

Marine Modal Diversion

Description

Greenhouse gas emissions from freight transport also may be reduced by shifting freight traffic from trucks or trains to ships, in markets where waterborne transport alternatives exist. These include short-sea shipping along coastal routes, as well as barge moves along inland waterways, especially in the Mississippi River basin and Great Lakes.

“Short-sea” shipping is defined as shipping on routes that do not cross the ocean. Several such services already in existence, including private services in niche markets on the West Coast (Cambridge Systematics, Inc. et al., 2007), and a privately run service along the Gulf Coast started in 2000 (GAO, 2005).

The Port Authority of New York and New Jersey and the Port of Albany initiated a subsidized service in 2003, but this was discontinued when funding ran out (GAO, 2005). Expansion of short-sea shipping has been studied as a congestion reduction strategy.

“Marine highways,” which encompass short-sea shipping routes, are coastal, intracoastal, and inland waterways, mostly in the Mississippi River basin, Great Lakes, and along the East Coast. The Marine Highway Program (run by the U.S. DOT’s Maritime Administration, MARAD) was established in 2007 to designate marine highway corridors, make these corridors eligible for support for improvements, and provide assistance in coordinating with and obtaining funding from existing sources.

Magnitude and Timing of Greenhouse Gas Reductions

Shifting freight from truck or rail to marine vessels is likely to result in GHG reduction benefits under certain circumstances, although the magnitude of these benefits is debated. One study comparing inland waterway shipments with rail and truck estimated that inland towing can move 576 ton-miles per gallon, a 28 percent improvement over rail (413 tonne-miles/gallon) and a 73 percent improvement over truck (155 tonne-miles/gallon) (Kruse et al., 2007). An international study found that the efficiency of oceangoing and coastwise shipping, as measured in CO₂ per ton-km, is typically in the range of 10 to 35 g/tonne-km for general cargo and container ships, compared with 35 to 50 g/tonne-km for intermodal (container) trains and 150 g/tonne-km for road (Buhaug et al., 2008). Modal efficiencies vary substantially by the type of shipment (e.g., bulk versus container); ranges for a variety of types are shown in Figure 4.5.

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Benefits: **Low:** 0.2-0.4 mmt CO₂e in 2030

Direct Costs: **High:** \$730 to \$1,500 per tonne

Net Included Costs: **High:** \$550 to \$1,300 per tonne

- Cost estimates for inland waterway system only – short-sea shipping not estimated

Confidence in Estimates: **Moderate**

- Precise estimate uncertain, but magnitude is bounded by size of system

Key Co-Benefits and Impacts: **Mixed**

- Benefits from reduced truck traffic on roadways; may be positive or negative local air quality impacts

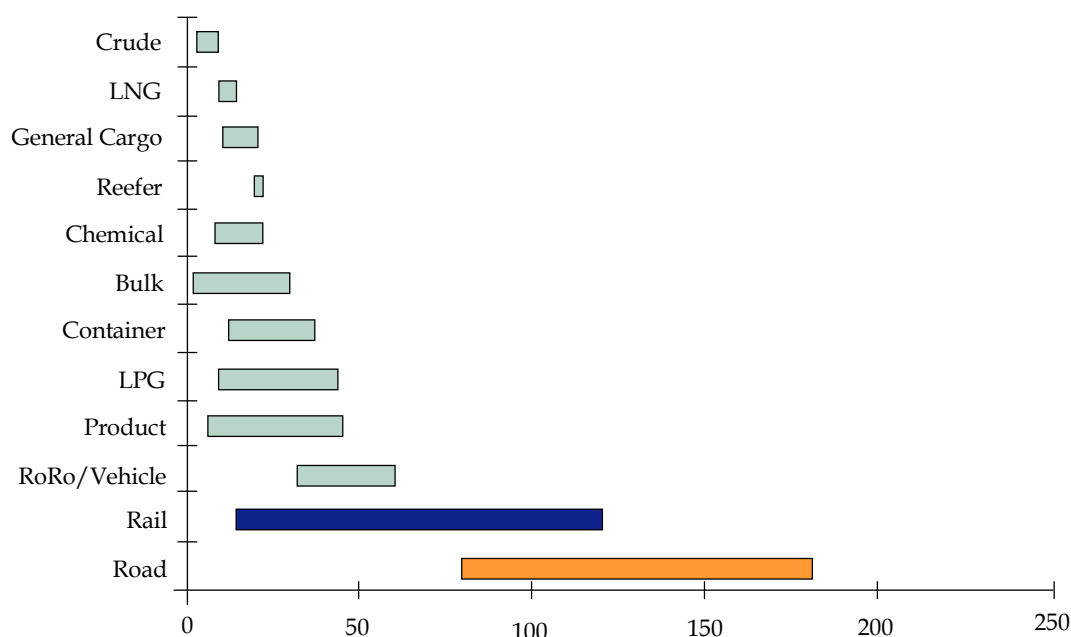
Feasibility: **Low to Moderate**

- Short-sea shipping initiatives have met with limited success

Key Policy Options:

- Capital investment in inland waterway system
- Subsidies for short-sea shipping

Figure 4.5 Range of Typical CO₂ Efficiencies for Various Cargo Carriers, g CO₂/tonne-km



Source: Buhaug et al 2008.

As with rail shipping, GHG emissions resulting from drayage moves to the port, as well as terminal operations, must be accounted for. Inland marine routes are generally considerably more circuitous than highway or rail routes, and some routes are often further constrained by seasonal variation (e.g., inland water level, Great Lakes waterway freezing). Furthermore, marine access simply does not exist for some population centers far from coasts or rivers. Similar to rail, marine shipping is primarily suited to larger bundles of goods and heavier commodities; inland river service has been dominated historically by lower-value-per-ton commodities such as agricultural, mineral, and energy cargoes.

Comprehensive estimates of the amount of cargo that could shift from truck or rail to marine have not been developed. One study assumed that investment in the waterway system would allow water traffic to grow by 33 to 75 percent between 2006 and 2025, rather than the annual reduction of 0.42 percent that has been seen in recent years.^{30,31} These assumptions resulted in a GHG emissions reduction of 0.2 to 0.4 mmt CO₂e in 2030 (Cambridge Systematics, 2009).³²

³⁰ A 50 percent increase was assumed in the *Waterborne Freight Transportation Bottom Line* prepared for AASHTO (Cambridge Systematics, Inc., 2006).

³¹ Derived from U.S. Army Corps of Engineers (2006).

³² Some consider this to be a conservative estimate of the amount of freight that could be diverted to marine.

Cost-Effectiveness

A private short-sea shipping service along the Gulf Coast has been successful in operating without public subsidies. However, for the New York service, the ports had to provide subsidies to set shipping rates 10 percent lower than truck rates, with the program funded at over \$2 million in 2005 (GAO, 2005). A study of short-sea shipping between U.S. and Canadian ports in the Pacific Northwest concluded that service to the Ports of Vancouver and Seattle would yield only minimal shipping cost savings and therefore require a subsidy of at least \$1.6 million per year to be viable. However, the study also found that service to the Port of Tacoma would generate a 9 percent cost savings and could be viable (Cambridge Systematics, Inc. et al., 2007). These cost differentials could change depending upon changes in fuel, labor, and other costs.

Overall, the cost-effectiveness of lakewise and inland waterway improvements when judged on GHG reduction appears to be poor, with one set of estimates ranging from \$730 to \$1,450 per tonne considering investment and operations costs only, or \$550 to \$1,270 per tonne considering shipper cost savings (Cambridge Systematics, 2009). This study assumed capital investment costs of \$3 to \$12 billion through 2025, based on the total construction backlog for Army Corps of Engineers navigation projects estimated to be \$10 billion in 2003 (Vining, 2003), and annual maintenance costs of five percent of the capital costs.

Cobenefits

Any shipper or business that voluntarily shifts modes is assumed to realize a net benefit from reduced shipping costs, which would more than offset the value of any fees paid for the service as well as any increases in other logistics costs. The magnitude of the cost savings would depend greatly upon the specific improvements made and characteristics of the modal alternatives available to a given shipper.

Despite the higher energy efficiency of marine goods movement, emissions of air pollutants may not necessarily be reduced due to the less stringent air pollution controls on marine vessels. One study of truck, rail, and marine alternatives along the East Coast suggests that marine vessels emit slightly less VOC per ton equivalent unit (TEU)-mile than trucks, but slightly greater NO_x and PM and significantly greater levels of sulfur dioxide (Corbett et al., 2007). However, recent changes to Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) may result in significant improvements for reducing marine emissions of NO_x, SO_x and PM and will likely reverse this situation. Marine vessels also have higher emissions than rail for all pollutants (Table 4.4). Another study comparing inland towing with truck and rail modes came to different conclusions, estimating that inland marine vessels emitted 13 percent less HC and about 35 percent less VOC and NO_x than trucks, and also less emissions than railroads (Kruse et al., 2007). None of these estimates include emissions from drayage activity. Furthermore, they do not consider future changes in emissions levels (such as will be achieved through greater regulation of marine vessel emissions), which could change the relative impact of each mode.

Even if emissions levels per tonne are higher from marine vessels, the net health impacts of these emissions will be lower if they are concentrated offshore, away from populated areas, as opposed to land-based truck and rail traffic concentrated near populated areas.

Feasibility

Public investment may be required in subsidizing services such as short-sea shipping, in order to establish services that may not be viable for the private sector. Substantial increases in fuel costs could potentially make short-sea shipping more competitive. Short-sea shipping has some unique additional constraints. As for truck-rail movements, costs are largely determined by the cost of handling shipments at the interchanges. The handling costs at ports are often high – the result of labor agreements as well as lower productivity rates in moving small volumes of container or trailers to and from barges compared to ocean-going containerships. An additional constraint on short-sea shipping is the Jones Act, which restricts water transport of cargo between U.S. ports to U.S.-flagged carriers. The provisions of the Jones Act protects U.S.-flagged carriers from competition by lower-cost foreign carriers (lower cost because the foreign carriers may be working under less rigorous labor, safety, and environmental regulations), but those provisions also make short-sea shipping more costly and less competitive than domestic trucking and rail-freight service.

Rail and Intermodal Terminal Operations

Description

Emissions may be reduced from locomotives through reduced idling or other operational efficiencies. Operating efficiency improvements may be realized by relieving chokepoints as discussed in the previous strategy, as well as by implementing revised operating procedures and idle reduction technologies in rail yards.

The most significant efficiency benefits may be from switcher locomotives, which spend virtually all of their time within a rail yard, assembling and disassembling trains. Switcher locomotives never reach high speeds and can spend up to 75 percent of their time idling, consuming 27 percent of their fuel while idling (Argonne, 2009). Idle

<p>Rail and Intermodal Terminal Operations</p> <p><i>Benefits: Low:</i> 1-2 mmt CO₂e in 2030</p> <ul style="list-style-type: none"> • Includes only switchyard idle reduction and rail-highway grade crossing elimination <p><i>Direct Costs: Unknown</i></p> <p><i>Net Included Costs: Unknown</i></p> <ul style="list-style-type: none"> • Net savings for locomotive idling reduction <p><i>Confidence in Estimates: Low</i></p> <ul style="list-style-type: none"> • Benefits of chokepoint relief, rail operations, and port/terminal equipment unknown <p><i>Key Co-Benefits and Impacts: Positive</i></p> <ul style="list-style-type: none"> • Air quality benefits from reduced idling and other emissions; cost savings to shippers <p><i>Feasibility: Moderate</i></p> <ul style="list-style-type: none"> • Some idle reduction initiatives undertaken at a State level <p><i>Key Policy Options:</i></p> <ul style="list-style-type: none"> • Investment in rail and intermodal infrastructure • Regulations or voluntary partnerships with railroads to promote GHG assessment and reduction practices (e.g., idle reduction)
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