
Incentives for Innovation	The three pillars of the Freight Transport Strategy are: <ol style="list-style-type: none"> 1. Competitiveness 2. Environment (fossil free) 3. Innovation One of the key incentives and the main innovation program will be the Triple F (Fossil Free Freight) program, which was just approved for 290 million SEK over 12 years. This will be topped up with funding from other agencies. It will cover the entire freight sector.
Best Practices and Lessons Learned	One of the guiding principles in all policy development in Sweden is to make small adaptations. For instance, redoing or building new infrastructure to deal with congestion, etc. is not a priority. Instead, small adaptations are made to address the issues on hand, such as investing in and deploying new technologies, changing licensing systems, etc. Major conventional infrastructure projects are not considered to be best practice.

Policy Objective and Impact

Environmental Goal	As stated in the Climate Act, which went into force January 1, 2018, the overarching goal of the Government is to reduce GHG emissions to zero net emissions by 2045 and to achieve a fossil fuel independent transport sector by 2030. (By 2030, emissions from domestic transport, excluding aviation, will be reduced by at least 70% compared to 2010 levels). All strategies/policies come from the overall policy goal of zero net emissions by 2045. They each support moving towards that goal in different ways. For example, the annual biofuel target will increase the share of biofuel blending and reduce emissions at the tailpipe over time. Increased payload is known to reduce average GHGs/tonne.km.
Environmental Performance Measure	The overall goal is not being measured/monitored. Different policies are lead by different departments, so there is no one authority responsible for overall monitoring. The closest to this would be the Transport Analysis Authority that performs an annual review of the transport sector with respect to reviewing, analysing, and evaluating proposed and implemented policy measures.

	<p>5. For the success of the Freight Transport Strategy, it will need to be monitored and evaluated continuously.</p> <p>6. The strategic plan includes controls and indicators to monitor developments in the transport sector.</p> <p>7. The scheme is subject to regular monitoring. In addition, an evaluation plan was submitted as part of the scheme, including evaluation of direct impacts, indirect effects, and the appropriateness of the chosen policy instrument. Direct impacts include whether the tax reduction affects the volumes used and sold. It also will reevaluate whether the scheme contributes to the long term goal of a fossil fuel free transport sector.</p>
Environmental Benefits (Results)	<p>3. Two longer heavier vehicles replace three conventional vehicles. Resulting in reduced total fuel consumption and reduced emissions per t.km. A number of studies have been conducted on the potential GHG emission reductions for individual transports and overall on the sector. It has been shown that emissions reductions from individual companies can be significant. That is individual longer heavier trucks are more fuel efficient on a tonne-km basis (different studies have varying results, but trials in Sweden show a 16% to 20% reduction). The overall emission savings on the transport sector is less clear and depends on whether the vehicles are restricted to certain regions or roadways, and assumptions related to modal shift and induced demand.</p>
Environmental Results Data Sources	<p>3. Independent (academic) studies on the impacts of longer heavier vehicles.</p> <p>5. The government has given Transport Analysis the mission to continuously monitor and evaluate the strategy.</p> <p>7. The evaluation will be performed by the Swedish Energy Agency (independent of the Swedish Government).</p>
Other Goals	
Other Benefits (Results)	<p>3. There is lack of reliable data to determine if a reverse mode shift from rail to road freight typically occurs as a result of improved efficiencies and cheaper goods transport by longer heavier vehicles. It should be noted however that currently in Sweden, there is no spare capacity for additional rail freight (i.e., it could not accommodate potential demand). Therefore, modal shift effects if they occur are likely to capture the excess demand, not take away from the current rail freight.</p>
Other Results Data Sources	<p>3. Independent (academic) studies on the impacts of longer heavier vehicles.</p>

Comprehensiveness, Coverage, and Effectiveness

Regional/Sector Coverage	<p>1. and 2. The electrified road trials only cover a few kilometres of roadway for the operation of a few prototype heavy duty vehicles. An ultimate roll out of electrified roadways would target the main transport arteries across the country.</p>
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	<p>3. Longer heavier vehicles are generally accepted to be better suited for long distance transport.</p> <p>5. All of Sweden, all modes, all aspects of freight transport are covered by the Freight Transport Policy.</p> <p>6. Freight transport sector is included in the strategic plan.</p> <p>7. Biofuels produced in and imported to Sweden.</p>
Goal Coverage	<p>1. and 2. The GHG coverage depends on the source of electricity supplying the electrified rails and lines. Renewable electricity would result in zero emissions, however, other forms of electricity generation, such as natural gas would result in decreased emissions.</p> <p>5. Full coverage with a focus on fuels and efficient vehicles.</p>
Target Audience Coverage	<p>1. and 2. OEMs and fleet owners/operators</p> <p>3. Fleet owners/operators</p> <p>5. All stakeholders in the freight and logistics sectors.</p> <p>7. Tax exemptions claimed by fuel suppliers (not the producers).</p>
Participation	<p>1. and 2. These are in a demonstration phase.</p> <p>3. From a 2011 study, longer heavier vehicles carry almost 10 times as many goods as conventional trucks in tonne-km terms in Sweden and approximately 2.5 times as many goods in terms of tonnage.</p>
Implementation	
Policy Preference	<p>A mix of policies is used, including special government assignments, where different departments (e.g., Transport Administration) are assigned to study a specific topic and report back.</p> <p>Regarding the new Freight Transport Strategy, a National Freight Transport Council with industry, associations, research institutes, academics, and state, regional and local representatives, was established in order to ensure that the strategy and implemented measures, regardless of type, remain relevant to the industry.</p>
Policy Interaction	
Selection of Timeline(s)	
Partnerships	<p>1. Partnership for Innovation involves the German and Swedish governments.</p>

	3. Amendment to Sweden’s length and weight vehicle regulation requires a special provision in/exemption from the EU directive (96/53/EC, now (EU) 2015/719) governing the same.
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Enforcement and Compliance

Enforcement/ Compliance Measures	3. On-road spot checks. Future goal is to do more technology-based enforcement.
Responsible Party(ies)	3. Swedish Transport Authority and Police. 7. Swedish Energy Agency.
Non-compliance	7. Failure to fulfill the blending mandates will result in a fee, not to exceed 7 SEK per kg CO ₂ e that remain to be met.
Incentives for Participation	

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China

General Overview

Country	China
Name	No overarching policy strategy identified.
Policy Type(s)	<ol style="list-style-type: none"> 1. Measures for improving the fuel consumption of vehicles 2. Green freight program 3. Emissions (fuel consumption) standards 4. Alternative fuels and technologies
Policy Suite Description	<p>1. 13th Five-Year Plan for Economic and Social Development of the People's Republic of China (2016-2020) (13th FYP):</p> <p>The Five-Year Plan is a national strategy set by the country's top leaders to guide China's social, political, and economic development. The 13th FYP marks the first time in the history of Five-Year Plans that Low Carbon Transport has been specifically mentioned as a target area. The main transportation tasks within the 13th Five-Year Plan period are to promote low carbon and intelligent development in the sector and to further improve modern comprehensive transportation systems. The strategy is focussing on the following core tasks:</p> <ul style="list-style-type: none"> • Green and Low Carbon Transportation • Interconnected and Multimodal Transportation • Smart Transportation • International Transportation Networks <p>2. China Green Freight Initiative (CGFI):</p> <p>The China Green Freight Initiative (CGFI) is a national voluntary program to improve energy efficiency and reduce emissions from road freight, improve and upgrade trucks, and promote broader sustainable development of the road freight sector. The program has three components: green management, green technology and green driving.</p> <ul style="list-style-type: none"> • Green management: aims to improve the fleets and management (e.g., better loading practices, drop-and-hook practices using articulated vehicles). • Green technologies: promotes the adoption of green technologies for trucks through green truck standards and a catalogue of green technologies and energy-saving products. • Green driving: plans to establish eco-driving driver-training programs and guidebooks. <p>CGFI is developing two standards: the Green Freight Enterprise Standard and the Green Freight Vehicle Standard. In 2013, twenty Chinese enterprises were selected to pilot these standards. The next priorities for CGFI include: providing policy support and services for freight enterprises; promoting and implementing the</p>

	<p>standards; accelerating industry-government alliance; establishing a data collection and assessment method; and starting pilot projects such as technology verification.</p> <p>3. Fuel consumption standard (National Standard GB 30510-2014): China's Ministry of Industry and Information Technology (MIIT) currently has primary authority for setting fuel consumption limits for motor vehicles. China is the third country, following Japan and the United States, to adopt fuel consumption standards for HDVs. The fuel consumption standard in China has been rolled out in 3 waves: National Standard (Phase 1, 2012-2015), National Standard (Phase II, 2014-2020) and National Standard (Phase III, from 2019). The fuel consumption standard applies to all HDVs and gasoline vehicles with a GVW (gross vehicle weight) greater than 3.5 metric tons. Trucks are regulated by total vehicle and payload weight (not by weight class). Phase I was intended to establish a benchmark against which to design the next phase of standards to ensure the development of more effective standards. It was used for data collection and a verification exercise to measure the efficiency and fuel consumption of trucks on the market.</p> <p>4. Alternative fuels: There is a natural gas favourable price difference (compared to diesel) in China. This along with the low cost of retrofitting vehicles and local and national government policies has resulted in the uptake of natural gas heavy duty vehicles. Note that the main driver for the policies is to improve air quality; however, use of natural gas over diesel also results in reduced GHG emissions. The number of natural gas fuelling stations has grown from 1000 in 2008 to 7950 in 2016. In 2014, 28500 natural gas trucks were produced in China. LNG vehicles stock grew from 7000 in 2010 to 132000 in 2015. CNG and LNG are promoted in the HDV sector to improve local air quality and for energy security reasons.</p>
Policy Funding	2. CGFI: Funded by Energy Foundation and partners co-finance events and activities.
Timeline(s)	<p>1. 13th FYP: The 13th FYP will serve as a central government guideline for sustainable and low carbon transport development and as a framework for the implementation bodies on different administrative levels in China from 2016 through to 2020.</p> <p>2. CGFI: At the start of the program in 2012, the CGFI guideline was issued that includes the concept of green freight, its goals and principles of the program and identified tasks with a 5-year roadmap.</p> <p>3. Fuel consumption standards: MIIT first announced its plan to develop fuel consumption standards for commercial heavy-duty vehicles (HDVs) in 2008. Known as the National Standard (Phase I), it was adopted by MIIT at the very end of 2011 and was implemented for new vehicle type approvals on July 1, 2012. The standard</p>

	was a precursor to the more comprehensive National Standard (Phase II), which was finalized in December 2013. It took effect July 1, 2014, for new type approvals and July 1, 2015, for all new vehicle sales and registrations. The proposed Stage III standard is expected to be introduced in 2019 for type approvals and 2021 for all new vehicle sales.
Government Leads	<ol style="list-style-type: none"> 1. 13th FYP: Central Committee of the Communist Party of China 2. CGFI: Ministry of Transport (MOT) 3. Fuel consumption standard: Ministry of Industry and Information Technology (MIIT)
Private Sector Involvement	2. CGFI: Managed by the China Road Transport Association (CRTA) (primary partner), and supported by the Research Institute of Highways (RIOH) and Clean Air Asia (CAA), which are involved in the development and function of the CGFI. It is a public-private partnership.
Key Policies	1. The 13 th FYP is the overarching framework in China that will be used by all ministries to inform and shape their policies and programs. The government is relying on the CGFI, in addition to regulatory initiatives like the fuel consumption regulations, to fulfill the overall low carbon transport goals of the 13 th FYP.
Incentives for Innovation	3. Mandatory standards designed uniquely for China drive technology development.
Best Practices and Lessons Learned	No matter what the policy, strong enforcement and compliance, including the legal basis to do so, is required to make it effective. To facilitate this, a good monitoring system needs to be put into place, including resources, data, etc.

Policy Objective and Impact

Environmental Goal	<p>The economy wide GHG reduction target is 40 – 45% from 2005 levels.</p> <ol style="list-style-type: none"> 1. 13th FYP: China`s submission of INDCs to the UNFCCC (2015) is pledging to achieve the peaking of CO₂ emissions around 2030 and the submission has targeted a low-carbon transportation system as key to achieving its goal. 2. CGFI: No targets set for individual companies. Members are encouraged to meet the CGFI standards. 3. Fuel consumption standard: The goal of the Phase III fuel consumption standard is to reduce fuel consumption by 15% below 2015 levels. Average or targeted efficiency improvements for Phase II were 11.5% for trucks compared to MY 2012. And for Phase III are 23.7% for trucks compared to MY 2012. 4. Alternative fuels: There is no explicit goal related to the use of alternative fuels in China.
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Environmental Performance Measure	<p>2. CGFI: There are plans to develop a methodology for calculating road freight emissions, which will build on existing international methodologies, frameworks and standards.</p> <p>3. Fuel consumption standard: Emission reduction results are modelled, not measured.</p>
Environmental Benefits (Results)	3. Fuel consumption standards: The fuel consumption standards were estimated to have reduced CO2 emissions by 2 Mt in 2015.
Environmental Results Data Sources	<p>Government agencies issue annual reports.</p> <p>Local government annual reports will often discuss results of demonstration level projects (e.g., green freight) within their region.</p>
Other Goals	None identified.
Other Benefits (Results)	N/A
Other Results Data Sources	N/A

Comprehensiveness, Coverage, and Effectiveness

Regional/Sector Coverage	<p>The suite of policies is intended to cover the entire country, as well as the entire HDV sector.</p> <p>There is no direct GHG regulation for the transport sector in China.</p>
Goal Coverage	3. Fuel consumption standard: The standard applies to all HDVs and gasoline vehicles with a GVW (gross vehicle weight) greater than 3.5 metric tons.
Target Audience Coverage	<p>2. CGFI: targets fleet owners.</p> <p>3. Fuel efficiency standards: target OEMs.</p>
Participation	<p>2. CGFI: As of May 2015, 20 carriers joined the program and participated in the pilot of the draft standards. Two shippers, Lenovo and Procter & Gamble, joined the program in 2014. MOT partners with MEE to give educational sessions, but there is no official tracking for the specifics of program participation.</p> <p>3. Fuel efficiency standards: Standards are mandatory. The government must educate the industry and does so by holding regular workshops to educate stakeholders on the implications of the standards. The government publishes annual compliance reports indicating which companies have met the standards and which have not.</p>
Implementation	2. CGFI: There have been a number of local pilot projects, but these never develop into large scale green freight programs/activities. For the most part, the CGFI

	remains at the pilot program scale. In addition, the current policies/incentives are not quite attractive enough for fleet owners/stakeholders to become involved. Policies in China are very dynamic, they change very quickly, and the incentives are not reflecting the changes.
Policy Preference	
Policy Interaction	<p>The policies tend to be more independent than connected since they are tackling separate areas. However, they are still working towards a common overall goal of reduced environmental impact of the HDV sector and under the overarching 13th FYP low-carbon transportation sector goals.</p> <p>There is an emerging trend in China for multiple policies to be designed to work together to serve one major goal. As a result, the past and current system of individual policies acting in silos may be changing soon.</p>
Selection of Timeline(s)	The policies were rolled out separately.
Partnerships	2. CGFI: Annual CGFI seminars are held to share best practices and experiences from other countries and to promote CGFI's program across other nations. CGFI has worked on cooperation projects under the China-US Climate Cooperation Working Group.

Enforcement and Compliance

Enforcement/ Compliance Measures	<p>3. Fuel efficiency standards: The enforcement is conducted at the prototype or pre-production vehicle model stage. MIIT reviews these vehicles to provide certification. The China Automotive Technology and Research Center (CATARC) was commissioned by MIIT to develop the fuel consumption test procedure which combines chassis dynamometer testing and simulation modelling.</p> <p>There is no enforcement/compliance at the in-use stage. Once the vehicle is in production and sold into market, MIIT has no way to track them for efficiency standards. MIIT has only 4-5 staff in charge of all motor vehicles in China. There is a severe lack of institutional capacity, technical capacity, technical tools, etc. to conduct in-use enforcement for efficiency standards.</p>
Responsible Party(ies)	MIIT
Non-compliance	<p>3. Fuel efficiency standards: In conducting the certification testing, MIIT can deny "type approval" for new models that don't meet the fuel consumption standards. They can also suspend production of certain existing high-fuel-consumption models until the recalculated corporate average fuel consumption complies, based on an adjusted production plan.</p>
Incentives for Participation	

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Brazil

General Overview

Country	Brazil
Name	No overarching policy strategy identified.
Policy Type(s)	<ol style="list-style-type: none"> 1. Green freight program 2. Operational practices 3. Alternative fuels and technologies
Policy Suite Description	<p>1. Green freight program (GFP): Brazil does not have an official GFP in place. They're still working on the program design and full details on what the program will include are not yet known. CNT (National Confederation of Transport), an industry consortium, has expressed interest in energy efficiency standards/programs. This institutional organization is uniquely positioned to be able to reach thousands of companies and nearly 2 million drivers. They have moved forward with a training program (with the idea that it will eventually be incorporated into a full GFP). Recently a memorandum of understanding (MOU) was signed between Natural Resources Canada, CNT, and the ICCT. The aim is to offer eco-driving training to 50,000 drivers. Additionally, the organization conducted a fuel efficiency survey on road freight to better assess the current situation of the sector. The immediate next step for the program is to start a pilot project on technology verification.</p> <p>2. Load-sharing program (National Logistics Plan): Working on a strategy around vehicle use reduction and increased rail transport. Brazil is looking into infrastructure to help transition more goods movement from road to rail, which is currently much smaller than the rail transportation sector in Canada or the U.S. The first phase of the logistics plan includes the work on three railroads (2 new and 1 upgrade). It is expected that contracts for these infrastructure projects will go on out for bid before the end of the year.</p> <p>3. Biofuel standards: Brazil's current standard (PROALCOOL) requires a 9% blend of biodiesel in diesel.</p>
Policy Funding	
Timeline(s)	<ol style="list-style-type: none"> 1. Green freight program: As mentioned above, the training portion of the program has moved ahead. The details of the official GFP still need to be determined, however it is expected that a full pilot program could run within the next 12 months. 2. Load-sharing program: For the national logistics plan (i.e. load sharing) they are working on phase 1 of the program through to 2025. The goal is to reduce bottlenecks and reduce road share from 60% down to 50% and increase rail usage from 18% to 31%.

	3. Biodiesel standards: Brazil will gradually require an increase in biodiesel blends: 8% in March of 2017, 9% in March of 2018, and 10% in March of 2019.
Government Leads	2. The load-sharing program is also being developed through the Ministry of Environment. 3. The biodiesel standards are regulated by the National Agency of Petroleum, Natural Gas and Biofuels (ANP), which is an agency of the Ministry of Mines and Energy (MME).
Private Sector Involvement	1. The green freight program is being developed through CNT, the industry consortium.
Key Policies	1. GFP and the proposed load-sharing program are the top policies Brazil is focussing on. 3. The biodiesel policy is a secondary policy.
Incentives for Innovation	1. Green freight program: A GFP will rely on the use of more energy efficient technologies. As a result, technology development and innovation has become a key driver and major component of Brazil's GFP.
Best Practices and Lessons Learned	To a large extent, government is implementing Brazil's HDV policies. Many of the regulating bodies lack the technical capacity to evaluate the effectiveness of current policies and determine where policies need to head in order to achieve Brazil's emission reduction targets. Government agencies need to be better equipped to negotiate with auto makers. Government needs to work with more public institutions to better understand public response to the regulation of the transportation sector in Brazil. They need to have a better understanding of what the public want to see regarding standards for the industry. A lot of policy discussions are happening behind closed doors. A more open and transparent policy process would help public agencies contribute and ensure that intended benefits are being compared to real-world implementation results. Data transparency is needed to inform policy and ensure that policies can be effectively evaluated. This will allow necessary policy changes to happen faster and with less implementation difficulties going forward.

Policy Objective and Impact

Environmental Goal	The overarching environmental goal for Brazil relates to the commitment they made as part of the Paris agreement. As noted, there is no specific goal related to the HDV sector.
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	<p>Brazil has committed to a reduction in GHG emissions 37% below 2005 levels by 2025 and 43% below 2005 levels by 2030.</p> <p>As part of this commitment there are no specific goals for the transportation sector, including the HDV sector.</p> <p>3. There are goals around the participation of biofuel usage (18% by 2030). This includes both biodiesel and ethanol.</p>
Environmental Performance Measure	<p>2. On the load sharing side, Brazil has a logistics research department (EPE) and they are responsible for doing origin and destination surveys to help track load sharing goals/targets.</p> <p>Most environmental performance measures are voluntary and reporting is not required for many of the other programs such as load-sharing and GFP.</p>
Environmental Benefits (Results)	
Environmental Results Data Sources	<p>Modeling data is often used outside of areas where specific data is being collected (e.g. Sao Paulo).</p> <p>Private agencies often collect data for use in their own studies and keep it for their own internal use.</p> <p>Data transparency and accessibility is an issue in the public domain.</p>
Other Goals	Currently there are no specific economic or social goals linked to the HDV policy.
Other Benefits (Results)	Not applicable.
Other Results Data Sources	Not applicable.

Comprehensiveness, Coverage, and Effectiveness

Regional/Sector Coverage	The suite of policies is intended to cover the entire country, as well as the entire HDV (trucks and buses) sector.
Goal Coverage	<p>In terms of Brazil's main GHG reduction target, 2 policies that will be key to achieving results are the GFP and the load-sharing program.</p> <p>1. The GFP is designed to make fleets more efficient and to keep unnecessary vehicles off the road. This will incur GHG savings.</p> <p>2. Likewise, the load-sharing program will keep vehicles off the road and rely on the use of rail for transportation needs.</p>

	Emissions and air quality standards are not designed to help with the overall GHG reduction target (except for black carbon management).
Target Audience Coverage	<p>1. GFP largely effect legacy fleets and large carriers (i.e. mostly private fleets). GFP will involve partnerships with technology providers to enable technology RD&D (research, development, and deployment).</p> <p>One of the largest sources of emissions are generated by very old fleets that are owned by small carriers or owners/operators. In theory they are covered by the GFP but, it is hard to reach out to those carriers and get them involved. Getting older fleets turned over is a challenge that currently exists.</p>
Participation	<p>1. The GFP has not officially begun.</p> <p>2. With the load-sharing/logistics program it is difficult to measure since it is market-driven and encouraging a transition from truck to rail transportation will likely require mandatory participation or strong incentives in order to be effective.</p>
Implementation	
Policy Preference	2. The government has been focussing on developing a strong load-sharing program to help reduce GHG emissions.
Policy Interaction	<p>Generally, any policy that encourages efficiency improvements should be developed with specific emissions standards in mind since they work to optimize engine operation and reduce emissions. It also allows for easier determination of emission reductions achievable through a policy.</p> <p>The policies tend to be more independent than connected since they are tackling separate areas. However, they are still working towards a common overall goal of reduced environmental impact of the HDV sector.</p>
Selection of Timeline(s)	<p>The policies were rolled out separately.</p> <p>On the HDV side for emissions standards most Brazilian areas are not meeting the WHO guidelines for air quality standards (particular Sao Paulo) so that is a strong motivation for progressing emissions standards for trucks/buses. Buses and trucks fall under the same regulations and they are working in Sao Paulo to limit CO₂ emissions in the city and therefore both vehicle types are facing the same pressures. Auto makers are trying to delay these timelines.</p>
Partnerships	<p>No formal partnerships exist.</p> <p>There are conversations between Brazil and other countries in Latin America to align GFPs.</p> <p>Global Green Freight action plan has a goal is to expand and align GFPs globally. The goal is to expand GFPs into other countries including Chile, Argentina, and Brazil, etc. That is a strong area of international collaboration at the moment.</p>

Enforcement and Compliance

Enforcement/ Compliance Measures	Overall it isn't always clear who is enforcing the policies.
Responsible Party(ies)	Ministry of Environment and the police.
Non-compliance	
Incentives for Participation	The complete GFP and load-sharing programs are still being developed and it is unknown if incentives will be included as part of the programs.

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