Achieving Emissions Reductions in the Freight Sector: Understanding Freight Flows and Exploring Reduction Options

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Acknowledgments

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• For more information about TCI see: http://www.georgetownclimate.org/state-action/transportation-and-climate-initiative

• I am also grateful to Dr. James Corbett (UD), Dr. Scott Hawker (RIT), and Dr. Karl Korfmacher (RIT) for contributions related to the GIFT model.
Overview

- Understand the problem
- Characterize the data
- Identify energy and emissions reduction opportunities
- Implement results
- Questions and discussion
Understand the Problem

Freight is closely tied to economic growth and is growing; unfortunately, the bulk of freight is moved by high energy-intensive and GHG-intensive modes (truck).

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For every trillion dollar increase in GDP, we expect an additional $\sim 140$ billion ton-miles.

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Source: BTS (2011)

Note:
These represent top-down averages and should not be used for blanket modal comparisons!

Source: Transportation Energy Data Book 27

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Range of typical CO2 efficiencies for various cargo carriers

NOTE: Impacts are a function of many factors related to route and modal characteristics.
Total emissions from transportation \(~1.9 \text{ GtCO}_2\text{eq/yr}\)

Total emissions from all energy sectors \(~5.9 \text{ GtCO}_2\text{eq/yr}\)

Source: AEO 2011.
Characterize the Data (Northeast and Mid-Atlantic (TCI) Region)

Freight flows for the TCI region are dominated by truck (87%); about 50% of the commodities moved by weight include: gravel and stone; refined fuel; non-metallic minerals; and coal.

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Overview of Characterization Project

- **Purpose**
  - Characterize freight flows for the TCI region
  - Provide EXCEL and ArcGIS datasets on freight flows

- **Value**
  - Results provide data and context for regional plans, programs, and policies to reduce improve efficiency and reduce the environmental impacts from freight transportation

- **Supported by the Georgetown Climate Center**

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Scope of Study

• Geography
  • Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Vermont.

• Modes: Truck, Rail, Ship

• Commodities: All available and reported
Weight of Freight Flows by State by Mode, Northeast States to All U.S. States

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Freight Flow (ktons) to Northeast Counties from the Northeast Region

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Freight Flow to Northeast Counties from U.S. States Outside of the Northeast Region, by Weight

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Identify Energy and Emissions Reduction Opportunities

The IF-TOLD framework provides insights into options for emissions reductions from freight; the GIFT model can be used to evaluate trade-offs across important criteria (cost, time-of-delivery, emissions, etc.).

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The IF-TOLD Mitigation Framework

The IF-TOLD framework:

- **Intermodalism/Infrastructure** – use of efficient modes and infrastructure
- **Fuels** – use of low carbon fuels
- **Technology** – application of efficient technologies
- **Operations** – best practices in operator behavior
- **Logistics** – improve supply chain management
- **Demand** – reduce how much STUFF we consume

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Example Using the Geospatial Intermodal Freight Transportation (GIFT) Model

GIFT has been jointly developed at the Rochester Institute of Technology (RIT) and the University of Delaware with partial support from the U.S. Department of Transportation, Maritime Administration and the Great Lakes Maritime Research Institute.

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Connect Multiple Transportation Mode Networks at Intermodal Transfer Facilities

Road Network

Rail Network

Waterway Network

Intermodal Transfer Facility

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Montreal to Cleveland (Ship 1)  Montreal to Cleveland (Ship 2)

Emissions and Time of Delivery Tradeoffs
Montreal to Cleveland

CO$_2$ (kg)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Time-of Delivery (hrs)</th>
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<tr>
<td>Truck</td>
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<tr>
<td>Ship (DR)</td>
<td>40</td>
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<tr>
<td>Rail</td>
<td>60</td>
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<tr>
<td>Ship (EJ)</td>
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Mode
CO$_2$ Comparison

- Truck Only
- Rail Only
- Ship-Truck
- Rail-Truck

Legend:
- Rail-Truck
- Ship-Truck
- Rail Only
- Truck Only

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Implement Results

More analysis of policy impacts needed for the Northeast and Mid-Atlantic states; however, one could use IF-TOLD to identify potential opportunities for a menu of policies.

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Policy Options

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Questions/Discussion

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