



# Freight Modal Shifting

## Quantifying the GHG Impacts of Shifting from Truck to Rail



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# Overview

- Introduction – what is modal shifting?
- Challenges
- Future of the protocol

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# What is Modal Shift?

- The transition from a higher to a lower greenhouse gas (GHG) intensive mode of transportation
  - Truck to rail
- Project emissions which include more transportation by rail are lower than baseline emissions which include more transportation by truck
- Mechanism is reduced use of diesel fuel





# Stage of Development

- Approved Alberta Protocol
  - Credit generation potential relies on distance – distances in Alberta are small
    - Requires many shipments to overcome project administration costs
- Draft federal protocol
  - Protocol included in the ‘Turning the Corner’ fast-track process
  - Applicable to shipments or portions of shipments taking place in Canada
  - Improve usability through consultation with potential users





# Overall Challenge

- We want to reward people who choose lower emission rail, however ...
- We also need to ensure that real reductions are occurring relative to what would have occurred anyways
  - Convincing people of this, in writing and according to the ISO standard, is the tough part – difficult to build something that is both flexible and specific enough to get approved by government





# Specific Challenges

- Defining a project proponent
- Selecting a baseline
- Developing a quantification methodology
- Deriving emission factors





# Project Proponent

- Possible proponents
  - Shippers vs. Receivers
  - Good producers
  - Good aggregators
  - Warehouses
  - Third party logistics companies
- Considerations
  - How much does shipping change annually?
    - Proponent should have relatively fixed shipping habits
  - What is the degree of heterogeneity of shipped/received goods?
  - Who owns the shipping decision?





# Shipping Products vs. Receiving Shipments

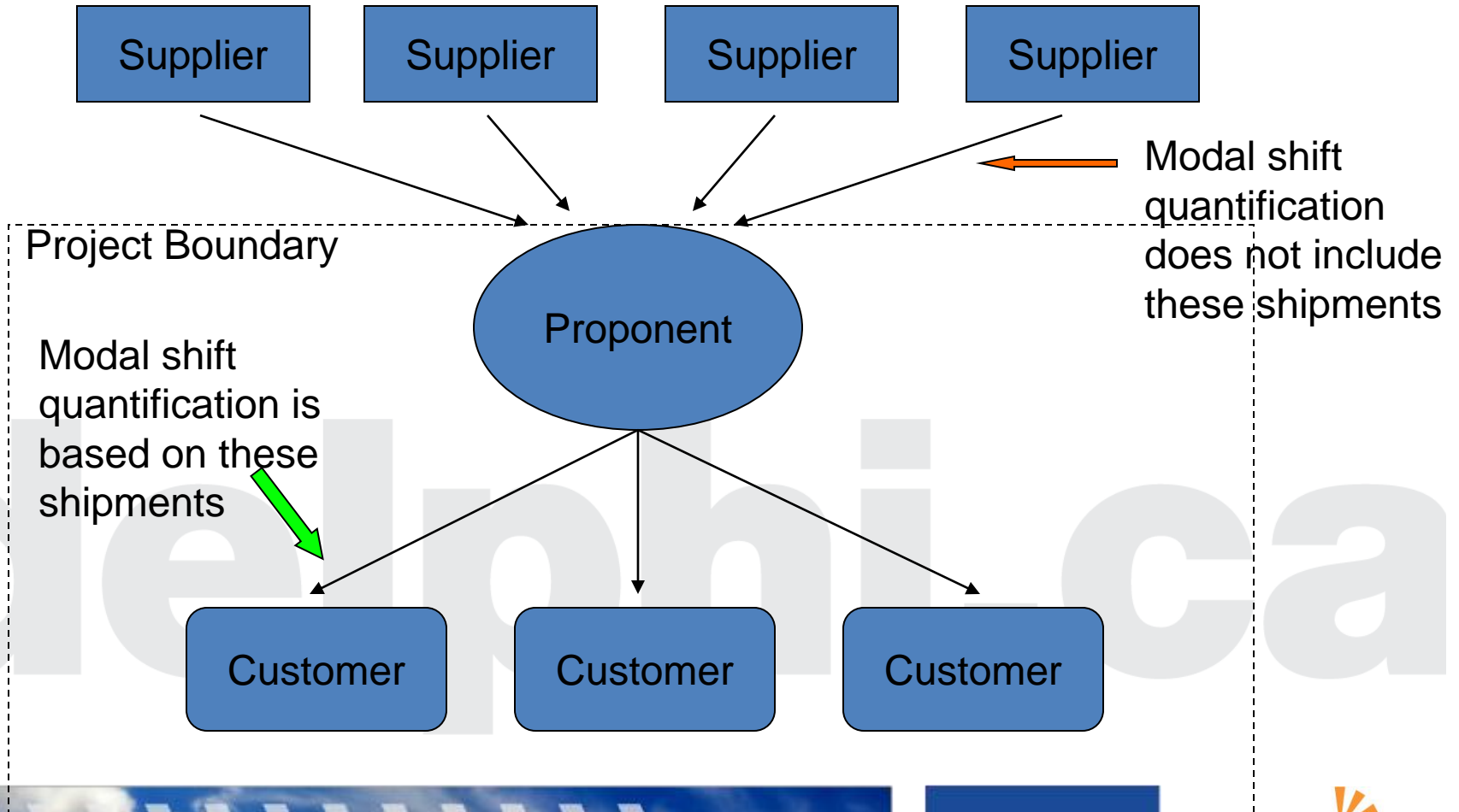


- Should the project include shipments made and/or shipments received?
- Shipments made by the proponent are more likely to be of a similar type (less heterogeneous)
- Ownership challenge – who would own the credits from the shipments received by the proponent?
  - Credits from shipments received by the proponent are owned by the company/facility making the shipment
    - Project proponent would need series of ownership agreements with suppliers



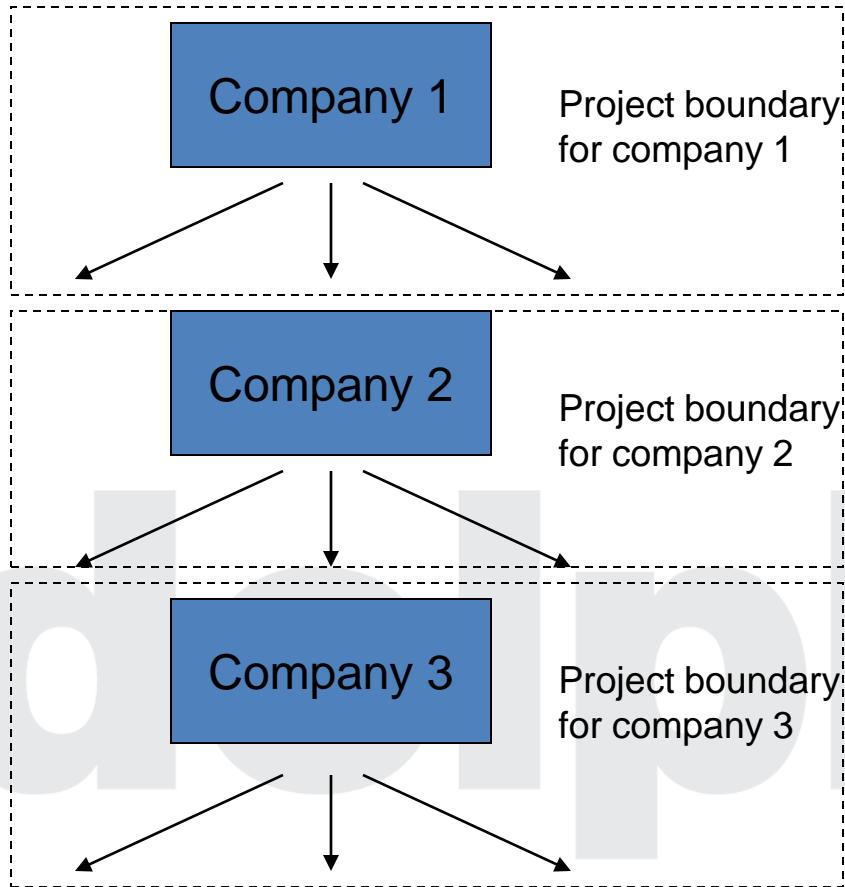


# Modal Shift Projects - What shipments are included?





# Supply Chains and Projects



- Each company/facility in the supply chain is quantified separately
  - Company 2's project quantification includes all outgoing shipments but does not include the shipment from Company 1 (this shipment belongs to Company 1's project quantification)





# Types of Baselines



- Types of Baseline
  - Performance Standard
  - Historic Benchmark
  - Comparison Based
  - Projection Based
  - Pre-registered (pre-approved approach)
  - Other (e.g. direct measurement of inputs and outputs)
  - Normalized Baseline





# Performance Standard

- Shipping of goods depends on many factors requiring multiple performance standards:
  - Type of good
  - Location of shipper
  - Location of receiver
- Lack of incentive to improve shipping habits if significantly below performance standard
- Significant effort may not increase usefulness and environmental integrity of protocol





# Historic Benchmark

- Baseline in the Alberta Protocol is a 3-year historic benchmark baseline
  - Shipping behaviour averaged over the 3 year period prior to project initiation
  - Excludes new facilities
- Why 3 years?
  - Account for annual fluctuation





# Projection Based Baseline



- Applicable to new facilities
- Implement a barriers test for shipments
  - Barriers might include higher cost, less convenient timing, etc.
    - Emission reductions will be quantified for shipments made by rail despite the presence of barriers
- Defining barriers will be difficult and may require addressing specific shipping scenarios
  - A generic barriers test will put large onus on verifiers
  - Specific barriers test may become exclusive
- No precedent in Canada – risk for approval





# Baseline for Modal Shift Protocol

- For companies with 3 years of historic data, use a historic baseline
- For new facilities/companies, develop a projection based baseline relying on a barriers test.
  - While generic barriers tests exist, such as the WRI barriers test, it is recommended that the barriers test include a discussion of specific barriers in order to provide sufficient guidance to verifiers





# Quantification Methodology

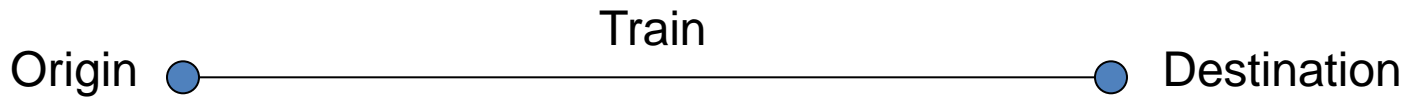
- Quantification methodology needs to address business growth and shrinkage
  - Absolute numbers not appropriate
- Work with ratios
  - % RTK (revenue tonne km) rail, % RTK truck
  - Compare ratios to baseline ratios – increase in % rail results in credit allocation



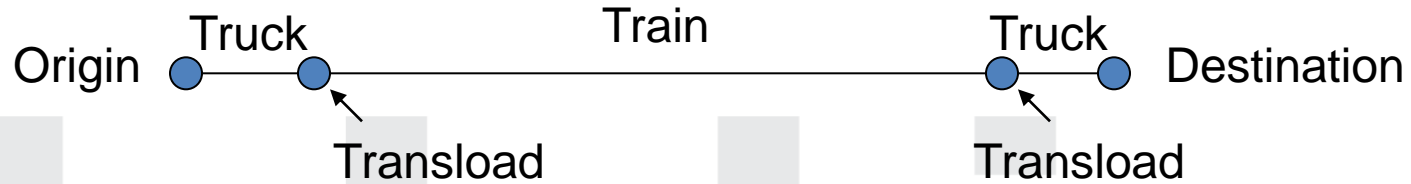


# Project and Baseline

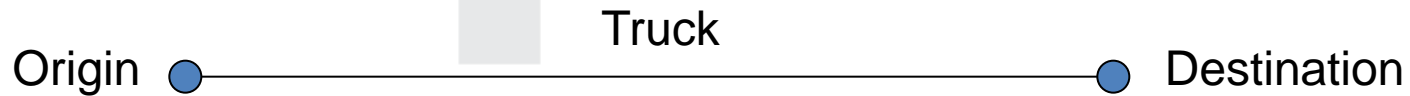
- Project



OR



- Baseline





# Project Lifecycle Diagram

## Upstream SS's During Project

P3 Extraction and Production of Diesel Fuel

P4 Transportation of Diesel Fuel

P5 Extraction and Production of Other Fuels

P6 Transportation of Other Fuels

P7 Extraction, Production and Transportation of Resource Fuel

P8 Generation of Grid Electricity

## Upstream SS's Before Project

P1 Facility and Equipment Construction

P2 Transport Infrastructure Construction

## On-Site SS's During Project

P9 Truck Operation

P10 Truck Maintenance

P11 Train Operation

P12 Train Maintenance

P13 Loading Operations at Origin

P14 Loading & Unloading Operations during Shipping

P15 Unloading Operations at Destination

P16 Transport Infrastructure Maintenance

P17 Building and Facility Maintenance

## Downstream SS's After Project

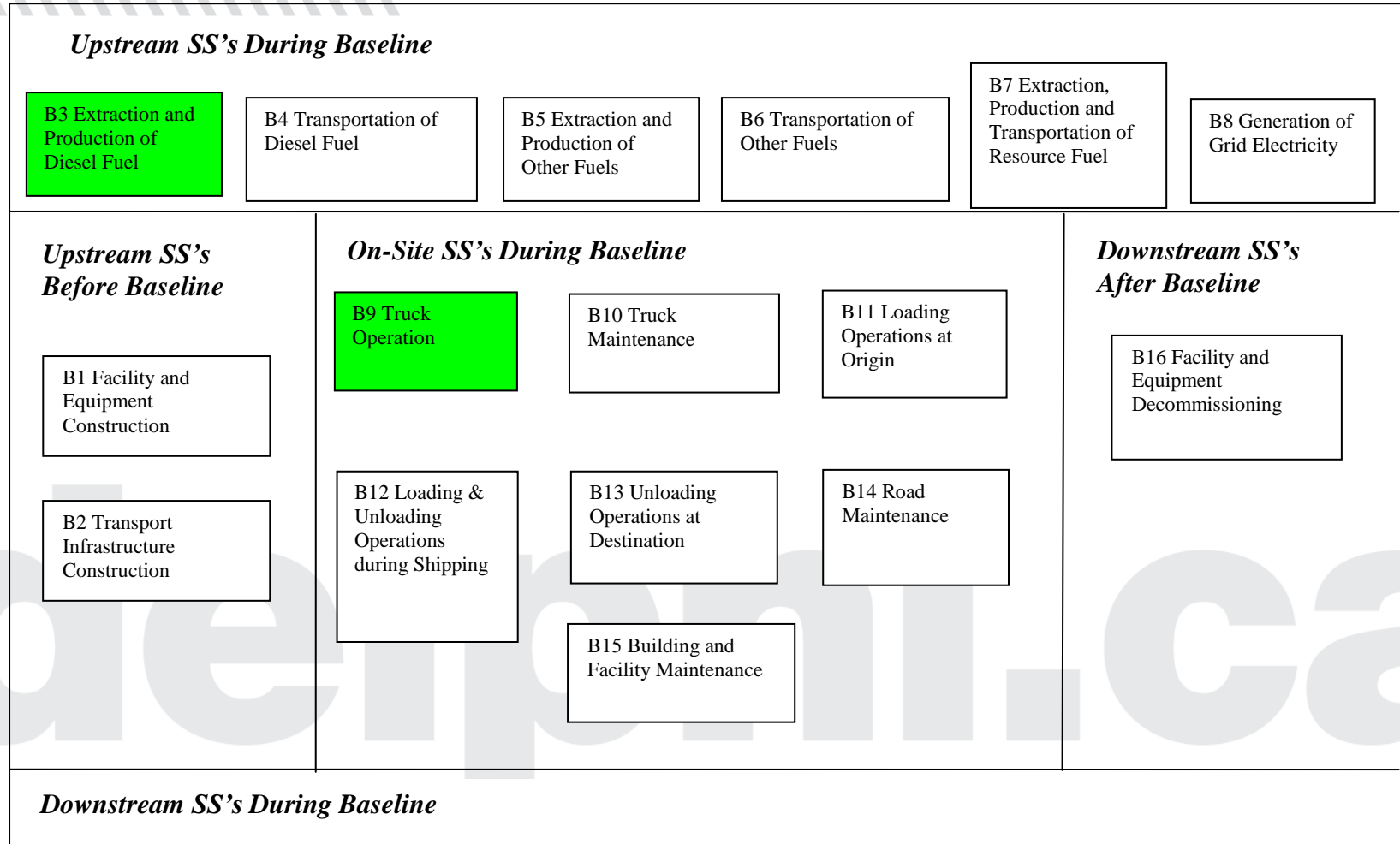
P18 Facility and Equipment Decommissioning

## Downstream SS's During Project





# Baseline Lifecycle Diagram





# Emission Reduction Calculation

$$\text{Emission Reduction} = \text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Project}}$$

$$\text{Emissions}_{\text{Baseline}} = \text{Emissions}_{\text{Truck Operation}} + \text{Emissions}_{\text{Extraction and Production of Diesel Fuel}}$$

$$\text{Emissions}_{\text{Project}} = \text{Emissions}_{\text{Train Operation}} + \text{Emissions}_{\text{Extraction and Production of Diesel Fuel}} + \text{Emissions}_{\text{Loading \& Unloading Operations during Shipping}}$$

- Key data to be monitored:
  - Simplified approach (Alberta only): total tonnes shipped by truck and rail
  - Detailed approach: tonnage and distance shipped by truck and rail for each shipment





# Emission Factors

- Rail
  - Fuel consumption factor taken from RAC (Railway Association of Canada) reports
    - Includes emissions from non-revenue transport
  - Diesel fuel combustion emission factor from Environment Canada
  - 18.5 gCO<sub>2</sub>e/tonne.km
- Truck
  - Significantly more challenging





# Trucking Emission Factor

114 gCO<sub>2</sub>e/  
tonne.km

Data Source	Data Year	Applicability	Emission Factor (g CO <sub>2</sub> e / tonne-km)	Explanation / Derivation
1. Transportation Table, National Climate Change Process, "Foundation Paper on Climate Change – Transportation Section –"	1995	Diesel trucks, for-hire	114	<p>Calculated by the Authors using:</p> <ul style="list-style-type: none"> <li>• Diesel fuel consumption data from Statistics Canada's Trucking in Canada 1995 survey for for-hire trucking companies with revenues greater the \$1M; and</li> <li>• Tonne-km data from Statistics Canada's For-Hire Trucking Commodity Origin / Destination Survey 1995 that was modified by Transport Canada to include an estimated tonne-km amount for smaller freight carriers.</li> </ul> <p>The above statistical data is gathered through voluntary surveying of the industry.</p>
2. Statistics Canada and Environment Canada, analyzed by The Delphi Group	2003	Diesel trucks, for-hire, greater than 15 tonne gross vehicle weight (Class 8)	153	<p>Calculated by The Delphi Group using:</p> <ul style="list-style-type: none"> <li>• Diesel fuel consumption and associated vehicle kilometer data for trucks greater than 15 tonne gross vehicle weight (Class 8) from Statistics Canada's Canadian Vehicle Survey annual reports (Catalogue# 53-223)</li> <li>• Average weight per shipment data for domestic (vs. cross-border) for-hire truck transport of all vehicle sizes from Statistics Canada's Trucking in Canada reports (Catalogue# 53-222), which surveyed for-hire trucking companies with revenues greater the \$1M (note, the report indicates that the majority of for-hire trucking is long-distance, suggesting that it would also involve larger loads). Average load ranged from 7.0 to 7.3 tonnes over the 2000 – 2003 period.</li> <li>• Diesel fuel combustion GHG emission factor for Heavy Duty Diesel Vehicles with moderate controls from Canada's GHG Inventory 1990 – 2003, produced by Environment Canada</li> </ul> <p>The above statistical data (with the exception of the diesel emission factor) is gathered through voluntary surveying of the industry.</p> <p>Total diesel fuel consumption was multiplied by the diesel fuel emission factor from Environment Canada, and divided by total vehicle kilometers and average shipment weight to give a results in units of g CO<sub>2</sub>e / tonne-km for the years 2000 – 2003</p>
	2002		159	
	2001		148	
	2000		164	
3. Statistics Canada and	2003	Diesel trucks, for-	71.0	Calculated by The Delphi Group using the same assumptions as for 3., except assuming 15 tonnes average shipment load
	2002		73.7	



# The Path Forward

- Significant policy uncertainty
  - Multiple jurisdictions
- Goal: Approved modal shift protocols in Canada and U.S. national offset systems
- Strategy: engage offset systems as they develop
- Increase Usability
  - Individual user consultations
  - Convene a working group





# Any Questions?

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