

**U.S. Environmental Protection Agency's  
SmartWay Transport Partnership Program:**

**Recommendations and Findings**

**SmartWay Legacy Fleet Workgroup**

**Mobile Source Technical Review Subcommittee**

**Clean Air Act Advisory Committee**

**U.S. EPA**

**April 2014**

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## Executive Summary

The SmartWay Legacy Fleet workgroup presents this report to the Mobile Source Technical Review Subcommittee (MSTRS) at the request of U.S. Environmental Protection Agency's (EPA) Office of Transportation and Air Quality (OTAQ). EPA is seeking advice on potential enhancements to the SmartWay Transport Partnership (SmartWay) program, as well as the applicability of the SmartWay program in the marine, air and nonroad transportation sectors.

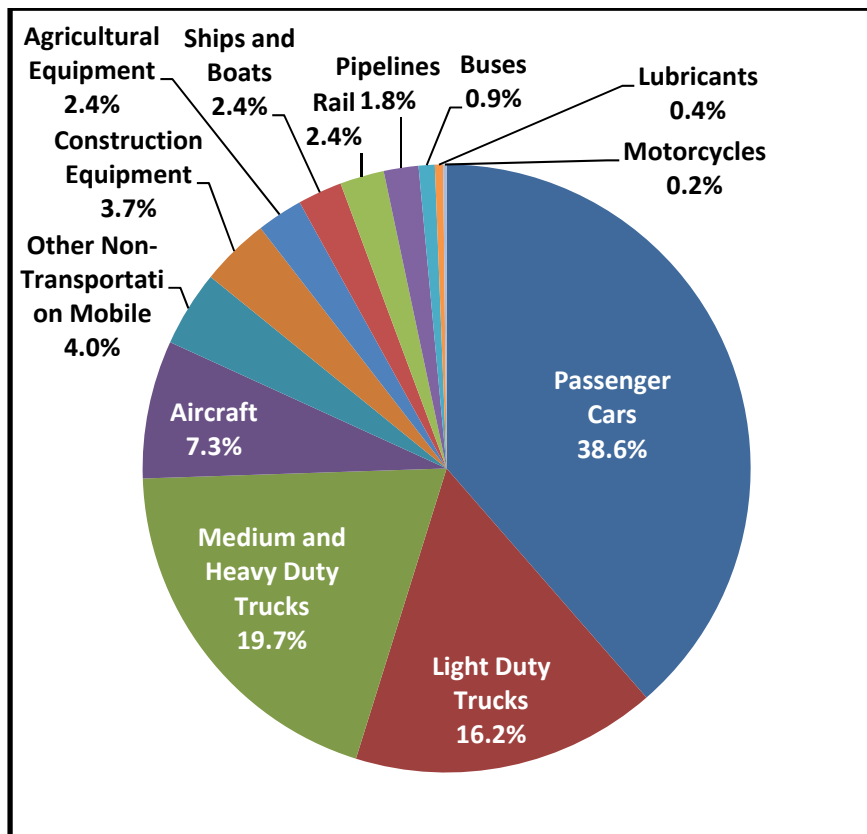
The observations and recommendations in this report were developed through a workgroup process formed under The Clean Air Act Advisory Committee (CAAAC), under the provisions of the Federal Advisory Committee Act (FACA), 5 U.S.C. App.2 § 9 (c). This report is based on the advice, input and recommendations made by key stakeholders in the freight transportation and nonroad sectors, business and industry, academic experts, environmental and community groups and states (**Appendix A**).

SmartWay is a market-based public-private partnership, created and administered by EPA to help industry move goods in cleaner, more efficient ways. Freight efficiency is a growing concern for policy makers as goods movement represents a significant portion of the nation's transportation greenhouse gas inventory and is growing more rapidly than passenger transport emissions. SmartWay provides a standard set of quantification, benchmarking and reporting tools that help industry to optimize the energy and environmental performance of their domestic, ground freight supply chain. SmartWay enables shippers, carriers and logistics firms to exchange performance data in ways that improve freight efficiency by accelerating the adoption of advanced technologies and strategies which reduce fuel use, costs and emissions. These efforts protect the environment, enhance our nation's energy security and foster economic vitality.

To encourage continuous improvement in freight efficiency, SmartWay provides incentives and recognition for top performers, including use of the SmartWay brand as a mark of cleaner more sustainable transportation, and an annual awards program. Smart Way's three-thousand partners include large and small firms, dozens of Fortune 500 companies and represent major economic sectors such as retail, food & beverage, manufacturing, chemicals, paper & lumber, consumer goods, and others. Since 2004, SmartWay partners have eliminated over 51 million metric tons of CO<sub>2</sub>, saved over 120 million barrels of oil and \$16 billion in fuel costs, and reduced 738,000 tons of NO<sub>x</sub> and 37,000 tons of PM.

The success of SmartWay in the U.S. has led to its adoption in Canada, where Natural Resources Canada now administers the program for Canadian firms, using the same tools methods and metrics for assessing freight efficiency. In addition, the SmartWay public-private partnership model is now being replicated in other countries in Latin America, Asia and the European Union. SmartWay is also being used as a template to inform the development of freight sustainability programs under the United Nations Environment Program’s Climate and Clean Air Coalition.

EPA is seeking advice from MSTRS as part of its ongoing mission to improve the environmental efficiency of the transportation sector. While light duty passenger cars and trucks represent over half the nation’s mobile source greenhouse gas emissions, the freight (primarily trucking and rail) and nonroad sectors are a significant component of emissions<sup>1</sup> as seen in **Figure 1** below.



**Figure 1: Share of U.S. Mobile Sources GHG Emissions by Sector**

<sup>1</sup> <http://www.epa.gov/otaq/climate/documents/420f13033a.pdf> Fast Facts, U.S. Transportation Sector Greenhouse Gas Emissions 1990-2011.

The future success of SmartWay will require EPA to continue program innovation to ensure that the program's value proposition remains strong. SmartWay must evolve to meet the needs of the market and its partners, so that it can continue to generate more emissions reductions and cost savings. While the program results and replication by other countries are good indicators of the program's success, SmartWay does have gaps and limitations which are noted in this report and are the basis for multiple recommendations to EPA.

The workgroup, in affirming the on-going value of SmartWay as a voluntary partnership program, also considered Agency resource implications of program continuance and the resource implications of workgroup recommendations. The SmartWay program, at current program maturity levels, is providing valuable service to program participants and, in addition to those benefits, is providing direct support to the Agency's core mission of protecting human health and the environment. This direct support is accomplished by extending the agency's impact from regulatory programs to the broader supply chain participants that can provide substantive and quantifiable incremental emission reduction and fuel efficiency improvement benefits to society.

Additional recommendations from the workgroup heavily leverage existing, externally available reports and resources that minimize the need to invent, create or manage additional data sources as the program expands. While modest resource additions may be required, the benefit of this extension to the Agency's core mission as described above should be able to fully justify such resource additions.

Recognizing the strengths and limitations of SmartWay in its current configuration, the workgroup finds that EPA should consider numerous programmatic and policy enhancements. These changes will help the program reach its full potential and continue to drive further emissions reductions and energy and costs savings in the transportation sector.

The workgroup recommends that EPA continue to enhance, expand, support and resource the current program, by strategically implementing recommendations summarized in the tables below, and detailed later in this report. This includes recommendations that EPA consider extending the existing program to achieve greater emissions reductions by including the modes of air and marine freight. It also includes recommendations for implementing a market based, public-private partnership like SmartWay in the nonroad sector, also detailed in later sections of this report

| General Recommendations |   |   |      |
|-------------------------|---|---|------|
| #                       | Recommendation  | Considerations  | Page |
| G-1                     | Use <b>maturity scale</b> and sector <b>evaluation and filtering tool</b> to assess transportation (including truck, rail, marine and air) sectors and subsectors for inclusion in SmartWay | Helps EPA establish key areas for focus in the truck, rail, marine and air sectors and avoid transportation sectors where little or no impact is likely, while aligning priorities with limited resources | 30   |
| G-2                     | Continue to enhance <b>data quality</b> and rigor of data validation  | Implement quality assurance process, consider audits, cross check with other data providers   | 34   |
| G-3                     | Strengthen SmartWay <b>brand</b>  | Conduct research on brand awareness and perceptions of stakeholders   | 35   |
| G-4                     | Strengthen <b>partner recruiting</b> efforts, develop expert group to advise EPA  | Expand visibility, use social media, package labeling, add other freight modes to enable the shipper module to do supply chain assessments  | 36   |
| G-5                     | Strengthen <b>partner retention</b> efforts, develop expert group to advise EPA   | Simplify and streamline benchmarking tools, provide report cards, webinars, educational forums, opportunities to engage, expand role of Affiliates  | 36   |
| G-6                     | Enhance <b>financing programs</b> , subject to funding  | Leverage state and federal funds, prioritize by hotspots, develop common application, reach out to underserved populations  | 37   |
| G-7                     | Incorporate <b>black carbon</b> reporting and reduction incentives  | Include in all modes incentivize diesel retrofits, support adoption of low sulfur fuels globally  | 38   |
| G-8                     | Incorporate <b>operational strategies</b> and accord credit appropriately to partners implementing the strategy   | Require shippers to report carbon targets and include operational strategies across all modes, but do not double count activity implemented by carriers, publish case studies, best practices             | 40   |

| Truck and Rail Recommendations |   |   |      |
|--------------------------------|---|---|------|
| #                              | Recommendation  | Considerations  | Page |
| 1-1                            | Limit focus on <b>vocational trucks</b> to large fleets and operators   | Avoid highly specialized, non-freight operators   | 45   |
| 1-2                            | Keep <b>drayage</b> focus on fleets of 50+, use port metrics and technology to measure idling and queuing                                 | Data collection and reporting requirements may be too onerous, create web based interface to ease reporting, develop port metrics   | 46   |
| 1-3                            | Enhance role of <b>third party logistics</b> (3PL) partners, and account for various logistics business models, refine reporting guidance | Identify credit opportunities for 3PLS which foster mode shift and operational improvements, refine performance ratings to account for varying fleet sizes and modes utilized | 47   |



|     |   |   |    |
|-----|---|---|----|
| 1-4 | Ease and simplify participation for <b>small carriers</b> and owner operators   | Create web-based simple reporting tool for small carriers, or have a third party collect and aggregate data for EPA, provide incentives to participate                              | 49 |
| 1-5 | Incorporate SmartWay into <b>driver training</b> schools  | Fosters improved performance and creates awareness  | 51 |
| 1-6 | Ensure SmartWay continues to <b>inform EPA regulatory programs</b> such as the Phase 2 Heavy Duty Diesel GHG rulemaking | Improve and streamline technology verification process, incorporate emerging technologies, raise performance threshold on SmartWay Designation for Model Year 2014 and newer trucks | 52 |
| 1-7 | Enhance integration of <b>Rail</b> partners in SmartWay   | Incorporate rail operational strategies, provide greater visibility, streamline reporting to parallel standard reporting currently done for Surface Transportation Board            | 53 |
| 1-8 | Include <b>Transportation Refrigeration Units (TRUs)</b> in SmartWay program  | Require reporting on TRU fuel use, incentivize maintenance and improvements, including alternative refrigerants   | 54 |

| <b>Air and Marine Recommendations</b> |   |   |             |
|---------------------------------------|---|---|-------------|
| <b>#</b>                              | <b>Recommendation</b>   | <b>Considerations</b>   | <b>Page</b> |
| 2-1                                   | Incorporate <b>Air and Marine Freight</b> into SmartWay Partnership shipper tools and <b>create Air Freight and Marine Partner categories</b>                                   | Establish methods to enable shippers to assess supply chain carbon impacts across all modes including air cargo and ocean shipping. Include foreign flag carriers. Provide partner categories for these modes and include foreign flag carriers.    | 62<br>69    |
| 2-2                                   | The addition of other freight modes in SmartWay can best be achieved through reciprocity and/or data sharing arrangements with existing and established protocols and data sets | Streamline data acquisition by capturing DOT Form 41 data for air cargo and through reciprocity with BSR's Clean Cargo Working Group for marine cargo to reduce Agency and industry burden  | 63<br>69    |
| 2-3                                   | EPA should adopt <b>metric units</b> currently used by rest of world, for EPA tools and methods   | Combinations of metric and English units are not understood by Europeans, and switching between short tons and metric tons leads to errors  | 69          |
| 2-4                                   | SmartWay should commit to the ongoing <b>global efforts to harmonize and align multimodal supply chain carbon accounting</b> methodologies, and tools                           | Since discussion of such methodologies are developing quickly in North America, Europe and global organizations, EPA should support and provide resources for active involvement in the supply chain metrics alignment work now ramping up globally | 70          |

| <b>Nonroad Recommendations</b> |   |  |             |
|--------------------------------|---|--|-------------|
| <b>#</b>                       | <b>Recommendation</b>   | <b>Considerations</b>  | <b>Page</b> |
| 3-1                            | EPA should create a voluntary, <b>market based partnership for nonroad</b> sector based on data gained in pilot projects. | Model on principles and design of SmartWay but create alternate brand, using pilot projects to inform construct of a more comprehensive program  | 84          |
| 3-2                            | EPA should implement a <b>Pilot program</b> for the nonroad sector  | Focus on subsectors with fixed work sites, such as quarry and mining, or the goods movement portion of a nonroad sectors' freight activity, such as transporting agricultural products from agricultural sites | 86<br>87    |

## **Introduction**

The SmartWay Transport Partnership (SmartWay) is a non-regulatory, market-based public-private partnership developed by the U.S. Environmental Protection Agency (EPA) in collaboration with the domestic ground freight sector. Launched in 2004 by EPA's Office of Transportation and Air Quality, SmartWay aims to improve the energy and environmental efficiency of the freight sector by accelerating the adoption of advanced technologies and operational strategies that save fuel and reduce emissions. To date, SmartWay has focused its efforts on the truck and rail sectors.

SmartWay partners and affiliates work with EPA to benchmark, report and improve environmental and energy performance, share best practices, promote freight sustainability and educate others on these efforts. EPA provides the benchmarking tools and partnership framework, facilitates information exchange, validates partner data and vendor technologies, markets the branded program, provides incentives and recognizes partner achievements.

As part of its commitment to cost-effective public policy and strategic implementation of its programs, the EPA asked the Mobile Source Technical Review Subcommittee (MSTRS) to consider the SmartWay program and advise EPA on ways to enhance and sustain it. EPA was also interested in looking at the potential application of SmartWay in the air and marine modes of freight transportation and in the nonroad sector.

A "Charge" was created to guide this assessment and a workgroup was formed in the fall of 2011 to complete the task. The workgroup was comprised of business and industry leaders, academia, state and local authorities, technical experts and non-governmental stakeholders. The Charge was written as follows:

### **Charge for MSTRS SmartWay Legacy Fleet Workgroup**

To sustain and improve EPA's success in helping SmartWay partners cut fuel use and emissions in goods movement while adapting to fit the changing business environment and needs of our program partners and stakeholders, EPA asks the workgroup to make recommendations that will enable EPA to both sustain its legacy fleet programs and extend SmartWay into the broader transportation supply chain.

To continue to achieve additional emissions reductions and contribute to energy independence, while meeting the needs for more partners in more modes without

assuming a commensurate increase in resources, EPA asks the workgroup to make recommendations that will enable SmartWay to maximize opportunities for program efficiencies and strategic program growth, while refining our understanding of the needs and challenges of multiple stakeholder groups.

More specifically, the workgroup is asked to help EPA by making recommendations on how to:

**1) Accelerate and sustain continued legacy fleet efficiency improvements in the trucking and rail sectors:**

- Incorporate cutting edge technologies and operational innovations
- Enhance data quality and reporting throughout industry
- Provide feedback on EPA legacy fleet strategies

**2) Explore opportunities for additional fuel savings and emission reductions from other freight transport modes such as marine and air freight:**

- Integrate new modes and freight sectors into SmartWay
- Enhance multimodal supply chain environmental and energy performance assessment (carbon accounting) to reflect all modes for SmartWay
- Inform the ongoing global dialogue which is working to standardize methods and tools, using SmartWay tools and factors where appropriate

**3) Explore opportunities to apply the public-private market based partnership model into the nonroad sector:**

- Introduce the non-freight sector to the SmartWay Partnership model, using the public-private, market based collaboration to drive further emission reductions and enhanced energy security
- Recommend how to design, build and implement program features, tools, processes and methods which drive additional emissions reductions from the nonroad sector

## Organization of Report

This report was written with the assumption that the reader may have little or no background or exposure to the SmartWay Transport Partnership and/or the freight sector. The program is summarized early in the report in order to give the reader a general understanding of the SmartWay program, its background and history, features, processes, status, and results. It also identifies key gaps and limitations of the program as well as the international replication of green freight programs like SmartWay. This background is intended to provide a context and foundation for the recommendations later in the report.

The report then provides an overview of the workgroup process that was used to develop the recommendations, including a suggested prioritization and decision process for setting goals, a sector evaluation tool, and goals and guiding principles. These resources and principles are intended to serve as tools for EPA to support the recommendations in this report and future decision making and planning for the program. The report goes on to make overarching recommendations that are broadly applicable to the program and not specific to the workgroup charge.

The remainder of the report is divided into three sections that reflect the three key components of the charge described above:

- 1) The first section addresses key questions about how to enhance and strengthen the existing program in its current configuration.
- 2) The second speaks to the questions of applying SmartWay to other freight modes, specifically air and marine.
- 3) The third section applies to the question of whether the public-private, market based SmartWay program template should be applied in the nonroad sector.

Each of these three areas of consideration requires different background and information to support the recommendations, as did the workgroup deliberations, and thus the approach, background and format used will vary in these sections.

Finally, the appendix includes supplemental information on the workgroup roadmap, as well as templates of the decision and prioritization matrix developed by the workgroup for EPA.

## Transportation Fuel Consumption and Emissions

The key drivers for EPA investing resources in a program like SmartWay stem from the energy and environmental impacts of the transportation sector. There are numerous and diverse on-road and nonroad sources of greenhouse gas and criteria emissions in the transportation sector. Criteria air pollution emissions have declined considerably in recent years due to stringent new emission standards, and attention has turned to transportation GHG emissions.

The transportation sector is a major consumer of energy and almost entirely reliant on petroleum, with implications for national energy security. The transportation sector in the U.S annually generates over 1.7 billion metric tons of CO<sub>2</sub> emission from fuel combustion, or about 27% of the total greenhouse gases.<sup>2</sup> When including emissions from *non-transportation* mobile sources such as agricultural, lawn and garden, and construction equipment, mobile sources constituted nearly a third, or 30%, of total U.S. GHG emissions in 2011.<sup>3</sup> Over 70% of total petroleum used in the U.S. is consumed by the transportation sector where petroleum accounts for 93% of total energy used<sup>4</sup>.

While light duty passenger cars and trucks are the most significant source of greenhouse gases, heavy duty diesel and nonroad sources are also significant. Although fuel efficiency and emissions standards help ensure cleaner, more energy efficient vehicles in today's new fleets, and less emissions in the future, the legacy diesel fleet will be in service for years to come. This is a concern particularly in the heavy duty diesel fleet (on-road and nonroad) because of the durability and longevity of these vehicles, engines and equipment. With rebuilds and repowers, heavy duty trucks and equipment can operate for decades and millions of miles and hours, at the emission levels of much earlier standards. This presents a challenge but also an opportunity for programs like SmartWay that have proven to improve the energy and environmental efficiency of the legacy fleet.

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<sup>2</sup> EPA 430-R-13-001, U.S. EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2011, April 2013

<sup>3</sup> <http://www.epa.gov/otaq/climate/documents/420f13033a.pdf>. Fast Facts, U.S. Transportation Sector Greenhouse Gas Emissions 1990-2011.

<sup>4</sup> U.S. Energy Information Administration, *What are the major sources and users of energy in the United States?* August 2013, [http://www.eia.gov/energy\\_in\\_brief/article/major\\_energy\\_sources\\_and\\_users.cfm](http://www.eia.gov/energy_in_brief/article/major_energy_sources_and_users.cfm)

## SmartWay Background and Role in Freight Sector

### Background and History

Because of the scale and growth of emissions from heavy duty diesel trucks and rail over the last couple decades, EPA saw opportunities to work with the freight sector. EPA first engaged with industry stakeholders in 2001 to explore ideas for a new, public-private collaboration focused specifically on the freight sector and goods movement. Discussions centered on developing a voluntary, market based initiative that would achieve multiple goals:

- Reduce harmful greenhouse gas emissions and other pollutants from goods movement by;
- Accelerate the adoption of fuel and cost saving technologies and strategies;
- Create recognition and visibility for freight sustainability achievements by industry leaders; and
- Enhance the working relationship between EPA and the transportation sector.

From those early discussions, the concept for the SmartWay Transport Partnership was born.

Working closely with the American Trucking Associations and Business for Social Responsibility, a Charter Partner group of business leaders was created in 2003 to kick off this effort. These 15 Charter Partners<sup>5</sup> advised EPA on the creation of SmartWay, including the development of the partnership structure and program design, the performance benchmarking tools and methods, technologies and best practices, and the SmartWay brand. Other companies were invited to participate and the program was launched on February 9, 2004 with 50 Partners from the trucking, rail and shipper sectors.

The Partnership has grown considerably in the decade since and now includes about 3,000 shippers and carriers of freight (both truck and rail), third party logistics providers and freight brokers, as well as non-profits and other affiliates. These partners and affiliates represent a wide range of Fortune 500 firms and small enterprises from most

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<sup>5</sup> The SmartWay Charter Partners: American Trucking Associations, Business for Social Responsibility, Canon, Coca Cola Enterprises, CSX, FedEx, H-E-B, The Home Depot, IKEA, Interface, Nike, Schneider National, Swift, Yellow Roadway, and UPS.

major economic sectors including retail, food and beverage, manufacturing, consumer goods, lumber and paper, agriculture, chemicals, pharmaceuticals and others. These industry leaders are working together with EPA to accelerate the adoption of advanced technologies and strategies to reduce fuel use from goods movement. SmartWay partners also are able to monitor their progress through the program's performance benchmarking and reporting tools.

The fundamental mission of SmartWay is to give businesses the information and tools needed to optimize goods movement energy and environmental efficiency in a continuous improvement process. EPA also provides credible information on verified SmartWay technologies and best practices, recognition and other incentives to encourage partner progress.

The SmartWay program has become an influential element of the domestic ground freight industry. By establishing criteria for line-haul class 8 tractors and trailers and verifying the performance of energy saving technologies, EPA is helping create awareness and confidence which helps accelerate the adoption of these technologies.

EPA articulates the SmartWay "value proposition" as:

- Helping carriers to become more efficient and reduce emissions by **saving fuel and reducing costs**, which offers carrier partners a competitive advantage.
- Helping shippers identify **more efficient carriers** and acquire better data and visibility of their freight supply chain operations which helps them to reduce their transportation footprint.
- **Enhancing the energy security** of the freight sector in the U.S. to help it become more sustainable and competitive.
- **Providing participating businesses** with visibility and opportunities to showcase achievements and leadership.

### [SmartWay Process and Role of Program in Freight Sector](#)

#### **Partnership Process**

To achieve the goals as described above, EPA facilitates the exchange of freight performance information and data in three SmartWay partner categories:



**Freight carriers (rail, truck and multimodal)** benchmark and report the environmental performance of their fleets while working to improve efficiency and cut costs, using technologies and strategies which save fuel and reduce emissions.

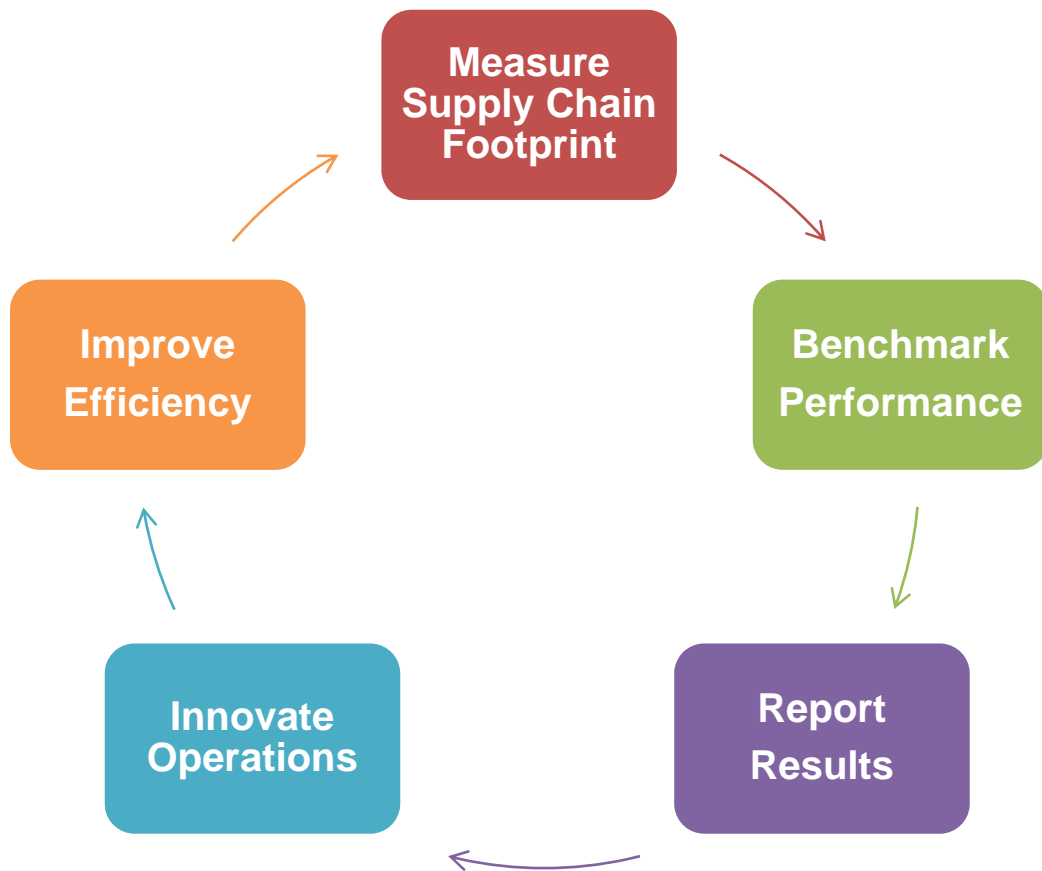
**Logistics firms** benchmark and report performance based on freight brokered with SmartWay and non-SmartWay registered carriers, while engaging with carriers and shipper clients to improve efficiency.

**Freight shippers** benchmark, analyze and report freight operations efficiency and operational practices, while committing to ship more of their goods with SmartWay Carriers.

**All partners** get credible carbon benchmarking data and assessments that can be used to meet their growing need to report, disclose and reduce their carbon emissions.

SmartWay also has an **Affiliate** category which works closely with EPA and the freight sector to promote the goals of SmartWay. SmartWay affiliates include non-profit professional and trade associations, environmental groups, non-governmental organizations and others stakeholders which work with their membership to learn the drivers for and benefits of freight sustainability. Affiliates actively promote SmartWay to their constituencies through webinars, events and meetings, as well as publications and other educational materials. EPA has expanded the affiliate category to also include for-profit truck dealers, and truck leasing companies, with the purpose of promoting SmartWay tractors and trailers, as well as and travel plazas and truck stops, to promote idle reduction.

The SmartWay program provides a process and a platform where shippers and carriers of freight are able to collaborate on their shared goals for better efficiencies and reduced costs. As shippers, carriers and logistics firms register in the program, report freight operations data and benchmark their performance, EPA facilitates an exchange of data and best practices that helps all partners collaborate more effectively in a continuous improvement process. These steps are presented in **Figure 2** and summarized below:



**Figure 2 - The SmartWay continuous improvement process**

**1. Measure Supply Chain Footprint**

Each partner group is provided with SmartWay calculator tools which are used to report freight activity data to EPA (as required to participate in the program). The truck carrier, multimodal and rail SmartWay tools prompt these partners to report on their equipment types and model years, fuel use, miles driven and tons of freight carried, among other factors. Logistics and Shipper partners report the miles and tons of freight shipped with of SmartWay registered and non-SmartWay carriers and other key performance data.

**2. Benchmark Performance**

Each partner uses the SmartWay tools to benchmark the performance of their freight operations using a gram per mile and gram per ton-mile metric for CO<sub>2</sub>,

NOx and PM emissions. The carrier assessment is performance based, and reflective of the amount (and type) of fuel used to move a given quantity of freight and miles. The logistics and shipper results are reflective of the quantity of miles and freight moved by their SmartWay and non-SmartWay carriers, as well as the actual performance of those carriers. Using higher performing carriers will generate lower emissions results.

### **3. Report Results**

Carrier partner tools assess data and create emission factors that are used in the shipper and logistics assessments as described above. All SmartWay tools create reports that partners use for public reporting needs such as Corporate Social Responsibility Reports, Carbon Disclosure Project submittals and Global Reporting Index reporting. EPA SmartWay provides a degree of credibility for reporting results, especially for carbon foot printing and disclosure, which is a growing trend in business.

### **4. Innovate Operations**

EPA works with partners to help foster innovations that save fuel and reduce costs and emissions. By verifying the performance of fuel saving technologies, EPA helps provide more reliable information to the market and create confidence for carriers to invest in new equipment. By collecting and sharing best practices on operational strategies and providing driver training curriculum, EPA helps SmartWay partners to share and learn new ways to optimize freight operations' energy and environmental efficiency.

### **5. Improve Efficiency**

As partners implement new technologies and strategies, the improved efficiency will be seen in reduced costs and lower grams per mile and grams per ton-mile emissions for freight movement. Carriers can demonstrate their lower emission factors (i.e., improved performance) to their shipper clients (who are increasing demands for cleaner transportation providers), and shippers can demonstrate and report reduced emissions footprints. SmartWay Partners continue this ongoing improvement process from year to year and collectively generate significant reductions of emissions.

## Utilization of SmartWay by EPA for Regulatory Development

Over the past decade, as EPA worked with the trucking and rail sector to develop and implement SmartWay, it developed a collaborative working relationship with key stakeholders, including trucking firms and equipment manufacturers, rail and truck associations, and technology vendors. SmartWay partnership activities created opportunities for EPA to learn from these stakeholders about the challenges and needs of this important economic sector. The technology program provided unique opportunities to develop better data about the real world performance of fuel saving and emission reducing technologies.

EPA conducted much of the testing for SmartWay, bringing together vehicle manufacturers, technology suppliers, testing facilities, technical organizations, and end users to evaluate technologies and vehicle designs of most interest to the heavy duty trucking fleets. These include aerodynamic vehicle features and equipment, idle reduction technologies, new and retreaded lower rolling resistance tire products, and emission control devices.

By identifying and refining test methods, EPA with its SmartWay and industry partners helped to advance the collective technical understanding of how to best evaluate the in-use performance of new and emerging technologies for the heavy duty sector. This insight coupled with the SmartWay data was instrumental in helping EPA to develop a refined understanding of the heavy duty trucking sector, including the performance of heavy duty truck fleets, equipment and technologies, the complexity and diversity of fleet operations and the needs and challenge of this important sector.

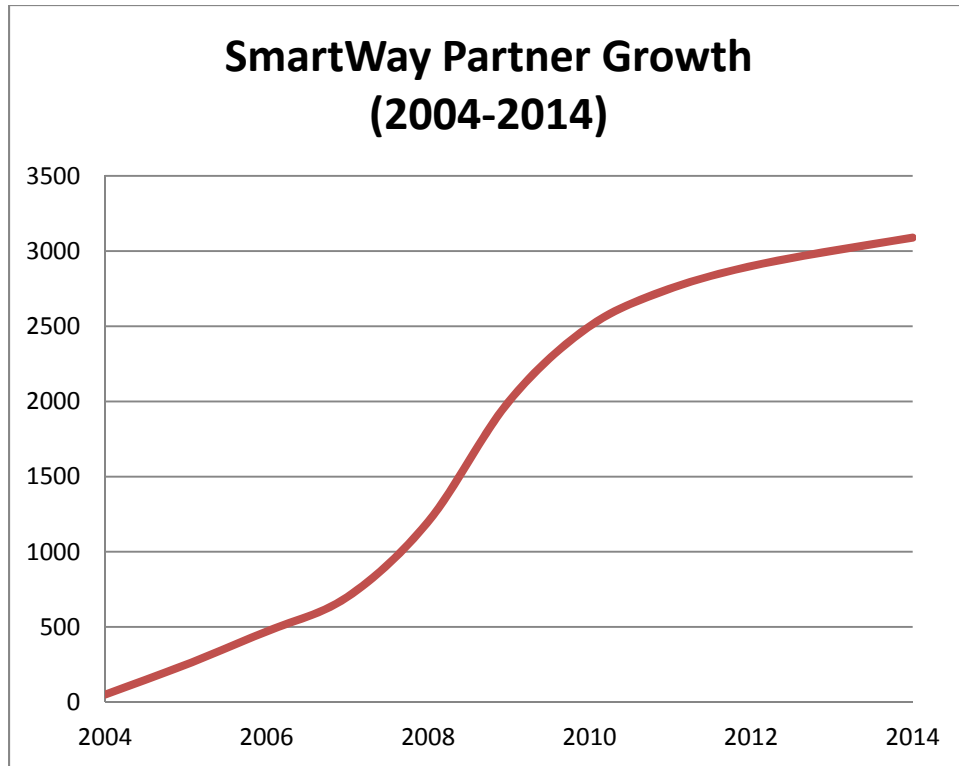
When EPA began development of the Heavy Duty Greenhouse Gas Rule, it drew heavily from the SmartWay experience, including the development of test procedures to evaluate long haul trucks and truck components as well as establishing benchmark performance levels from the use of the best available technologies identified in the SmartWay program. These technologies provide part of the basis for the GHG emission and fuel consumption standards adopted in this rulemaking for certain types of new heavy-duty Class 7 and 8 combination tractors.

## Adoption and Utilization of SmartWay by Industry

The current SmartWay program design and focus is limited to the trucking and rail segments of the goods movement supply chain. Other modes such as barge, air, marine or pipeline are not part of SmartWay.

There are currently about 3,000 total shipper, carrier, and logistics partners and affiliates in SmartWay. Current carrier categories include all Class 1 railroads and over 2,300 carriers registered in the program. Participation in the trucking and rail carrier categories grew rapidly in the early years of the program and has leveled off in recent years. **(Figure 3)** EPA estimates that the truck carriers represent about 10% of the total fleet of commercial trucks in the U.S. and over 25% of the total miles traveled by trucking, both commercial for-hire and private fleets.

Over 2,000 carriers participate in SmartWay. Increasingly SmartWay shippers prefer SmartWay-registered carriers over non-registered carriers with many making SmartWay registration either a requirement or a preference in contracts and RFPs. About 300 logistics firms also participate in SmartWay. Logistics firms procure carrier services on behalf of shipper clients, and they often use SmartWay data and partner status as criteria to broker freight for shipper clients that are requesting SmartWay registered carriers.

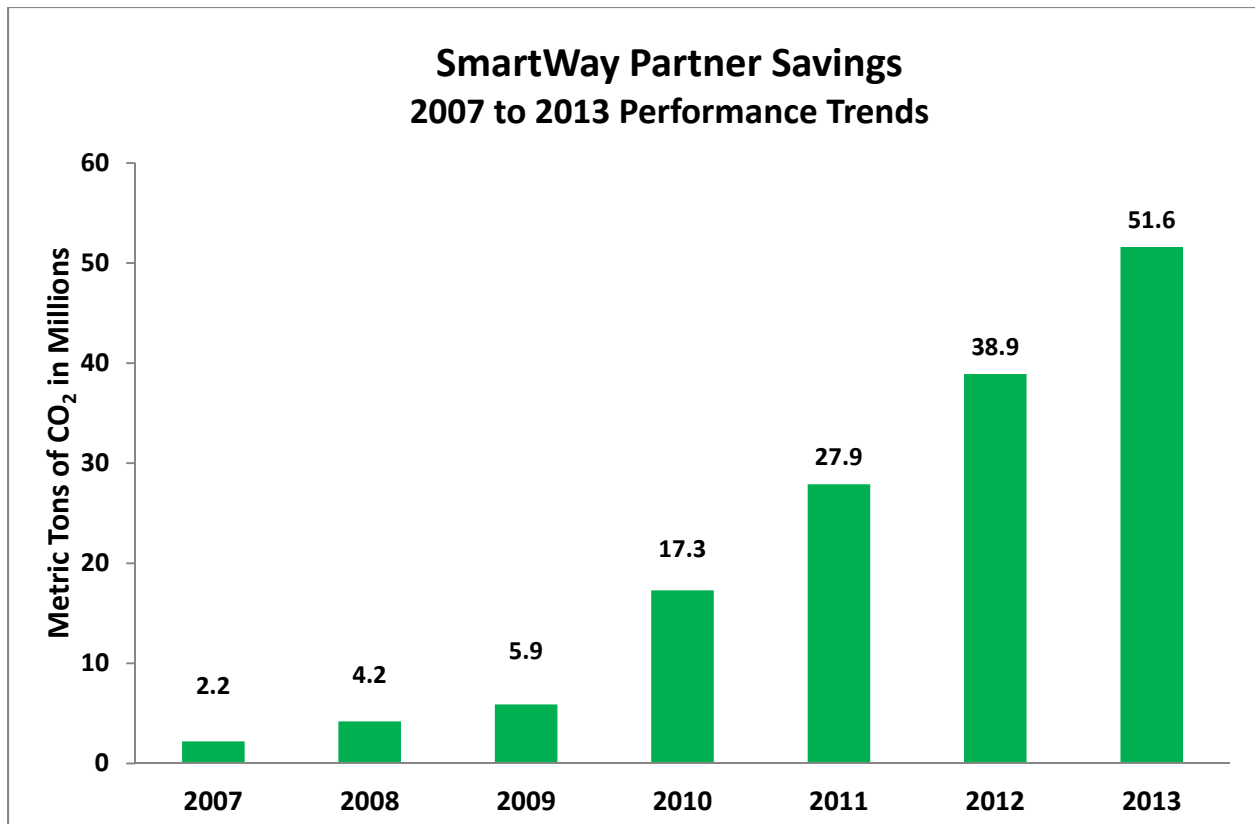


**Figure 3 – SmartWay Partner Growth**

SmartWay calculator tools help companies to assess improvements from year to year and estimates the emissions reductions achieved from efficiency improvements. EPA aggregates the total emissions reductions of all partners to quantify the program results.

Based on data submitted since program launch in 2004, SmartWay Partners have saved:

- 51.6 million metric tons of CO<sub>2</sub> (**Figure 4**)
- 738,000 tons NOx
- 37,000 tons PM
- 120.7 million barrels of oil
- 5 billion gallons of fuel
- \$16.8 billion dollars in fuel costs



**Figure 4 – SmartWay Program CO<sub>2</sub> reductions**

[International Adoption and Replication of SmartWay Program](#)

The SmartWay program has served as a template for other countries and regions which are working to deploy public-private, market based partnerships to address freight emissions. EPA and NRCAN signed a letter of Agreement in 2012 to extend the SmartWay program into Canada. This effort has replicated the SmartWay tools into metric and French versions for use in Canada. EPA and NRCAN work together to create a seamless program for partners in both countries. Mexico replicated 1<sup>st</sup> generation SmartWay tools and methods in its Transporte Limpio program which is administered by the environmental authority SEMARNAT.

EPA collaborated with a range of stakeholders including World Bank, Clean Air Asia, and others to pilot SmartWay technologies in China. Those efforts fostered the development of the Green Freight China Initiative which is being implemented by the Ministry of Transportation (MOT) using many of the program design elements of

SmartWay. In Europe, a consortium of SmartWay partners and other firms developed the Green Freight EU program, again, modeled on many SmartWay program features and processes. Similar efforts are underway in Latin America where other countries like Brazil and Chile are exploring fuel-saving and emission reducing technologies and program opportunities.

The global proliferation of green freight programs like SmartWay has captured the attention of the United Nations and its Climate and Clean Air Coalition. This coalition of countries is working to address short lived climate forcers and has created a Heavy Duty Vehicle and Engines Initiative aimed at reducing black carbon emissions and greenhouse gases. A key element of this initiative includes a Global Green Freight Call to Action and Global Green Freight Action Plan which is using the SmartWay program as a template for replication globally.

### Key Features and Elements of the SmartWay Program

EPA utilizes multiple features of the program to support the Partnership with industry, add value and incentives, and help ensure the program meets its goals. These include:

**Performance benchmarking and reporting tools:** As the program has grown, EPA has worked to evolve SmartWay to keep pace with the challenges and demands of the marketplace and its partner community. The program was launched with a set of simple, “1<sup>st</sup> generation” spreadsheet calculation and reporting tools that used technology surveys to estimate carrier efficiency. In turn, those efficiency estimates served to create relative rankings of carrier performance. While useful to educate carriers about technologies and practices, this method did not provide the emissions factors that shippers increasingly needed to conduct emission footprint analysis and reporting.

Those spreadsheet calculators were recently replaced with 2<sup>nd</sup> generation performance benchmarking tools. These new, existing tools enable partners to perform more comprehensive assessments of their freight operations and provide more data to help optimize performance, increase efficiency and reduce emissions and reduce costs. More information on these tools and methods can be found on the SmartWay Website.

**Data Quality and Assurance:** As SmartWay partners increasingly report and publicly disclose their carbon freight emissions, the program’s influence has grown and it has become subject to greater scrutiny. In response, EPA has taken steps to ensure the



quality and credibility of data reported by partners. EPA created a SmartWay Data Verification Program to achieve this. The effort involves SmartWay staff visits to a sample of partners each year. Through these visits, SmartWay learns the steps its partners take to collect, quality check, and track the data reported to EPA. EPA also has published and shared with its partners and other stakeholders, a “SmartWay Data Best Practices Guidance” document that is available on the SmartWay web.

**Technology verification:** EPA created a technology verification program to raise awareness and build credibility for technologies that carriers can use to save fuel and reduce emissions. EPA learned early in the development of SmartWay, that this technology market was fragmented and that confidence and awareness was lacking in many areas. Many carriers could not afford to risk unproven technologies, or had lost confidence due to unsupported claims by vendors. The SmartWay technology program was created to test and collect data on the performance of idle reduction and retrofit devices, aerodynamic equipment, and tires.

EPA publishes a list of those verified technologies and promotes these categories to industry. EPA also uses the verification program to set criteria for SmartWay designated tractors and trailers. The SmartWay designation program allows for manufactures to build and market equipment with the specification criteria, or for partners to retrofit existing equipment and label it as “SmartWay Designated”

**Partner visibility and recognition:** To encourage and provide incentives for partners to accelerate efficiency improvements, EPA provides opportunities for partner visibility and recognition. These opportunities help EPA to recognize freight industry leaders for their corporate citizenship and achievements in emissions reductions and fuels savings while also encouraging their peers to compete to earn the recognition. EPA does this through the annual SmartWay Excellence Awards program where top performers in each partner category are awarded at a major industry event in front of their peers. Partners compete intensively for these awards and go on to tout their achievements in the media. EPA provides additional recognition and visibility for partners through public service advertisements, partner spotlight articles, panel sessions at industry conferences and through other media channels

**Branding and marketing:** EPA created a SmartWay brand and logo to educate the public about cleaner, more sustainable transportation options. EPA uses the SmartWay brand in the SmartWay tractor and trailer designation program, described above, its affiliate program and a light duty vehicle labeling program in addition to the SmartWay Partnership program. Partners in good standing may use the brand per EPA logo

guidelines to promote their participation in the Partnership and their commitment to improve freight efficiency. Partners use the brand in business-to-business communication, websites, advertising and reporting. EPA creates awareness and visibility for the brand, and thus enhances the SmartWay value proposition for partners, by creating public service campaigns and advertising with the brand. The variations of the brand can be seen in **Figure 5** below.

## SmartWay Brand Marks/Logos



**Figure 5 - The SmartWay logo and its multiple variations**

### Potential Gaps and Limitations of the SmartWay Program

SmartWay program results should be commensurate with the resources applied by EPA and partners alike. The future success of the SmartWay program will require EPA to continue program innovation to ensure that the value proposition remains strong and that it evolves to meet the needs of the market and the partners. While the program results and replication by other countries are indications of the program's success, the

program does have gaps and limitations which are worth noting for purposes of this report and its recommendations to EPA.

First and foremost, for a sustainability program that aims to help the freight sector improve supply chain environmental performance, the program may be lacking in scope. Currently, SmartWay provides tools for improving sustainability to the trucking and rail sector.

While the trucking and rail modes create the most emissions in the U.S., significant emissions are generated in the other freight modes of air and marine. By not including air and marine freight modes in SmartWay, EPA may be forgoing opportunities to leverage partners and market mechanisms in these sectors to generate additional emissions reductions.

Although EPA has limited resources to invest in the SmartWay program, the question of applying SmartWay in all modes of freight transportation, including air and marine is one of the key elements of the workgroup charge. By not helping SmartWay partners to benchmark their entire freight supply chain EPA may be limiting the utility of SmartWay and diminishing the value proposition that it represents. These questions will be addressed later in this report in the section for Air and Marine.

Secondly, EPA and Natural Resources Canada (NRCan) administer SmartWay in their respective countries to address the freight sector in the U.S. and Canada. While this reflects domestic obligations and priorities, it may not effectively meet the more global needs of multinational firms which are sourcing goods abroad and moving them through a global, multimodal supply chain. While the SmartWay template may be adopted internationally, in varying forms, countries which implement green freight programs are more often than not, using tools, methods and metrics which are not necessarily aligned with each other in ways that facilitate the reporting and exchange of key freight data. Again, the impact of SmartWay may be limited domestically, by not enabling its more global partners to complete more comprehensive global supply chain benchmarking.

On a related note, country and regional authorities, as well as investors and consumers are increasingly requiring or demanding carbon accounting and disclosure. This trend is driving more firms to seek tools, methods and metrics to do carbon benchmarking and reporting. SmartWay is used by some of its partners to do this work domestically, yet many firms are forced to use other methods abroad. Experts and industry stakeholders alike increasingly see a need to standardize or harmonize freight supply chain carbon accounting methods, tools and metrics across all freight modes. EPA may

consider opportunities to engage in the growing global dialogue on how to address this challenge, again with the goal of strengthening the domestic SmartWay program.

Third, as the SmartWay program has grown in market influence, and more shippers use SmartWay data in their carrier selection process, EPA has determined that there is more incentive for partners to submit data which overstates performance in order to enhance their ratings in the program. EPA's Inspector General reviewed SmartWay in 2012 and found that while the program has a positive impact on industry, a data verification process should be implemented to ensure the integrity of self-reported data. EPA had already begun to implement such a program at the time of the review and has created a multi-faceted process to address these concerns. These actions included the development of a Data Quality Best Practices guidance document, training and outreach to partners, annual site visits, and tool and data process enhancements which flag any suspect data for further review.

Finally, EPA resources will largely determine the future success of the SmartWay program as partner participation grows and the scope potentially expands to other modes. To administer the current program EPA must allocate funding for staffing to manage the tools, the database and the partner data process, in addition to marketing, education, stakeholder support, technology verification, and other program needs. In order for the SmartWay program to meet goals for continued emissions reductions, and if SmartWay continues to expand to other modes and grow its partner base, EPA will need to consider how budgeting priorities shall be commensurate to support program goals.

## Workgroup Approach

### Developing a Framework for EPA

In examining the charge from the Mobile Sources Technical Review Subcommittee, the SmartWay Legacy Fleet Workgroup determined that the most significant and enduring input it could provide was to suggest an overarching framework for strengthening the program. The aim is to give the agency a structured approach as it considers options for modifying and possibly expanding SmartWay.

This framework consists of four main components:

- 1) Goals and guiding principles,
- 2) A maturity scale for program assessment,
- 3) An evaluation and filtering tool for all transportation sectors and subsectors, and
- 4) Specific recommendations on the main categories of air, marine and nonroad sectors.

### Goals and Guiding Principles

The first and foremost element of this framework involves being clear about the direction and priorities. The workgroup recommends that EPA immediately and clearly articulate its goals for the SmartWay program. To help establish these goals, the workgroup recommends that EPA grow the SmartWay program and enhance integrity by:

- Maximizing reductions of greenhouse gases and criteria pollutant emissions across all transportation sectors
- Increasing the engagement and commitments of more partners and stakeholders, across more sectors
- Continuously improving program assets such as partner tools, web site, education and training, brand equity, database, and data management processes
- Ensuring the validity of results and benefits through rigorous data analysis and research, assessment methodologies, peer review, and QA/QC processes

However, this list does not provide the level of clarity that EPA will need as it works to address various tradeoffs and considers where to focus resources. The MSTRS charge specifically included goals to achieve “further emission reductions and enhanced energy security”. With this charge, clarity is needed on program goals and how to measure SmartWay’s success. Will SmartWay have goals around participation, CO<sub>2</sub>

reduction/fuel savings, criteria pollutants, additional greenhouse gas emissions (GHGs) such as methane and nitrous oxide, and/or black carbon? For example, if the goal is to grow participation in SmartWay, then this will lead to a program that has a low bar for entry and numerous players.

Or, if the main goal is to reduce CO<sub>2</sub> emissions then the agency will need to prioritize those areas with the biggest emissions reduction and fuel efficiency opportunities. Similarly, if the main goal is reduction in criteria pollutant emissions, then the program design may shift from fuel efficiency to incentivizing retrofits and other emissions reduction efforts. If EPA intends to focus on addressing black carbon via SmartWay, EPA may need to use both a 100-year global warming potential (GWP) and a 20-year GWP for scoring credits. This is especially important if EPA intends to focus on addressing black carbon via SmartWay.

Thus, the workgroup recommends EPA consider these recommended goals but take it a step farther by prioritizing them. A logical prioritization could be first to reduce greenhouse gases, second to grow participation, third to strengthen the rigor of the program and fourth to improve program assets.

Additionally, the workgroup recommends that EPA work with other agencies and entities to ensure that this is a national vision for the SmartWay program. It is important to the success of this effort that there is a single program with a single agency leading the way. The government should avoid duplication of efforts in freight sustainability and EPA may work to subsume other related efforts.

The workgroup also identified Guiding Principles and Strategies that are key to the program's success. The workgroup believes that EPA should create value for SmartWay partners and stakeholders by focusing on:

- Increasing partner support and incentives for participation through technical assistance, education, branding and recognition
- Providing robust and user friendly tools for performance benchmarking which increases the flow of information
- Driving development, demonstration and broad deployment of fuel saving technologies and best practices
- Helping partners achieve cost effective fuel savings across all sectors
- Creating broader market demand for fuel efficiency:
  - internal to company operations
  - from customers and clients

- via shareholders and other stakeholders

### Maturity Scale and Evaluation Tool

The second element of this framework is to recognize that there is a progression for firms in various sectors (e.g., marine or nonroad) and subsectors (e.g., container vessel or mining) to participate in the SmartWay program. This occurs naturally as an entity first starts to participate and must learn the procedures and value of such a program.

Over time, partners become more familiar and will seek to grow their involvement and thus the value for them. In recognition of this natural progression, the Workgroup recommends that EPA establish a formal Maturity Scale (**Figure 6**) and Filtering Evaluation tool (**Appendix C**) to better serve the participants and ensure they get as much benefit as possible out of the program. In considering a possible progression, the Workgroup considered three levels or phases to reflect participants growing engagement in SmartWay:

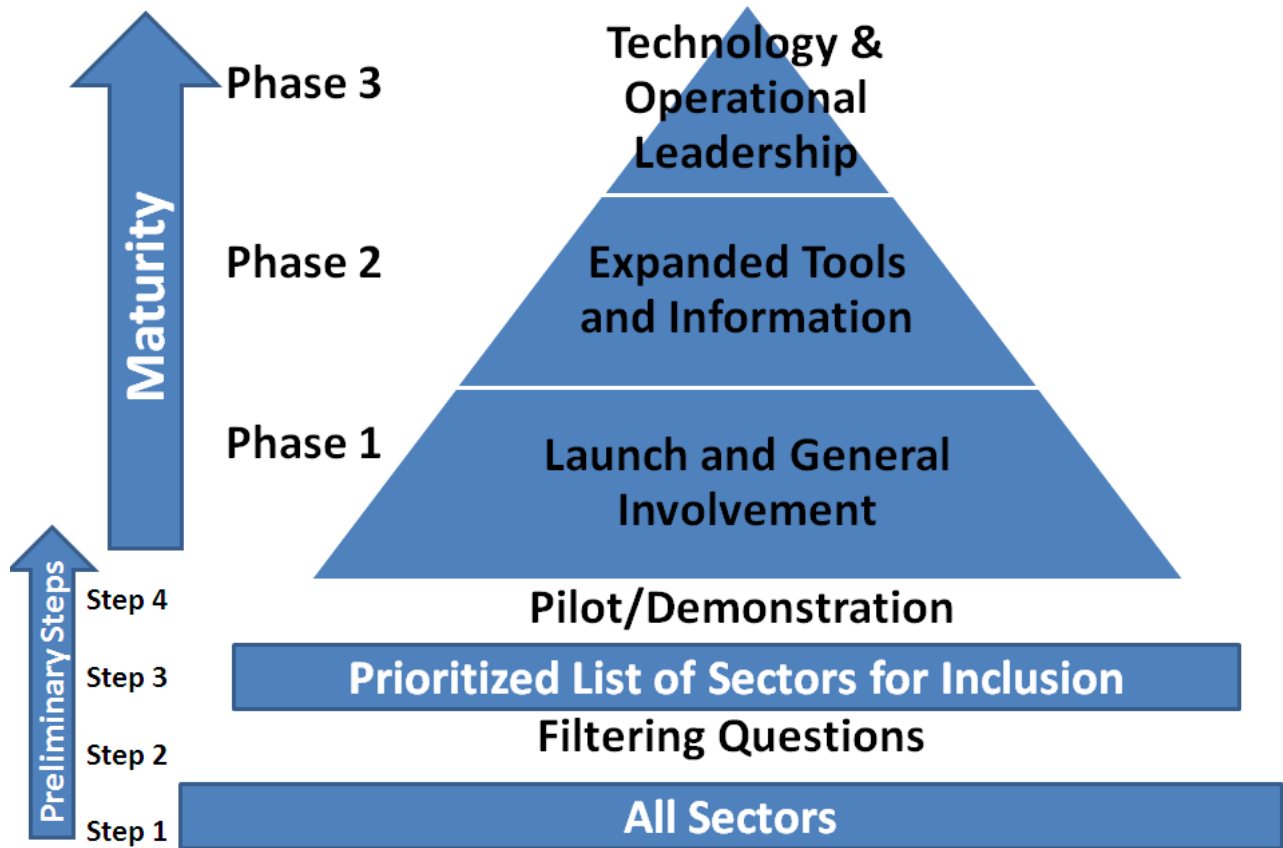
**Phase 1 - Launch and General Involvement** to get as many organizations as possible involved;

**Phase 2 - Expanded Tools and Information** to enhance the tools and add value to the SmartWay partners; and

**Phase 3 - Technology and Operational Leadership** by creating classes of industry and sector leaders so that entities can distinguish themselves from others and drive further GHG reductions.

This approach has several positive aspects. First, it enables EPA to present a vision for how they hope sectors and subsectors may be engaged going forward. Second, it allows for unique considerations by sector instead of a cookie cutter approach. Third, it provides greater value to those who remain active and are industry leaders as a reflection of their increasing priority on the SmartWay program's objectives.

# The Maturity Scale



**Figure 6 - Sector Evaluation and Filtering Process**

For the third element of this suggested framework, the workgroup developed a methodology (described below) for the agency to utilize when considering the inclusion of a sector or subsector into the SmartWay program. This was developed because the decision about what sectors to include in the program is ultimately EPA's to make. The workgroup considered various sectors as examples but does not have the resources or breadth to take on the broad scope needed.

Leaving this to EPA, the workgroup decided to focus its attention and resources on providing a sound methodology so that the agency has a standard process for use over the long-term to facilitate such decisions. The workgroup created the following methodology and tool and recommends that EPA integrate it into their processes.



## **Sector Evaluation and Filtering Process:**

**STEP 1** -- As a first step, EPA needs to determine what sectors or subsectors to consider. The workgroup contends that any sector can be considered for inclusion in the SmartWay program through this methodology. The challenge is doing it at the right level. For example, considering the nonroad sector as a whole will not be effective given the variation and complexity of the sector. This means that EPA will need to segment into subsectors based on similarities that allow vehicles/equipment to be grouped together. These similarities could include how the vehicles or equipment are used, who uses them, and the technologies to improve efficiency, among others

**STEP 2** -- Once a sector or subsector has been identified for consideration, EPA should utilize the filtering tool (see Appendix C) developed by the workgroup to take it through an evaluation process. The tool will promote a standard process consistent with EPA's goals and vision for the program to determine whether a sector should be prioritized for inclusion in the SmartWay program. The tool involves asking specific filtering questions about the market, fuel, technology, operation and efforts already underway to improve efficiency in the sector. Quantitative and qualitative data should be gathered as much as possible in this stage. The workgroup believes this standardized process will make it much more data based and efficient.

**STEP 3** -- After EPA has considered various sectors and taken them through the tool, the workgroup recommends evaluating them together to establish a prioritization. This is accomplished by considering the output from the evaluation tool and plotting the sectors against degree of impact and likelihood of success.

**STEP 4** -- These sectors should then be evaluated and next steps recommended. The Agency should consider the type and level of engagement for each sector. Options include 1) not recommending the sector for inclusion in a SmartWay type program, 2) partnering with another organization focused on GHG reductions for the sector but not through SmartWay, or 3) including it in the SmartWay program.

**STEP 5** -- Once a sector has been recommended for inclusion in the SmartWay program, the Agency would consider the sector's maturity. Different sectors will require different focus. For one sector, the focus may simply be on getting the industry involved while another sector may need to be more focused on establishing differentiation based on technological and operation leadership. The Agency should determine the sector's current maturity level and develop a strategy on how to move it to the next level.

The Workgroup created and then piloted this methodology with various sectors. The methodology has been refined through this process. (see example in Appendix C) However, the overall methodology and tool are not considered final and the Workgroup recommends that EPA tailors and continues to further improve the methodology and tool. Furthermore, the Workgroup recommends that EPA dedicate a resource to implement and integrate them into the Agency's processes to create a more disciplined structure for the SmartWay program over the long-term.

As mentioned, the Workgroup utilized this methodology in considering three main categories of sectors: (1) truck and rail, (2) air and marine and (3) nonroad. Based on our evaluation, the Workgroup has developed multiple overarching recommendations as well as numerous sector-specific recommendations for each of these areas.

## Overarching Workgroup Recommendations

Numerous recommendations specific to each element of the charge were generated from the sub workgroup process and discussions. Those recommendations are made in the latter sections. However, multiple recommendations arose that were common to SmartWay at any level regardless of sector or subsector. These recommendations are offered below as overarching recommendations for EPA to enhance and strengthen SmartWay, independent of any other recommendations or potential policy changes.

### Data Quality Assurance and Quality Control

The long-term credibility of any voluntary partnership program rests heavily upon the ability of independent observers to accept the functionality of program elements, data accuracy and data quality. To that end, the EPA Inspector General's office conducted a review of SmartWay data integrity and the Work Group believes that report serves as a useful validation of existing SmartWay data quality elements and points to continuous improvement opportunities which should be pursued. Specifically, the Work Group recommends:

EPA consider as a core program design principle, the need to balance the need for rigorous data reporting requirements with a user-friendly, simple process that can be readily adopted by business and industry. The program requirements must be credible but not too onerous.

#### **The SmartWay Legacy Fleet workgroup recommends the following:**

- EPA should continue to enhance SmartWay data quality and validity by collaborating and cross-checking with other data providers (i.e., Clean Cargo Working Group), forming data sharing agreements with classification societies, key shipping organizations and companies, and consulting with independent organizations that are doing similar work (i.e., ICCT, academic institutions).
- EPA should continue to enhance the utility of data from new tools, metrics, performance benchmarking and reporting transparency by:
  - Implementing data quality assurance processes via phased approaches
  - Encouraging further transparency by partners

- Identifying opportunities to align with other standard methodologies for data collection, verification and supply chain application.
- Where available, adopt and harmonize data and methodologies for other modes with other recognized entities such as BSR's Clean Cargo Working Group.
- EPA should develop a data audit protocol to communicate and ensure quality of SmartWay data. This protocol should be based on assessments that target the most impactful and widest spread data sources and collection techniques.
- EPA should develop guidelines for third-party data verification.
  - A good starting point for this process would be the CCWG verification protocol. Companies with Environmental Management Systems such as ISO 14001 can incorporate the verification into their periodic audits to minimize the cost. Another idea might be a tiered approach: simplified data reporting (use EPA standards), user-reported fuel use (unverified – might be audited in their financial process), and a top level being third-party verified.
  - Guidelines should specify how/if third-party verification will be used for data dissemination or evaluation of SmartWay partners

### SmartWay Brand and Recognition

The strength of the SmartWay brand is crucial to its success. As is the case with another EPA program, ENERGYSTAR and its appliance label, the brand is most valuable when a high percentage of its target audience is aware of the brand and its benefits.

The SmartWay audience is its partners and potential partners, namely carriers and shippers, and any individuals or organizations with an interest in carbon or fuel reduction or corporate sustainability. The strength of the SmartWay brand can be measured by two core criteria: (1) the level of brand awareness among its core audiences, and (2) the willingness of SmartWay partners to promote their participation—and the participation of others—in the program.

**The SmartWay Legacy Fleet workgroup recommends the following:**

- EPA should conduct research on the level of awareness among partners and potential partners, on the partners' perceived benefits, and to determine its net promoter score; and
- Define the SmartWay brand in a way that leverages its strengths and perceived benefits based on the research; and
- Continue to enhance the tools, resources, awards, and other visibility efforts it offers to its partners.

### Partner Recruiting and Retention

The success and impact of the SmartWay program is driven by an engaged and growing partner base, commensurate with program resources. The SmartWay program needs a wide range of industry participation to help generate the emissions reductions and energy savings projected by EPA. The partnership dynamic depends upon the carriers who operate the fleets from which the emissions reductions are generated, while the shippers and logistics firms drive the demand for more efficient freight services. It is important to include participation of commercial, for-hire carriers as well as private fleets, including large and small firms and potentially owner operators. It is also important to work with shippers in the economic sectors which move the most ton-miles of freight, and the logistics firms which broker the most freight.

While attracting more partners into the program, it is equally as important to retain existing partners. Partner retention is important to program results because emissions reductions are calculated from the change in partner performance from year to year. Partner retention also strengthens the program by maintaining momentum, visibility and support of longstanding partners who champion and promote the program. The SmartWay value proposition must remain strong to help partner retention.

To enhance SmartWay membership recruiting efforts, grow participation, and achieve continued emissions reductions,

#### **The SmartWay Legacy Fleet workgroup recommends the following:**

- EPA should continue to expand the visibility and application of the SmartWay brand in creative and low or no-cost ways to help create more awareness within industry and enhance brand value for prospective and existing partners; and

- Enhance the visibility of SmartWay with consumers through a package labeling program which demonstrates that freight is carried in a more sustainable manner by SmartWay Partners; and
- Utilize social media to promote the program by EPA and SmartWay Partners; and
- Expand the SmartWay program to include other modes of freight as recommended elsewhere in this report; and
- Develop an expert group to advise EPA on new and better ways to market SmartWay more effectively and grow its partner base.

To enhance SmartWay partner retention, and strengthen the existing program to achieve continued emissions reductions, EPA should:

- Continue to amplify partner visibility and benefits through the awards and recognition programs, public service advertisements, and other forums and venues where partners can be recognized for their commitment and achievements; and
- Expand collaboration with SmartWay Affiliates by offering more incentives for them to participate in SmartWay, such as award and recognition opportunities, engagement with senior EPA officials and enhanced social media; and
- Enhance, streamline and simplify partner educational resources, including partner report cards, benchmarking and reporting tools; and
- Continue to provide opportunities for regular information exchange and networking for Partners through webinars, meetings, conferences and other forums.

## Financing

Financing is a critical element in a transition to newer fleets. Given the transient nature of the transportation business, many operators have difficulty competing in the market with regard to obtaining loans and financing the purchase of new engines and maintenance and upkeep of older equipment. Financing provides an incentive for adoption of newer technologies as well as assistance to the industry in complying with regulatory requirements. In an effort to facilitate transition to cleaner and more efficient fleets, EPA should enhance and refine current financing efforts, subject to resource and budget constraints. The following recommendations highlight opportunities to leverage existing resources and maximize investments.

### **The SmartWay Legacy Fleet workgroup recommends the following:**

- Implement small scale pilot projects to demonstrate the cost effectiveness of SmartWay;
- Reassess allocation of resources across regions and prioritize hotspot or heavily polluted areas;
- Require more public/private partnerships to distribute burden of cost share;
- Encourage additional credit in scoring rubric for multi-pollutant reductions;
- Work with lenders and others to facilitate financing of replacement trucks, and adopt minimum eligibility criteria for financing;
- Develop a common application for financing that may be tailored based on regional considerations;
- Work more closely with individual states to leverage state funds with federal dollars; and
- Encourage outreach in areas that may be underserved or have special demographic considerations, for instance minorities or non-English speakers.

### Black Carbon

Though the science of black carbon (BC) impact on climate is rapidly developing, BC emissions have known impacts on public health, the environment, and the Earth's climate. Yet as a voluntary and leading edge program, SmartWay has an opportunity to directly impact BC emissions through its existing focus on particulate matter (in addition to CO<sub>2</sub> and NO<sub>x</sub> emissions). The Agency is capable of distinguishing BC in its assessment metrics and avoid "double-counting" of BC and particulate matter reductions. The SmartWay Legacy Fleet workgroup recommends that BC be included in the assessment metrics for the program as detailed below, with a caveat from one member that EPA continue to keep abreast of the science as it develops.

According to U.S. EPA's March 2012 Report to Congress on Black Carbon,<sup>6</sup> BC is a significant component of particle pollution, which has been linked to adverse health and environmental impacts through decades of scientific research. Recent work indicates that BC also plays an important role in climate change; BC has been linked to a range of climate impacts, including increased temperatures, accelerated ice and snow melt, and disruptions to precipitation patterns. Importantly, reducing current emissions of BC may help slow the near-term rate of climate change. A new comprehensive

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<sup>6</sup> EPA EPA-450/R-12-001 (March 2012), <http://www.epa.gov/blackcarbon/>

assessment of BC climate-forcing<sup>7</sup> – estimates that BC, with a total climate forcing of +1.1 Wm<sup>-2</sup>, is the second most important human emission in terms of its climate-forcing in the present-day atmosphere. Only carbon dioxide has a greater forcing effect, according to the results published in this new study. BC reductions are also one of the short term climate forcing agents that is the focus of a new international coalition under the United Nations Environment Program that includes the United States and Canada, called the Climate and Clean Air Coalition<sup>8</sup>.

For mobile sources, both new engine standards (e.g., EPA's 2007-2010 heavy-duty highway engine standards) that establish strict performance-based standards and particulate filter retrofits of existing engines/vehicles (e.g., EPA's National Clean Diesel Campaign or California's Diesel Risk Reduction Program) can help reduce BC emissions. The availability of ultra-low sulfur fuel is an important enabler to the deployment of BC reducing technologies such as catalyzed diesel particulate filters in the on-road or off-road sectors. While many developing countries have already begun phasing in filter-forcing emissions and fuel standards, BC emissions related to mobile sources in developing countries are expected to continue to increase. According to the previously cited reports, diesel engine particulate emissions accounted for 20% of worldwide BC emissions in the year 2000. Emissions control requirements lag behind in some regions, as does on-the-ground deployment of diesel particulate filters and low sulfur fuels. Further or more rapid reductions in BC will benefit from accelerated deployment of clean engines and fuels.

**The SmartWay Legacy Fleet workgroup recommends the following:**

- Based on BC's importance as a climate forcing agent, EPA should consider enhancements to the SmartWay program that provide partners the opportunity to receive credits related to black carbon reductions associated with the use of particulate filters on new and existing engines employed by SmartWay partner fleets.
- This credit would be in addition to the current SmartWay scoring method that accounts for reductions in particulate matter (PM) emissions from trucks used in freight transportation. This additional BC credit would further incentivize fleets to

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<sup>7</sup> Bond et al., Bounding the Role of Black Carbon in the Climate System: A Scientific Assessment, *Journal of Geophysical Research: Atmospheres* (2013), <http://onlinelibrary.wiley.com/doi/10.1002/jgrd.50171/abstract>

<sup>8</sup> <http://www.unep.org/ccac/>



employ retrofit diesel particulate filters on older engines and/or replace older trucks with newer, particulate filter-equipped trucks.

- This black carbon reduction credit could also be extended to off-road or locomotive fleets as part of an expanded SmartWay program. A BC reduction credit may have more significance outside the U.S. in countries or regions that have less aggressive engine and fuel standards, and transportation fleets with low utilization of BC reduction technologies such as diesel particulate filters.
- As part of implementing a BC credit in SmartWay, EPA will need to determine an appropriate BC credit value based on the available science related to the estimated climate forcing factor for BC and an averaged BC content of particulate emissions from diesel or other types of engines used in the SmartWay program. The BC content of particulates emitted by engines will likely vary by engine type and engine technology content.
- As part of the international interest in SmartWay-like, green freight initiatives, EPA should strongly encourage the availability of ultra-low sulfur transportation fuels in developing countries to further facilitate BC reductions from the transportation sector associated with the use of particulate filters on new and existing diesel engines.

### Operational Strategies

Current EPA SmartWay Tools allow partners to describe a variety of operational strategies as part of their tool submission. These worksheets are unstructured in nature and are mostly “for information only” to EPA and are not directly tied to the scoring system or systematically shared between partners.

There are many practical, cost-saving operational practices that shippers can implement to meet carbon reduction goals. The report for shippers currently includes placeholders for reporting miles removed from the system, weight removed from the system, and modal shift. The criteria should be expanded to include additional carbon-saving operational strategies that shippers can implement. Below are some of the most widely used ones:

- Choose the most carbon-efficient transport mode possible.

- Choosing rail over road
- Choosing barge over road
- Choosing ocean over air
- Collaborate with other shippers, competitors, and service providers
  - Collaborative distribution
  - Co-loading freight
  - Backhaul matching
  - Flexible customer deadlines to enable consolidation
- Redesign your logistics network.
  - Optimizing for carbon-efficiency
  - Strategic location/upgrading of facilities to enable more carbon-efficiency modes
- Get the most out of every move, every day.
  - Container utilization (e.g. matching import/export containers)
  - Co-loading freight
  - Reducing empty backhaul
  - Package redesign for logistics

Partners are already implementing a variety of these strategies and it will be beneficial to the program to promote them widely, recognize their efforts and to provide resources for others to learn from these efforts.

SmartWay can also be a catalyzer and promoter of system-wide operational strategies. For example, matching export containers with import containers for import shippers. Many large import distribution centers have hundreds of empty containers, on site, which have to be transported back to the port of origin. This creates opportunities for shippers to reduce emissions (and congestion) by matching these empty containers with export loads. Walmart, for example, imports approximately 700,000 containers per year. If Walmart matched 25% of these it could result in potential fuel savings of 5,250,000 gallons of fuel per year.

**The SmartWay Legacy Fleet workgroup recommends the following:**

- Raise the bar for environmental performance of Shippers. The current reporting system should be expanded to include additional and more comprehensive operational strategies.
- The index for SmartWay Shippers should include establishing a carbon reduction target and publicly reporting it. Shippers like Nike have taken the lead in setting goals for supply chain carbon reductions. Nike has set an ambitious goal to reduce carbon emissions from inbound logistics by 30 percent from 2003 to

2020. Other shippers can, and should, be encouraged to do the same and set aggressive and achievable goals for their transportation system. With a public target available, documented operational strategies could be tied to absolute reductions.

- Ability to formally select (via checklist for example) to capture the operational strategies being used by partners. Partners will need to submit case studies or other documented reports to obtain “scoring points” on the strategies. Allow all partners to review case studies that outline how companies have achieved cost and environmental savings. See [http://ctl.mit.edu/research/case\\_studies\\_carbon\\_efficient\\_logistics](http://ctl.mit.edu/research/case_studies_carbon_efficient_logistics) for an example on how a case study can be written or submitted. These case studies can be organized by partner type, year, operational strategy, savings potential, etc. This will become a repository for others to look for inspiration and support the improvement of all partners.

As these operational strategies involve multiple parties (e.g. shippers, carriers and 3PLs), a clear reporting structure needs to be defined to avoid “double-counting” of fuel and/or CO<sub>2</sub> savings. A “Scope 1” vs. “Scope 3” approach similar to the GHG Protocol, could be used to differentiate CO<sub>2</sub> savings from owned assets vs. third-party assets.

## Truck and Rail

The U.S. economy is dependent on the freight sector to move commodities, food and manufactured goods, both for domestic consumption and for import and export. Over 17 billion tons of freight move each year across 4.1 million miles of roadways and 139,000 miles of railroad. Over \$16 trillion worth of freight is shipped yearly, or about \$46 billion worth of freight daily, creating significant economic activity.<sup>9</sup>

The trucking and rail sectors dominate freight activity in the U.S., in terms of weight shipped, energy used and GHG emissions generated from freight activity. Freight tonnage of trucking alone exceeds all other modes combined (**Figure 7**). Rail is a distant second, followed by water, pipeline and multimodal shipping, with air taking a small fraction.<sup>10</sup> Trucking accounts for about three-fourths of freight transportation energy consumption.<sup>11</sup> While freight accounts for about one-fourth of total transportation GHG emissions<sup>12</sup>, freight transportation GHGs has grown twice as fast as that for passenger travel since 1990.<sup>13</sup> Trucking accounted for the lion's share of freight emissions followed by freight rail, a distant second.<sup>14</sup>

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<sup>9</sup> U.S. Department of Transportation, Research & Innovative Technology Administration Bureau of Transportation Statistics, *Transportation Statistics Annual Report 2012* (Washington, DC: 2013) [http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/transportation\\_statistics\\_annual\\_report/2012/index.html](http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/transportation_statistics_annual_report/2012/index.html)

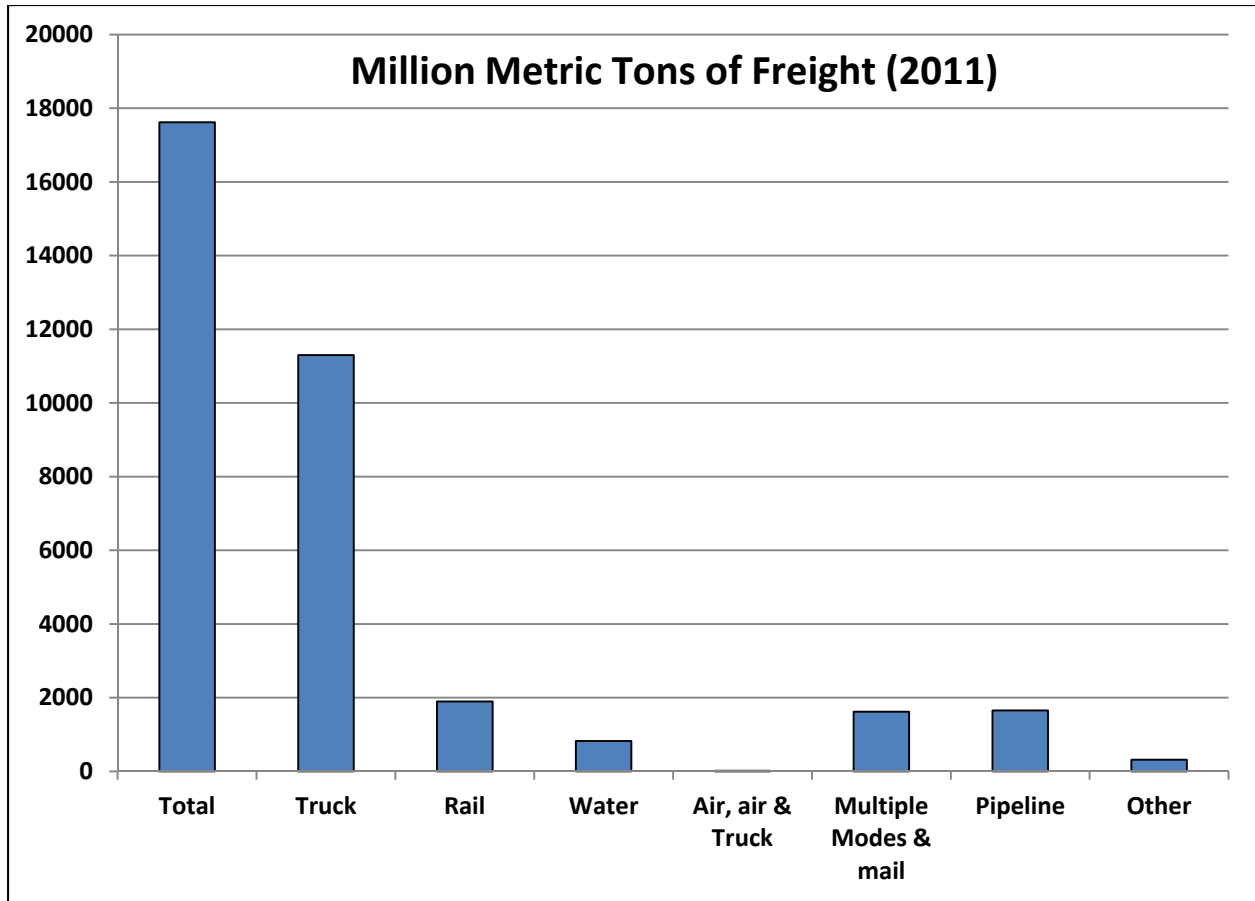
<sup>10</sup> U.S. Department of Transportation, Federal Highway Administration Office of Freight Management and Operations, *Freight Facts and Figures 2011* (Washington, DC: 2011) FHWA-HOP-12-002 [http://www.ops.fhwa.dot.gov/freight/freight\\_analysis/nat\\_freight\\_stats/docs/11factsfigures/index.htm](http://www.ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/docs/11factsfigures/index.htm)

<sup>11</sup> US DOT Freight Facts and Figures 2011

<sup>12</sup> US DOT Transportation Statistics Annual Report (2012)

<sup>13</sup> US DOT Freight Facts and Figures 2011

<sup>14</sup> US DOT Freight Facts and Figures 2011



**Figure 7 – Freight Tonnage by Mode<sup>15</sup>**

EPA focused its SmartWay efforts on the truck and rail freight modes primarily because they are the dominant areas of freight activity and have the greatest environmental impact domestically. By dedicating limited program resources to these modes, EPA could drive efficiency gains, cost savings and emissions reductions more strategically than if SmartWay were launched in every mode of the freight sector. While the program currently includes the participation of the Class 1 Rail lines, and over 2,300 carrier partners, it represents a fraction of ground based freight activity in the U.S. The recommendations that follow are intended to strengthen and grow the impact of the partnership and the results.

<sup>15</sup>[http://www.ops.fhwa.dot.gov/freight/freight\\_analysis/nat\\_freight\\_stats/docs/12factsfigures/pdfs/fff2012\\_highres.pdf](http://www.ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/docs/12factsfigures/pdfs/fff2012_highres.pdf) US DOT Freight Facts and Figures 2012

## Vocational Trucks

The Vocational Truck business subsector is a diverse and complex combination of specialized vehicles and fleet sizes that differs substantially from line-haul truck applications. Vehicles can range from higher volume city delivery vans and waste haulers, to low volume, very specialized severe duty vehicles used in energy exploration and unique combinations of on and off road use as well as use in powering driven equipment such as pumps, cranes, drill rigs and other specialty work tools. As a result, the impact of SmartWay technologies can vary widely.

For example, It can be presumed hybrid technologies could have benefit in applications where energy recovery through braking or repetitive work cycles are a feature of the product application while technologies such as aerodynamic features and low rolling resistance tires may have little or no effects in the vehicle's operation. Ownership characteristics also vary from large, international parcel delivery firms, to small, owner-operator severe duty dump trucks, where the freight shipping business case and shipper/carrier dynamic may not be applicable. More detail on a draft filtering analysis of this segment is available in Appendix C.

### **The SmartWay Legacy Fleet workgroup recommends the following:**

- EPA should limit its focus on Vocational Trucks to the existing fleet-based focus on operators of large refuse, delivery or utility truck fleets.
- EPA should put emphasis on specific technologies appropriate to the targeted Vocational Truck sub-segments to optimize program value. This may include hybridization for fleets where energy capture, storage and reuse are most feasible.
- EPA should not attempt extension of the SmartWay program to highly specialized owner-operator vehicles with non-freight operations where limited benefit can be expected and program requirements would discourage participation
- To the extent targeted Vocational Truck applications serve smaller groups of dominant customers such as utilities, municipalities or other enterprises, EPA

should seek to offer those entities a participation route in SmartWay similar to the Shipper – Carrier model used in line haul freight.

### Drayage Trucks

Drayage trucks play a critical role in moving freight from ports, railheads and borders via short haul to distribution hubs. Generally speaking, EPA should focus drayage program efforts on the medium and larger port drayage carriers (50 + tractors) because data collection and program requirements may be too onerous for smaller carriers and individual owner operators.

Generally speaking, drayage owner operators must contract with a licensed motor carrier because motor carriers have interchange agreements with steamship lines, railroads and other third party equipment providers in order to use their equipment. Many large shippers require Electronic Data Interchange (EDI) which is expensive and beyond the financial and technological capability of owner operators. The Intermodal Association of North America has data in this area.

#### **The SmartWay Legacy Fleet workgroup recommends the following:**

- EPA should consider the development of a web based calculation tool that would be easier for the medium and smaller drayage carriers to use. Possibly modeling the tool after some e-commerce web sites would encourage use.
- With respect to the drayage carrier community, the EPA should consider the development of port metrics. Numerous Marine Terminal Operators are installing automated technology to process trucks through the Port. Specifically, they are installing RFID tags on drayage tractors in order to identify the specific tractor as it enters and leaves the terminal. This technology could be used to measure the idling time within the terminal as well as the idling or queue time outside of the terminal.
- EPA could work with importers, exporters, freight forwarders and third party logistics companies to encourage the use of SmartWay drayage partners.

## Logistics

Logistics include a variety of actors that facilitate the movement of goods between shippers and customers. The current EPA SmartWay program was primarily designed to support two of those actors: shippers and carriers. As the program expands to other actors such as warehouse operators, ports and third party logistics providers, additional considerations are needed.

### Third Party Logistics Providers (3PLs)

In the last 10 years, the Third Party Logistics (3PL) industry has developed a number of business models that have proved challenging to the SmartWay program. 3PL business models can be broken down in two ways: non asset based vs. asset light (with limited internal fleets) and transportation brokerage (where the 3PL contracts with and selects the carrier and often the mode) vs. shippers agent (where the shipper selects and contracts directly with the carrier and the 3PL executes the load). These varying business models have important ramifications in data collection and scope of activities captured by the EPA SmartWay program. Specifically, there is an added increased complexity around which shipments to include when reporting data to EPA SmartWay. In addition, different operating units within a 3PL have specialized functions and are further broken down by geography or mode.

A salient issue around the participation and measurement of 3PLs is how to incorporate process and mode selection in the SmartWay data. 3PLs often adjust their operations by lane (e.g. origin-destination) to obtain higher efficiencies or to support new customer requirements. For example, when a 3PL switches a truckload lane to an intermodal lane, how should that mode change be counted? What characteristics qualify as a mode change? How long should the benefits of a mode change be counted – for 6 months, for one year?

Another important characteristic of 3PLs is the degree of specialization. If a 3PL specializes in a specific segment of the industry, the underlying carrier base could have very different participation rates amongst carriers within the SmartWay program. For example, a 3PL that has a large mix of LTL transactions will automatically route more transactions on SmartWay carriers than a 3PL who has a higher mix of TL transactions. Geography and contracting requirements increase the dimensions that may affect a 3PL's ability to fit existing SmartWay reporting strategies. More detailed definition and guidance is needed in order to better enable a comparison across 3PL market



segments.

### Other Logistics Actors

Warehouse operators, ports and freight terminals are part of the logistics network. Fuel and energy may be consumed at each of these locations. 3PLs, freight forwarders and shippers have a variety of footprints and strategies to manage these activities. It is unclear the value of adding these actors to the EPA SmartWay program since (a) energy consumption and not fuel consumption is often the main driver of GHG emissions ; (b) GHG is not their environmental priority (e.g. pollutants) and (c) other programs are being designed to support the specific characteristics of those actors (e.g. BSR and terminal operators)

Thus, EPA should further refine the participation and measurement of logistics companies in the SmartWay program as described in the recommendations below.

The SmartWay Legacy Fleet workgroup recommends the following:

- Keeping the focus on 3PLs and not branching into other actors of the logistics system.
- Providing clear definitions and instructions to 3PLs on which transactions to include when reporting to SmartWay. This should include guidance on how and whether to report freight moved on their own assets or others and guidance on whether shipments routed to carriers by shippers should count for a 3PL. Adopting a “Scope” based model similar to the one adopted by GHG Protocol for corporate reporting may be a starting point to help refine reporting guidelines.
  - Specifically, the “shippers’ agent” model of 3PLs should not be part of the EPA SmartWay program reporting since those decisions are fully controlled by the shipper.
- Providing clear definitions and instructions on how to classify and count mode changes and process improvement changes such as reducing detention time and increasing load factors for shippers and reducing dead-head miles for carriers. This is one of the top values a logistics company provides and certainly the most controllable variable in emission reduction. While a 3PL isn’t choosing which specific truck will haul each load, they can and do help their customers redesign

lane efficiency.

For this reason it is critical to capture this component. With a clearly defined methodology in data collection processes and expectations, this true representation of the part 3PLs play in reducing emissions and increasing efficiency would more accurately represent their unique contribution to the program instead of re-counting previously measured carriers.

- Setting mode specific SmartWay participation goals to accommodate the different modal focus of 3PLs (LTL, Intermodal, TL, etc.). For example, should LTL shipments be tendered to SmartWay carriers 85% of the time while Intermodal shipments should be tendered 95% of the time?
- When reporting and summarizing 3PL performance, SmartWay should differentiate between carrier fleet sizes in order to avoid a bias toward carriers with more than 100 trucks in their fleets. Just as mode specific goals should be more refined, fleet size should be used to differentiate and reflect the potential utilization by 3PLs. For example, fleets of 100 or more could have a utilization goal above 70% while fleets of 20 or less could have a utilization goal of more than 20%.
  - Geographical focus also has an important impact in overall 3PL performance. As such, EPA SmartWay reports should provide the right level of detail to users of final benchmarking metrics

### Small Carriers and Owner Operators

The single biggest area of opportunity to increase participation for SmartWay is in the small carrier and owner operator segment of the truck load market. However, it has been well documented that it is more costly on a per truck basis for SmartWay to manage and approve smaller fleets and owner operators compared to larger fleets. Participation rates in SmartWay drops considerably once you look past the largest 1,000 trucking companies in the country. There are still tens of thousands of trucking companies that can benefit by participating in the SmartWay program.

In order to drive increased participation and awareness of the SmartWay program among small fleets and owner operators, EPA should consider the recommendations outlined below.

### **The SmartWay Legacy Fleet workgroup recommends the following:**

- Continue to invest in equipment testing and verification. Small carriers and owner operators find value in quality third party accreditation of the many types of technology and products available to improve fuel efficiency and reduce emissions. This is often the exposure small fleets and owner operators have to the SmartWay brand and program.
- Identify a more practical entry point for small fleets and owner operators. This may include submitting self-validated data to a third party (like a 3PL) who can facilitate their data collection and participation in a way that minimizes the administrative burden for EPA and the resource constrained small carriers, while creating value and achieving additional cost savings and emissions reductions.
- Consider a web based tool which would be based on E-Commerce sites and would be easy to use by smaller carriers with limited resources. This could also include a “self-reported” designation for very small fleets that certify to a handful of requirements in order to be considered SmartWay partners.
- Explore facilitating better access to more capital for small fleets through contacts within government and the NGO community.
- Differentiate between carrier sizes within the TL sector, in order to avoid a bias toward carriers with more than 100 trucks in their fleets. Just as mode specific goals should be more refined, fleet size should be used to differentiate and reflect realistic potential utilization by shippers and 3PL’s. For example, fleets of 100 or more could have a utilization goal above 70% while fleets of 20 or less could have a utilization goal of more than 20%. This would provide focus for shippers and 3PL’s to both reach meaningful goals for utilizing small carriers and owner operators while not creating a potential bias towards large carriers.

## Driver Training

Training that targets fuel efficiency and maintenance offers multiple benefits that help drivers recognize and change driving habits that waste fuel. While efficiency practices reduce fuel costs, they can also save longer term maintenance costs, and improve safety. Even highly experienced truck drivers can boost skills and enhance driving performance through driver training programs. For example, driving 65 mph instead of 55mph can use up to 20 percent more fuel, idling a typical heavy-duty engine burns about 0.8 gallons of fuel per hour, and driving with the engine rpm too high can waste several gallons of fuel each hour. Other common habits that reduce fuel economy are frequent or improper shifting, too-rapid acceleration, too-frequent stops and starts from failing to anticipate traffic flow, and taking circuitous routes. Driver training programs can produce fuel savings of 5% or more, with some studies showing much greater results.

To support SmartWay partners and industry efforts to enhance driver performance, EPA collaborated with Natural Resources Canada to create an online training course to help drivers boost skills and save fuel. This self-directed, multi-media curriculum was launched in 2011 as the “SmartDriver E-Learning” program<sup>16</sup> and is available online, for free to all industry and public.

### **The SmartWay Legacy Fleet workgroup recommends the following:**

- The SmartWay program should be integrated into driver training schools as a good way to encourage participation in the program. This would generate more awareness of SmartWay and expand the base of drivers who are knowledgeable about how to collect and report data.

## SmartWay Designated Trucks

The verification and designation of SmartWay OEM equipment such as SmartWay trucks and SmartWay technologies, including retrofit technology equipment, play a critical role in marketplace. The workgroup strongly support EPA’s continued role in certifying and verifying such technologies.

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<sup>16</sup> <http://fleetsmartlearning.nrcan.gc.ca/Saba/Web/Main>

SmartWay provided substantial and valuable insight into Class 8 over-the-road fuel efficiency improvement and emission reduction technologies that furthered Agency understanding of the technical and business models available and utilized by the truck freight industry. This information provided critical background information for the Agency's Phase 1 Greenhouse Gas and Fuel Efficiency rulemaking that mapped a regulatory course for a 10% to 20% improvement (depending on truck class) in fuel efficiency and commensurate GHG reductions from the nations' medium and heavy-duty on-highway truck fleets. Many of the SmartWay promoted technologies and product attributes are now commonplace on the nation's roads and are being incorporated in certified configurations aimed at meeting the Phase 1 rulemaking, for model years 2014-2018. To further their penetration into the market, it is important these technologies remain within the SmartWay portfolio of choices as Phase 1 is implemented.

With widespread acceptance and integration of these technologies into the nation's fleet, it is now opportune for SmartWay to look ahead towards technologies and attributes that can inform and support the Phase 2 rulemaking in this area. The unique voluntary and market drive focus of SmartWay provides the Agency with a special opportunity to examine the practical and economic benefits of new technologies and understanding of appropriate scope and stringency in the Phase 2 rulemaking.

**The SmartWay Legacy Fleet workgroup recommends the following:**

- EPA should ensure the SmartWay program is aligned with any regulatory development program or research initiatives seeking to verify the performance of fuel saving technologies that might be incorporated in the Phase 2 rulemaking. This alignment needs to occur across Agency boundaries and governmental organizational roles & responsibilities.
- EPA should strive to improve and streamline the technology verification process for all sectors including how to make the process more accessible to all suppliers of promising technologies, with a view toward cost effective verification. Setting nominal timeframes for verification should be considered along with a transparent reporting process for verification status.
- EPA should consider a baseline of efficiency improvement to prioritize verification and programmatic elements. The workgroup recommends EPA assess future/emerging technologies that could be part of SmartWay portfolio and support to

overcome market barriers to adoption of those technologies. This includes calculating their costs, identifying and addressing market barriers, and quantifying energy and monetary savings of the SmartWay verified products.

- EPA should refine the baseline level of performance for SmartWay tractor designation requirements for 2014 and later model year tractors to match the Phase 1 rulemaking requirements and recognize decisions that add SmartWay technologies beyond those included in certified tractor configurations. Higher performance thresholds might be derived by looking at the bins in the regulation and pattern the SmartWay designation on the higher efficiency bins with improvement over time (e.g., raise the bar). The designation may include an updated or enhanced vehicle identification label to reflect the improved performance.
- EPA should continue the trailer aspect of the SmartWay program adding programmatic enhancements that could inform and support the Phase 2 rulemaking that may potentially include future trailer regulation.
- EPA should extend the application spectrum for the SmartWay program by including aspects of vocational truck utilization such as hybridization in start/stop fleets or in work tool oriented vehicles that include energy efficiency gain opportunities.
- The work group recommends that any alternative fuel technologies included within the program be measured against a common fuel performance baseline from traditional diesel or gasoline fuels. The analysis should be based on energy efficiency per unit of work performed and consider any non-regulated aspects of the technology's emissions impact.

## Rail

The U.S. economy depends on a multi-modal transportation system that efficiently links businesses with consumers, suppliers, and markets. Freight rail transportation meets this need with a vast network of over 139,000 miles of rail lines, operated by seven national Class I railroads, 21 regional Class II and 500 local Class III railroads.<sup>17</sup> These

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<sup>17</sup> U.S. Department of Transportation, Research & Innovative Technology Administration Bureau of Transportation Statistics, *Transportation Statistics Annual Report 2012* (Washington, DC: 2013)

rail operators connect U.S. consumers with agricultural, economic, logistics, and manufacturing centers domestically and with Canada and Mexico. In 2011, railroads carried 1.7 trillion freight ton-miles.

**The SmartWay Legacy Fleet workgroup recommends the following:**

- Because rail lines do not necessarily compete against each other in the same markets, they do not need to be ranked for comparison purposes. Rail emission factors should be provided in alpha listings rather than bin rankings.
- Comparing rail freight efficiency to truck freight efficiency is not easily done using volumetric metrics like TEU-mile for a truck equivalency factor. SmartWay should use a g/ton-mile or revenue ton-mile metric for comparing truck and rail freight.
- All railroads which commit to participate in SmartWay and submit data as required, should qualify to use the SmartWay Logo as recognition of that commitment. SmartWay should consider using a second tier logo to indicate superior environmental performance.
- SmartWay should incorporate operational strategies (e.g., rail lubrication, idle reduction) into the rail performance benchmarking system.
- SmartWay should revise the rail data reporting timeline to account for the Federal data reporting requirements (R1 Report) which are not due until June each year.
- EPA should enhance the visibility of and recognition for Rail participation the SmartWay program.

### Transportation Refrigeration Units

Transportation Refrigeration Units (TRU) are necessary to carry perishable goods and prevent their spoilage. These are attached to insulated containers and operate

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[http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/transportation\\_statistics\\_annual\\_report/2012/index.html](http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/transportation_statistics_annual_report/2012/index.html)

separately from the main engine via an alternative power source. TRUs produce carbon dioxide emissions during their operation. They also release refrigerant emissions with high global warming potential during the course of their lifetime, both through regular leakage from valves and hoses as well as irregular leakage from poor servicing practices and improper disposal. The transport of perishable goods requires that TRUs operate for long periods of time, including when the vehicle engine may be switched off and deliveries are being made, resulting in the consumption of significant amounts of fuel. Furthermore, the climate impacts of refrigerant emissions from TRUs are unregulated

**The SmartWay Legacy Fleet workgroup recommends the following:**

- EPA should have Partners account for the use of fuel in refrigerated containers and trailers in the SmartWay index scoring system.
- Additionally, EPA should incentivize and support the adoption of more efficient TRUs and low global warming potential (GWP) refrigerants as specifically outlined below.
  - The priority policy or strategy for TRUs should be to incentivize and accelerate the upgrade or purchase of refrigeration systems that utilize high efficiency technologies like electric compressors and other strategies. Information about the availability and cost of technologies to improve efficiency of TRUs is something SmartWay can and should provide. For instance, a transition to low GWP refrigerants during the purchase of new equipment should be rewarded with additional credits.
  - The operational strategies feature of the SmartWay tools could include credit for partners checking the leak rates of refrigerants on a routine basis.
  - Because low refrigerant charge increases fuel consumption of TRUs, the regular maintenance of TRUs to ensure proper refrigerant charge and identify irregular leaks should be given some form of credit in SmartWay.
  - Because the efficiency of TRUs can be affected by alternative refrigerants, and depending on operational conditions, EPA should provide information to educate potential purchasers regarding the appropriate improved alternative refrigerants and more efficient systems that make sense for each application.



- As an example for EPA to consider, the Clean Cargo Working Group incorporates the energy difference for dry container and refrigerated containers for ocean going vessels. The methodology determines separate factors for each trade lane based on these differences. This concept could be adopted for other modes by developing tables for average fuel consumption by temperature set points, thus simplifying the process vs. adding fuel use tracking for TRUs.

## Air and Marine Freight Sectors

### Introduction

The marine and air freight sectors represent respectively about 5% and 8%<sup>18</sup> of the energy used to transport goods in the United States. Historically, each sector has experienced steady growth on a global basis in the 20th century (4.0% per year for marine [1] and 7% per year for air freight [2]). This growth was in large part driven by increasing global specialization, and expanded supply chains. These trends persist for the maritime sector even through the recent economic recession. During that time, modal shifts have led to a contraction of air freight volumes that appear to be permanent. Air freight volumes are at approximately 2003 levels and aren't expected to increase until the global economy fully recovers. This growth is in large part driven by increasing global specialization, and expanded supply chains. As SmartWay seeks to improve the efficiency of freight transport in the United States, it is critical that the program understands the market, regulatory and technology drivers underlying the current performance of the marine and air freight sectors. Engaging in these sectors would enable the SmartWay program to have a more comprehensive view of goods movement to and from the United States. SmartWay may have an opportunity to standardize GHG performance indicators, document and publicize best practices, and promote the most efficient carriers. SmartWay could leverage industry-led and regulatory efforts with similar aims, to streamline data collection requirements and amplify the program's reach.

It is important to note the substantial differences between the marine and air freight sectors in terms of scale, market structure, and energy intensity. Domestically, about 10 million metric tons of freight was moved by air in 2010<sup>19</sup> compared to about 800 million metric tons of freight moved by ship in the same year<sup>20</sup>. From a metric ton-kilometer perspective, again domestically, about 18 billion ton-km were carried by air domestically in 2010<sup>21</sup> compared to 730 billion ton-km of freight carried by water<sup>22</sup>. Internationally, air and ocean cargo account for 143 billion<sup>23</sup> and 65 trillion ton-km<sup>24</sup> globally.

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<sup>18</sup> Oak Ridge National Laboratory (2012) "Transportation Energy Data Book" Edition 31

<sup>19</sup> [http://www.transtats.bts.gov/Oneway.asp?Display\\_Flag=0&Percent\\_Flag=0](http://www.transtats.bts.gov/Oneway.asp?Display_Flag=0&Percent_Flag=0)

<sup>20</sup> Oak Ridge National Laboratory (2012) "Transportation Energy Data Book" Edition 31

<sup>21</sup> BTS "Air Cargo Summary Data" <http://www.transtats.bts.gov/freight.asp>, Retrieved on January 25, 13

<sup>22</sup> Oak Ridge National Laboratory (2012) "Transportation Energy Data Book" Edition 31

<sup>23</sup> World Bank (2013) "World Development Indicators" <http://databank.worldbank.org/>

<sup>24</sup> UNCTAD (2012) "Review of Maritime Transport 2011"

Two major providers (FedEx and UPS) dominate the domestic air freight market. The marine sector is somewhat less concentrated with the top 20 operators controlling nearly 70% of the TEU (twenty-foot equivalent unit) capacity globally<sup>25</sup>. Moving goods by air emit 47 times as much CO<sub>2</sub> per ton-mile (32 per metric ton-km) as moving goods by ship<sup>26, 27</sup> although airlines account for only 2 percent of the nation's man-made greenhouse gas (GHG) emissions. Of course these modes are seldom direct competitors. Moving goods by air is more expensive than other modes and is often reserved for high value or highly perishable freight<sup>28</sup>. Marine cargo ranges from bulk materials and agricultural products to manufactured goods, vehicles and refrigerated cargos.

As inherently transnational transportation modes, shipping and aviation are regulated by international United Nations-affiliated bodies. Through the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO), member states work together to define the rules and regulations that govern shipping and aviation including environmental performance standards. Both venues have set standards for criteria pollution emissions. The United Nations Framework Convention on Climate Change conferred to IMO and ICAO the responsibility for developing sector-specific approaches to reducing GHG emissions. The IMO has adopted efficiency standards for new ships starting in 2015 based on an Energy Efficiency Design Index (EEDI), and Ship Energy Efficiency Management Plan are required to address in-use fuel consumption. The ICAO is currently developing CO<sub>2</sub> standards for new aircraft. Both venues are discussing the possibility of additional market based measures to further reduce GHG emissions.

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<sup>25</sup> UNCTAD (2012) "Review of Maritime Transport 2011"

<sup>26</sup> Calculated based on energy consumption and ton-mile freight data; emission factors come from Unit Conversion published by EPA 2004 version

<sup>27</sup> Graphic provided by Edgar Blanco, MIT Center for Transportation & Logistics

<sup>28</sup> In fact, in 2010, air shipments accounted for almost a third of the value of all exports (more than any other transportation sector) and the Bureau of Transportation Statistics confirms that air shipments account for nearly \$1 billion per day in international trade

## Air Cargo

### Air Cargo Market Characteristics

The US domestic air cargo market is dominated by two US carriers, FedEx and UPS that carry a combined 74% of domestic air freight<sup>29</sup>. The next three largest carriers are based in China and hold a combined 16% of the domestic market, with the remaining carriers holding 2% or less. FedEx and UPS also hold a significant share of the worldwide market accounting for 32% of the air cargo. The next three largest cargo carriers are Cathay Pacific Airways, Korean Airlines and Emirates Airline, which combined carry another 32% of worldwide air cargo. Remaining carriers each hold 9% or less of the worldwide market.

FedEx and UPS both publicly stated goals to increase the fuel efficiency of their aircraft fleets by 20% in 2020, in 2008 and 2009, respectively, on a ton mile basis. By 2011, FedEx had achieved a 13.8% increase in efficiency, and announced that it had increased its goal to 30% by 2020. Increases in fuel efficiency have been achieved by upgrading technology and improved management practices. The specific means of improving efficiency, and the degrees of success with which they are implemented are considered to be confidential business information, although they are likely very similar among the various airlines.

Airlines conserve fuel in many different ways, including reducing and more accurately measuring onboard weight; cruising longer at higher altitudes; employing greater use of flight-management systems; redesigning hubs and schedules to alleviate congestion and conducting more in-depth analyses of weather conditions. Due to the highly competitive nature of the industry, detailed information sharing is restricted.

The air cargo sector is fiercely competitive and fuel represents a significant percentage of operating costs. Further, the recent volatility of fuel prices over the last several years has put added pressure on carriers to maximize the efficiency of their operations. Generally, fuel is the second largest expense after salaries and fringe benefits, for an air cargo carrier. There is a strong incentive to reduce fuel use and maximize efficiency,

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<sup>29</sup> World Air Transport Statistics (WATS), 56th Edition

especially during the recent recession period when market growth has been stagnant or declining.

### Technology in the Air Cargo Sector

The number of suppliers in the airframe and aircraft engine market is limited. Airframes are supplied by two manufacturers, Airbus and Boeing. There are three manufacturers of jet aircraft engines for large aircraft, Pratt Whitney, GE, and Rolls Royce. The aircraft have useful lifetimes that extend beyond thirty years. The list prices of new aircraft range from \$75-\$200 million for a narrow-body and \$259-\$352 million for a wide-body aircraft, although these prices are typically heavily discounted for large customers<sup>30</sup>. With the support of airlines, commercial aircraft and engine manufacturers have made successive improvements in emissions and fuel efficiency, making today's airplanes more aerodynamic and cleaner-burning than any type ever produced, although the pace of improvement in recent decades has slowed. Between 1960 to 2010, the fuel efficiency of an average new jet commercial aircraft improved annually by approximately 1.5% on a ton mile basis, with the rate of improvement falling to approximately 1% in the 1990s and only 0.3% in the 2000s due to the lack of new, more efficient aircraft models designs being brought to market.<sup>31</sup>

Replacing aging aircraft with new equipment is the most expeditious manner in which to improve aircraft fleet efficiency, but the high costs involved militate against this option as an ongoing strategy under circumstances that would routinely require scrapping of equipment prior to the end of its useful life. "Major advances in aircraft fuel efficiency to enable the airline industry to more aggressively reduce its greenhouse gas emissions are dependent on new engine and airframe technologies not yet available in the marketplace. Unfortunately, in the near future, no major breakthrough in either aircraft or engine design is expected because of the enormous effort and cost of engineering research and development."<sup>32</sup> Despite these challenges, FedEx has been implementing an aggressive, multi-year aircraft replacement plan<sup>33</sup> and UPS states that it operates one of the industry's youngest air fleets<sup>34</sup>. Both of these US dominant carriers (as well

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<sup>30</sup> Boeing <http://www.boeing.com/commercial/prices/index.html>

<sup>31</sup> Rutherford, D.; Zeinali, M. "Efficiency Trends for New Commercial Jet Aircraft: 1960 to 2008." International Council on Clean Transportation. Updated in May 2011.

<sup>32</sup> Airlines For America <http://www.airlines.org/Pages/21st-Century-Aviation---A-Commitment-to-Technology,-Energy-and-Climate-Solutions.aspx>

<sup>33</sup> 2011 FedEx Global Citizenship Goals & Progress Update pg. 5 <http://about.van.fedex.com/environment-efficiency>

<sup>34</sup> 2011 UPS Sustainability Report pg. 75 <http://www.responsibility.ups.com/Sustainability>

as international carriers) are therefore already highly incentivized to upgrade the respective fleets for continued fuel efficiency advancements.

It may be possible to incentivize more rapid technology advancement through policy, regulation and public support. ICAO has projected that the fuel efficiency of new passenger aircraft, on which much belly freight is carried and from which freighters are derived or converted, could be improved by 25 to 35% in 2020 relative to an average aircraft delivered in 2010, and up to 70% in 2030, depending on the level of regulatory and environmental pressure applied to the sector, and funding available for basic research.<sup>35</sup>

## Regulatory Environment

Aviation-related greenhouse gas emissions are currently regulated primarily on a national and regional basis. In the EU, a nominal cost has been applied to greenhouse gas emissions in the EU under the Emission Trading Scheme (ETS), a cap and trade model (although the application of the system to intercontinental flights has been suspended for a year pending ICAO work on a potential global replacement measure). Australia has a similar domestic program and with the EU has outlined measures to implement plans that would link their carbon trading schemes as of mid-2015.

In 2013, France will begin to require that all package carriers provide “carbon invoicing” which will require freight handlers, including air cargo, to provide customers with the carbon cost involved in the delivery of their packages<sup>36</sup>. The U.K. is now considering adoption of the French model, too. Cargo carriers must adhere to required carbon accounting principles, in accordance with these laws. It is hoped that the reporting and accounting requirements of the laws can be harmonized. Finally, airlines report fairly extensive data to the government using DOT Form 41 including but not limited to fuel use; available ton-miles; and revenue ton-miles.

This air transport sector is highly regulated to maintain safety of the system as a whole. It isn't a sector that is readily adapted to field testing of innovative technology and approvals to make modifications come slowly. Those that have been approved and result in efficiency improvements are adopted relatively quickly when they are economically justifiable.

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<sup>35</sup> ICAO, Report of the Independent Experts on the Medium and Long Term Goals for Aviation Fuel Burn Reduction from Technology. 2010. ENGLISH ISBN 978-92-9231-765-2

<sup>36</sup> Article 228 of the Law no. 2010-788

## Opportunities and Barriers for SmartWay in Air Freight

Given the regulatory environment, market structure as well as the business environment, a traditional voluntary partnership SmartWay program similar to the one developed for trucks is unlikely to achieve any measurable environmental benefits. To the greatest extent practicable, the leaders within the sector have already achieved the increases in efficiency available through management practices and they are replacing their fleets, as financially feasible. The lack of potential environmental benefits presents a barrier to the investment of resources by EPA.

However, there does appear to be a demand among shippers for a “one-stop-shop” for assessing the greenhouse gas emissions associated with their freight movement, across all modes. While there would be resistance to reporting requirements that created an additional burden, there is an opportunity for EPA to use data that is already gathered by the US government to develop a tool that would allow calculation of greenhouse gas emissions by interested shippers. This would allow integration of the air freight sector into SmartWay and benefit shippers by providing a more holistic view of their supply chain.

The increasing efforts to track, report, and reduce aviation-related greenhouse gas emissions provide another opportunity for SmartWay. There is a definite need to standardize the commonly accepted metrics and accounting systems across the programs administered by the various regulatory agencies and voluntary associations. Currently, data retrieval for the EU ETS required programming at the mainframe level. This can't be supported under multiple methodologies or reporting boundaries.

### **The SmartWay Legacy Fleet workgroup recommends the following:**

- EPA should consider providing shippers with a means to calculate greenhouse gas emissions resulting from their air cargo shipments. This would fill a gap in shippers' assessments of the greenhouse gas emissions associated with their supply chain. Requirements to submit additional data or develop new accounting systems should be avoided.
- EPA should capture the DOT Form 41 data electronically, directly from the DOT database. Both foreign and domestic airlines are required by Federal law to submit extensive information to the U.S government on DOT Form 41, so it would be possible to calculate emission factors for all reporting airlines. The use of Form 41 will reduce agency and industry burden by eliminating airline data

submissions. In addition, this data would provide a higher level of quality assurance because the reports submitted to DOT must tie to the airlines' GAAP reporting.

- EPA should provide a membership category for air freight carriers to become SmartWay Partners.
- EPA should make an effort to bring foreign flag carriers (which also report on DOT form 41) into the program. The international nature of the air freight sector would require this broader participation to maximize the utility to the shippers. This would also significantly improve the relevance of benchmarking efforts.

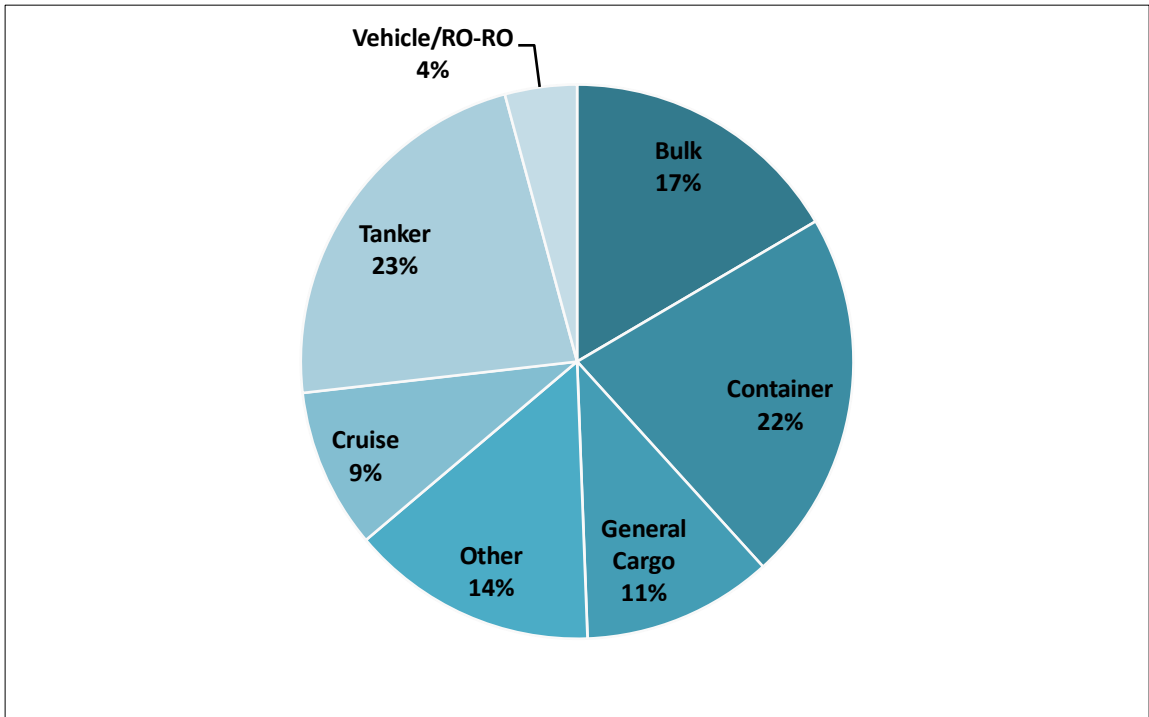


## Ocean / Marine Cargo

### Ocean Market Characteristics

The Ocean or Marine cargo market is more diverse than air transport. Segmentation and performance differences exist by vessel type/structure, cargo type, and scope of operations (local, regional or international). The fuel consumption of these segments at the global scale is presented in **Figure 8**. These segments can be summarized as follows:

- Containerized cargo vessels, which are “liner” shipping (run on a strict schedule of port calls)
- Bulk carriers carry bulk products, including agricultural products such as grain or fruit. A specialized segment is the refrigerated bulk carrier for perishable commodities such as agricultural products.
- Tankers carry both crude oil and liquid products.
- Roll-on-Roll-off vessels (RO-RO) which carry vehicles
- General cargo vessels (“break bulk”)
- Barges carry bulk or containerized cargo, and do not have propulsion capability, so require another vessel (tug) for motive force. These tugs and other inland and harbor craft are not considered in this analysis, but may present future needs/opportunities for SmartWay, since they do generate air emissions, operate in US waters, and are often part of the full supply chain.



**Figure 8 - The share of fuel consumptions by different ship segments<sup>37</sup>**

In the container industry, market share is concentrated among top carriers: the top 3 operators control nearly 30% of TEU capacity and top 20 operators control nearly 70%.<sup>38</sup> Complexity is multiplied by the participation of many brokers/intermediaries, and the thousands of shippers globally. Cargo owners and shippers have varying levels of sophistication regarding fuel cost, efficiencies, emissions profile, and reliability requirements. Vessel Sharing Agreements and alliances further complicate the market, as does the rise and prevalence of non-vessel operating common carriers in freight contracts.

Energy efficiency has become a priority for ocean carriers due to rising fuel costs; fuel now often represents over 50% of variable operating costs. Significant near-term efforts to cut costs/limit capacity such as slow-steaming and idling of underutilized vessels have effects on fuel efficiency and pricing, and have dramatically reduced emissions of fuel-related greenhouse gases and criteria pollutants per container carried. For

<sup>37</sup> IMO (2009) Second IMO GHG study  
<sup>38</sup> UNCTAD (2012) "Review of Maritime Transport 2011"

example, Maersk Line recently announced meeting their 2020 emissions reduction goal 8 years early, and increased their 2020 goal from 25% per container per km to 40%.<sup>39</sup> i

Most of the energy consumed / fuel burned in ocean shipping is used by foreign flagged ships (not US owned or operated). The international owners/operators of these vessels are less familiar with SmartWay and have expressed concerns about providing detailed operational data to an arm of the US EPA. These international vessels may spend only 5% of their operational lifetimes in the waters of any one state or country. These factors are significant considerations for the development of regulatory or voluntary programs in the ocean cargo sector.

The useful life of a ship can typically reach 30 years, although the average age of the fleet has been decreasing because of higher scrappage rates and a large number of new ships delivered to the market in recent years<sup>40</sup>. The EEDI, a metric to benchmark ship efficiency, only focuses on new ships built after 2013, leaving efficiency of the legacy fleet to be managed by Ship Energy Efficiency Management Plans and a less-well defined EEOI, and voluntary reporting systems.

In the United States, the average age of the fleet is older than the global average, due partly to a slow fleet turn-over. The Jones Act requires domestic ships to be US manufactured, US crewed, and US flagged, which makes US shipping companies less inclined to retire older ships. Indeed newer US-built ships are usually much more costly than those built in South Korea and China, the leading ship building locations. Legacy fleet issues are even more important when considering the domestic fleet.

## Regulatory Environment

International vessels must be registered in a country ("flag state") which is responsible for administering requirements, certifying equipment used on board, and technology verification and inspection.

In addition to adopting the IMO MARPOL VI standards for fuel sulfur, NOx and other air pollutants and the efficiency requirements for new ships, the US EPA, the Coast Guard and several US states (notably California) have established regulations for Ocean-going

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<sup>39</sup> <http://www.maerskline.com/link/?page=news&path=/news/news20130125>

<sup>40</sup> In 2012, the average ship age was 21.90, down from 22.93 in 2009. The average age by deadweight tonnage (DWT) in 2012 was 11.51, down from 13.95 in 2009. The containership fleet has a relatively younger age, averaging 10.90 per ship and 8.93 per DWT. The data come from UNCTAD Review of Maritime Transport 2011 and 2012.

vessels and Harbor Crafts. Very recent action by France will require CO<sub>2</sub> to be provided on shipment manifests. At this time no other countries have applied energy efficiency/CO<sub>2</sub> standards to vessels.

Very recently, several countries including the US have floated the idea of monitoring, reporting, and verification (MRV) as a way to better understand the current fleet's energy consumption and as a first step to regulate existing vessels that are not covered by the EEDI. The MRV concept is still in its infancy but is worth noting in that, if implemented, it could potentially provide cross-referencing for SmartWay.

### Ocean Cargo Industry Action

A number of industry organizations have been considering vessel-related emissions, and some have established methodologies or initiatives to measure and report address energy efficiency. These include:

- In the container industry, voluntary works began in 2001 to measure and reduce CO<sub>2</sub> and other environmental impacts. The Clean Cargo Working Group (“CCWG”)<sup>41</sup> is a business to business initiative comprised of major shippers, carriers and NVOCCs, organized as a working group under Business for Social Responsibility. CCWG is “dedicated to performance improvement in marine container transport through measurement, evaluation and reporting. CCWG membership accounts for 60 to 70% of the containers moved globally. The CCWG has developed methodologies for measuring and reporting emissions on the basis of grams of CO<sub>2</sub> per TEU per km. Since 2005 CCWG has conducted annual environmental performance surveys and a benchmarking study. Industry averages and descriptions of methodologies have been published. In 2009 a protocol for third-party verification was developed and most or all CCWG carriers now have their data and reporting systems verified.
- Other international reporting systems for container vessels include the Clean Shipping Index<sup>42</sup> (predominantly in Scandinavian countries), and the Environmental Ship Index<sup>43</sup> (established by the ports in IAPH/WPCI).

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<sup>41</sup> <http://www.bsr.org/en/our-work/working-groups/clean-cargo>

<sup>42</sup> <http://www.cleanshippingindex.com/>

<sup>43</sup> <http://www.environmentalshipindex.org/Public/Home>

- The Clean Shipping Index website states that CSI “is a business to business tool for cargo owners to select clean ships and quality ship operators. Transport buyers use it to calculate and minimize their environmental footprint. Ship-owners present the environmental profile of their fleet to a network of large customers who consider this in procurement situations. Ship-owners also use it as a bench-marking tool in order to identify areas for environmental improvement. The aim: a market demand for clean ships. CSI is driven by a non-profit organization.”
- ESI provides a centralized international data collection and scoring system for vessels, with the intention being to enable ports to provide incentive programs to attract cleaner vessels. The current focus is on fuel sulfur (SOx), engine NOx ratings, and the presence of shore power capability. Only a very small percentage (less than 3%) of a vessel's score relates to fuel/energy efficiency.
- The World Resources Institute (WRI) has defined a Green House Gas Protocol<sup>44</sup> for reporting and calculating supply chain carbon footprint. Industry-specific methodologies such as the CCWG methodologies mentioned above are based on these standards.
- The European Union has commissioned and partially funds a project (“COFRET”)<sup>45</sup> to define standards for calculating the carbon footprint of freight transport. The project website states that it “will deliver a methodology for the calculation of the carbon footprint along the full supply chain. The **COFRET** methodology will draw upon existing initiatives already being developed by various stakeholders in the supply chain so that it is aligned with the needs of those responsible for shipping and transporting goods by whatever means.”
- Other organizations focus more on transparency and reporting, including the Carbon War Room and Forum for the Future.

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<sup>44</sup> <http://www.wri.org/project/ghg-protocol>

<sup>45</sup> <http://www.cofret-project.eu/>

## Opportunities and Barriers for SmartWay in the Ocean Segment

Like the air freight segment, several factors present potential barriers to successful engagement of ocean carriers in a full SmartWay initiative. These include:

- Resistance by international companies to reporting to a US government entity – or any individual nation -- instead of the vessel's flag administration.
- The technology verification components of the existing SmartWay program may be seen as redundant due to the flag state verification process and port state inspections; however SmartWay may have a role as a technology clearing-house. This may not apply to smaller vessels and those vessels operating predominantly in US waters
- A seemingly small but difficult issue is that US EPA does not use the metric units used by the rest of the world. (e.g., “grams per ton mile” combines metric and English units, and is not understood by Europeans, switching between short tons and metric tons leads to errors). Globally, marine fuel is measured in metric tons, and distances sailed in kilometers.

An opportunity for SmartWay is the industry-led efforts to understand and address shipping’s carbon footprint that could serve as a useful entry point for a discussion of what a SmartWay program could look like for the marine cargo sector.

### **The SmartWay Legacy Fleet workgroup recommends the following:**

- EPA should enhance the existing SmartWay program to include complementary marine cargo partners, tools, performance benchmarking, ranking and reporting.
  - Short-term objective would be to add carriers in these modes to the SmartWay family of companies and programs.
  - Long term goals would include enabling SmartWay Shipper Partners to assess their existing supply chain impact across multiple modes, and provide tools to measure and compare the impacts of a variety of programs and choices such as near-sourcing, mode shifts and other operational changes.

- The addition of other freight modes in SmartWay can best be achieved through reciprocity and/or data-sharing arrangements with existing/established protocols and data sets.
  - SmartWay should collaborate with recognized mode-expert organizations, focusing initially on the Clean Cargo Working Group, while considering other global stakeholders.
  - SmartWay should not duplicate or conflict with these efforts but complement or align with them to share data, raise public awareness, and broaden the participation.
  - A concept paper is available describing such an approach. (Appendix D)
  - Coordinating with existing and developing international regulations on mandatory energy efficiency requirements may require future program adjustments.
- EPA's new Ports Initiative should be designed in such a way that SmartWay and related programs for other modes (e.g. CCWG) are integrated to cover equipment that is exclusively operated around ports, including vessels, drayage trucks, port handling equipment and rail.
- EPA could consider a technology clearing house or possible technology verification program for particular needs, keeping in mind EPA's and industry's resource limitations and preventing redundancy. This is especially important for the maritime sector, where programs should align where feasible with international, IMO and US Coast Guard programs, and consider state efforts such as those in California.
- Continue to refine the methodology and data collection periodically as international initiatives to monitor, report, and verify energy consumptions from the maritime sector are unfolding.

## **Implementation Recommendations**

To facilitate the addition of air and marine cargo to the SmartWay network, EPA should undertake the following actions:

- SmartWay should commit to supporting the ongoing global efforts to harmonize and align stakeholder multi-modal supply chain carbon accounting methodologies, metrics and tools. Since discussions of such methodologies are developing quickly in North America, Europe and global organizations, EPA should support and provide resources for active involvement in the supply chain metrics alignment work now ramping up globally.
- SmartWay should not duplicate or conflict with these efforts but complement or align with them to share data, raise public awareness, and broaden the participation.
- Coordinating with existing and developing international regulations on mandatory energy efficiency requirements may require future program adjustments.
- Since supply chains are global in nature, it is critical that EPA and Smart Way's supply chain tools and data be compatible with international standards and metric units. EPA should develop a strategy to address this critical issue.



## Nonroad Mobile Sources

### Workgroup Process

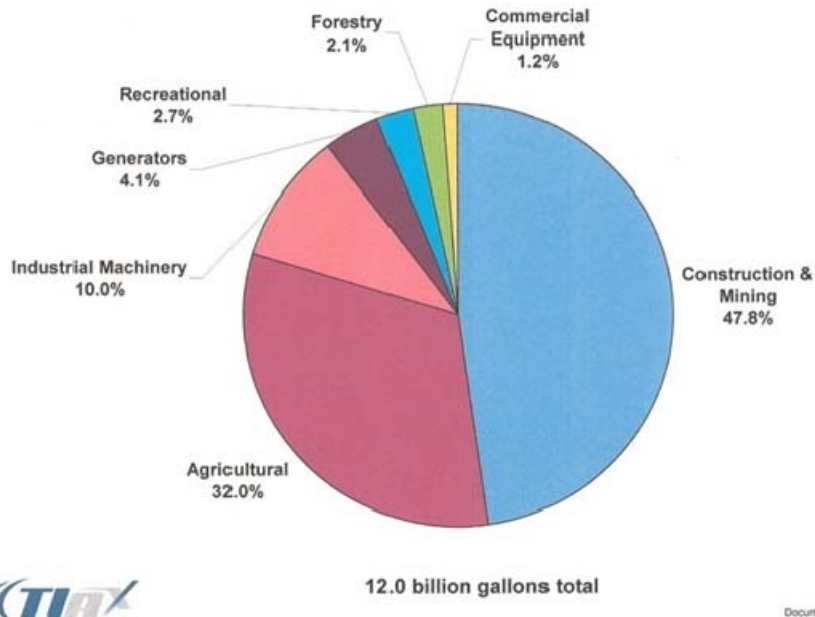
Addressing the subsection of the overall Work Group charge related to nonroad activity required some deviation from historic SmartWay program knowledge. The sector is economically and operationally different than the goods movement focus of the legacy SmartWay program. A subset of workgroup members was created to focus on nonroad issues.

Several discovery exercises were undertaken with contributions by the EU Commission, equipment manufacturers and nonroad equipment users to gain a baseline of sectoral understanding. The presentations associated with those discovery meetings are appended to this report as background and in support of the learning that resulted in the narrative and recommendations described here.

### **Nonroad Fuel Consumption Overview**

The following chart (**Figure 9**) estimating annual diesel consumption by nonroad equipment was compiled by TIAX for a study undertaken by the Engine Manufacturers Association. The base data was from the EPA NONROAD 2005 model. The total nonroad fuel consumption was estimated to be about 12.0 billion gallons per year.

**2014 nonroad diesel consumption distribution using EPA's equipment population and use factors and TIAX's market segments**



**Figure 9 - The share of annual fuel consumed by nonroad equipment**

The following tables (1 and 2) help further illustrate the relative fuel consumption of nonroad equipment as key components of the transportation sector.

|                                 |             |
|---------------------------------|-------------|
| <b>DIESEL FUEL*</b>             | <b>56.0</b> |
| <b>Transportation</b>           |             |
| Light-Duty Vehicles             | 1.7         |
| Passenger Cars                  | 0.4         |
| Light-Duty Trucks               | 1.3         |
| Buses                           | 1.5         |
| Medium- and Heavy-Duty Trucks   | 33.9        |
| Recreational Boats              | 0.4         |
| Ships and Boats                 | 1.0         |
| Rail                            | 4.0         |
| <b>Non-Transportation</b>       |             |
| Agricultural Equipment          | 4.1         |
| Construction Equipment *        | 6.7         |
| Other Non-Transportation Mobile | 2.7         |

\* includes mining

**Table 1 - U.S. Diesel Fuel Consumption (2011- billions of gallons)<sup>46</sup>**

For the purpose of SmartWay, nonroad fuel consumption would rank second behind medium and heavy duty trucks. Using the TIAX report to rank order specific categories of nonroad equipment, and comparing them to the values in the above table results in the following rank orders:

| <b>Rank</b> | <b>Equipment Type</b>           |
|-------------|---------------------------------|
| 1           | Medium & Heavy Duty Trucks      |
| 2           | Construction                    |
| 3           | Agricultural                    |
| 4           | Rail                            |
| 5           | Other Non-Transportation Mobile |
| 6           | Light Duty Vehicles             |
| 7           | Buses                           |

**Table 2 – Rank of equipment type by fuel use**

<sup>46</sup> <http://www.epa.gov/otaq/climate/documents/420f13033a.pdf> Fast Facts, U.S. Transportation Sector Greenhouse Gas Emissions 1990-2011.

## Overview of Nonroad Equipment Sector GHG Issues

### Nonroad GHG Equipment Fuel Consumption and CO<sub>2</sub> Emissions

With the exception of agricultural applications, for nonroad equipment, the CO<sub>2</sub> emitted from the burning of fossil fuels currently accounts for approximately 99% of all GHG emissions (CO<sub>2</sub>e) emitted in these applications. The unique aspects of agricultural applications are addressed within a subsector writing included in this section of the report. For non-agricultural aspects of the nonroad sector it is evident that when focusing on equipment within the nonroad sectors, mitigating GHG emissions basically means to minimize fuel consumption for a given amount of work to be performed or output produced. If the focus is expanded beyond equipment to a work site or farm site scope, the nonroad sector has varying GHG profiles within subsectors which would result in different GHG mitigation opportunities.

For the vast majority of nonroad equipment end users, operating costs are a very important aspect of their business. For example, cost of fuel is second only to labor costs at most construction job sites. Thus, there is already significant desire and incentive at the job site level to minimize fuel consumption for the work to be performed. With some contractors, estimating fuel consumption to complete a project is done in order to submit a bid to win the project. If the project is then 'won', that same fuel consumption estimate is very closely monitored and managed accordingly, as every gallon of fuel not consumed relative to the original estimate is dollars to the bottom line.

Energy costs are not a large contributor to farm total production expense as it may be in the construction subsector. Operating margins on particularly small farms can be less than ten percent and considering that a farm's revenue can be affected by many variables from federal support mechanisms, to food safety and nutrition policies, to macro and micro economic trends, to weather, farmers have more direct control over their costs than revenues and continuously seek the optimal use of all of their inputs including fuels. However, most fuel is consumed by large farms.

Also, the vast majority of nonroad machines are purchased as an investment, in order to perform work at a job site and farm site to achieve a return on that investment. So, while the specific subject of mitigating GHG emissions from nonroad equipment sectors may be relatively new, the subject of fuel efficiency, maximizing productivity and achieving a return on the investment have been strong motivating forces for both manufacturers and end users alike for many years.

It is also important to note unique aspects of certain nonroad subsectors, such as construction. Construction projects are often complex undertakings of varying duration in which many players participate. General contractors, sub-contractors, rented and leased equipment and progressive variation in job-site conditions, participants and work characteristics make application of traditional SmartWay concepts even more difficult than other nonroad sub-sectors with fixed site operational parameters. For that reason, the work group focused on larger, more manageable and more immediate opportunities for fuel efficiency improvements and GHG reductions. This is not to be interpreted as a suggestion that opportunities do not exist in the construction sub-sector, but examination of how that sub-sector might be addressed needs additional consideration by the agency and relevant stakeholders not represented on this Work Group.

Discussion with Work Group participants from existing, Goods Movement-focused aspects of the SmartWay program clearly indicated concern that an extension of the SmartWay brand without at least some clear delineation of programmatic aspects could weaken SmartWay's Goods Movement brand value. While no specific recommendation of branding for any nonroad voluntary partnership was developed, it was clear existing partners in the goods movement SmartWay program felt extension of the brand without some clear modification would weaken the existing brand impact.

### Nonroad Equipment and Application Diversity

The world of nonroad equipment and job sites/farm sites is very diverse in terms of:

- A) Type of work to be done at any given job site/farm sites,
- B) Amount of work to be done,
- C) Wide variety of different types of machines,
- D) Wide variety of sizes of machines for a given type of work,
- E) Different job functions any given machine can possibly perform
- F) Wide variety of work cycles and load factors,
- G) External factors such as weather, location, local geology and topography.
- H) Site specific management issues (such as shift scheduling, management-labor relations, etc.)
- I) Operator experience and skill set (efficiencies)

Any one of these factors may be more or less significant at any one job site/farm site. However, all these factors when combined together mean there are thousands of different types and sizes of nonroad machines, work cycles, applications and load

factors in use today. This basic nonroad machinery diversity (type, size, job function, application, load factor, work cycle) gets further compounded because of the longevity of many nonroad machines and because of the evolution of engine technologies to address criteria pollutants. For example, electronic engines are typically optimized to provide the best performance (fuel efficiency and emissions) in the operating ranges in which a given machine is needed to operate; whereas older mechanical injection diesel engines are not as flexible. Further complicating the diversity picture is the relatively low volume of any single configuration produced. Unlike automobiles or even on-highway trucks, in which single platforms are produced in unit volumes that can reach hundreds of thousands and/or up to more than one million units per year, most nonroad product platforms are produced in much lower volumes.

## **Potential Application of SmartWay Methodology to Nonroad Equipment Sectors**

### [Potential Methodology for a Pilot Nonroad GHG 'SmartWay-style' Project](#)

With the fundamental 'SmartWay' program elements described elsewhere, conducting a pilot project within an applicable sub-sector based on the results of the filter is suggested as an important step to understand potential application to the nonroad sector. Due to the extensive diversity within the nonroad sector it appears prudent to identify a couple of key nonroad sectors for a pilot project and to find key sector end users willing to work with EPA on investigating and implementing pilot project elements.

Familiarity with nonroad sectors suggests the SmartWay concept might be applicable to a variety of nonroad job sites and sectors, focused primarily on fixed site sub-sectors where reporting and control is subject to less variability due to transient job site and ambient conditions. Examples are mining, quarry & aggregate and solid waste management. As such, for a pilot project investigative effort, end users in a couple of these sub-sectors could be asked to donate their time and resources to assist, supplement and share EPA's time and resources, in exploring a pilot GHG SmartWay concept.

### [Job Site / Farm Site Level Focus vs. Equipment Level Focus](#)

Optimizing work to be performed at the job site/farm site 'operations' level while minimizing fuel consumption is the main 'point of economic action' for the vast majority of end users. Thus, the 'job site/farm site' level is suggested as the main focus for a pilot project. Decisions and actions at this 'job site/farm site' level drive both end users and

equipment manufacturers to focus on maximizing productivity and minimizing costs (including fuel), while doing so with an adequate return on their investment. This job site/farm site level focus on productivity and efficiency has the potential to encompass many areas of potential GHG improvement, including:

- > Fuel Selection
- > Machine Components
- > Machine Design
- > Machine Selection and Utilization at a Job Site/Farm Site
- > Operator Productivity
- > Job Site and Machine Maintenance
- > Operational Strategies, such as Coordination and Integration
- > Site lay-out and design
- > Site production priorities

All these general subjects above have the potential to meaningfully affect job site/farm site productivity and fuel efficiency, and thus GHG emissions on a per work performed or per output produced basis. Therefore, opportunities for GHG mitigation can also be a function of these subjects and not be limited to just CO<sub>2</sub> reduction but all GHG reduction as is the case in the agricultural subsector.

As a result of all these subjects having potential bearing on GHG mitigation, the nonroad GHG baseline measurements in this pilot GHG SmartWay project should be determined at the job site/farm site level.

### Carbon Footprint Analysis (CO<sub>2</sub>) for Nonroad Equipment

The 'energy' footprint can be established for nonroad equipment at a job-site/farm site level basis for any one point in time, by documenting the fuel and electrical energy consumption of the nonroad mobile equipment for that period of time. Some job sites/farm sites may know their actual energy (fuel or electricity) consumption machine by machine, on a daily basis. Other job sites may only know their energy purchases for a given period of time (daily, weekly or monthly) based on invoice data.

Since the vast majority of nonroad mobile equipment at a job site/farm site does not run on electricity, the proposed pilot SmartWay project should focus on the carbon (CO<sub>2</sub>) footprint created by the nonroad mobile equipment using liquid or gaseous fuels,

primarily diesel fuel in the case of nonroad mobile equipment. So, by knowing the type and amount of liquid or gaseous fuels consumed at a job site/farm site, this can be translated into a carbon footprint for nonroad mobile equipment at a job site/farm site.

Whether the fuel consumption is known machine-by-machine on a daily basis or just from fuel purchases, either approach could be used to calculate the carbon footprint of the nonroad mobile equipment at a job site/farm site. The primary difference between the two may be the degree of accuracy. Knowing the actual fuel consumed on a daily basis on a machine-by-machine basis at a job site/farm site may provide a more accurate carbon footprint than one based on fuel purchases. This greater granularity also helps to better identify and prioritize sources, and thus specific opportunities for improvement.

For those job sites/farm sites that know their actual fuel consumption on a daily basis, this information can come from a couple possible different sources:

- > Daily re-fueling information and records kept by site management
- > Some machines are capable of estimating the fuel used; and this fuel consumption data is available to job site management.

A carbon footprint analysis based on fuel purchases needs to take into consideration the amount of fuel in on-site inventory/storage in order to arrive at a calculation of actual fuel consumption. The basic equation for this would be:

Fuel consumption (for any given period) = Fuel on-hand in on-site inventory at the beginning of the period + New Fuel purchases – Fuel on-hand at the end of the period

In summary, machine-by-machine fuel accounting, coupled with information on the work performed at the site/output produced and the work conditions of the job site, will be important to reduce the carbon footprint and account for the benefit of those improvements.

The 'SmartWay' concept to be investigated for possible applicability to nonroad mobile equipment sectors is intended to be a voluntary program, just like EPA's SmartWay Transport Partnership program has been since 2004. There are four fundamental steps that appear essential for any proposed nonroad SmartWay program. These steps are also very similar, conceptually, to those basic steps used in EPA's SmartWay Transport Partnership. These four basic steps proposed for this pilot nonroad concept and programs are:



1. Assess the job site/farm site and perform an equipment carbon footprint analysis for the site in order to establish the CO<sub>2</sub> emissions baseline associated with fuels consumed in the nonroad mobile equipment used on the site
2. Set a multi-year improvement objective versus the baseline
3. Develop an Improvement Plan to achieve the objective
4. Monitor results and Report Periodically

It is acknowledged that a shortcoming in this approach – as mentioned at the beginning – is that this footprint will only reflect a point in time. For some non-road sectors such as agriculture and surface coal, whose fuel usage at the same job site/farm site can vary from season to season or year to year due to coal seam geology, weather, or crop planted, a one year baseline may not be representative of typical conditions from which to set a multi-year improvement objective against.

This nonroad SmartWay GHG pilot project initiative would require a learning curve by all involved to properly develop, investigate and quantify the most promising CO<sub>2</sub> mitigation opportunities for selected nonroad equipment sectors. Since this nonroad pilot CO<sub>2</sub> initiative is new and since a learning curve will be required, this pilot project concept would likely require a multi-phase pilot. The first phase (Phase I) could primarily comprise the following components:

#### Phase I:

- > Equipment Carbon (CO<sub>2</sub>) Footprint Analysis of the equipment job site/farm site per output produced/work done
- > Investigate possible CO<sub>2</sub> baseline metrics and measurements on an output produced/work done basis
- > Discussion and Identification of possible CO<sub>2</sub> mitigation strategies, best practices and technologies at the job site/farm site level per output produced/work done
- > Discussion of prioritization process for the various jobsite/farm site CO<sub>2</sub> mitigation opportunities

Based on learning from Phase I process, future efforts are likely to be focused on the following areas:

- > More thorough estimation or quantification of the CO<sub>2</sub> benefits of the most promising equipment CO<sub>2</sub> mitigation ideas used on a job site/farm site
- > Estimation or quantification of costs of implementing the priorities identified
- > Review of alternatives and applicability of the SmartWay concept for nonroad sectors and ability to measure performance relative to baseline
- > Summarize findings and results

Within the current Work Group process, three specific sectors were discussed in greater detail and prompt specific recommendations. These sectors are Agriculture, Surface Coal Mining and Quarry & Aggregate Production. Following are recommendations related to those three subsectors.

**The SmartWay Legacy Fleet workgroup recommends the following:**

- EPA can apply the public-private partnership model to the nonroad sector to accelerate energy efficiency gains and emission reductions. This partnership should not impact the SmartWay brand equity but could be a similar type of branded program.
- Any market based incentive program that is developed for nonroad sector should take account of unique sub-sector characteristics. This report identifies three such sub-sectors and some of those unique characteristics
- Establishment of a nonroad market-based program should be preceded with pilot projects in targeted sub-sectors to properly design the program for effective impact and strong voluntary participation.

## Agriculture

### Market characteristics unique to the nonroad agricultural sector

Agriculture is an incredibly complex system and analysis of market context and drivers within this sector are equally complex. The business of agriculture is to produce food and fiber from the soil. Agricultural equipment is the capital tools used to reduce labor and increase yields. The basic operations are soil preparation, planting, chemical application and harvesting. Agricultural equipment can be categorized as tractors,

combines and other. The other equipment includes seeding, chemical application equipment and other types of harvesting equipment. In the U.S. while there are only three full line engine powered equipment manufacturers in this sector, the diversity of the equipment utilized, the commodities produced, and the operations performed is immense. Farm conditions are highly variable at the individual farm site level (soil conditions, weather, rainfall, topography, etc.). In addition, a farm site may be “fixed” but the crop produced from season to season and/or year to year can be variable. In regards to equipment usage, equipment can move from one fixed farm site to another fixed farm site based on work to be accomplished, e.g. custom harvesters, and the machinery is used in various combinations. For example, tractors work in combination with their implements, and it is that combination which performs the work. This complexity highlights the importance of flexibility in any program design to maximize potential environmental benefits.

Improvements in engine, equipment and production operational efficiency continue to make the agricultural sector overall more fuel efficient and it is expected by the industry to continue. Whether the focus is at the engine level – which the industry has been focused on since emission regulations were effective in 1996 or at the operational level, this focus on productivity and efficiency has already brought about a large reduction in the amount of diesel fuel used to grow row crops. Mold board plowing and crop residue disking operations have mostly been eliminated. Mechanical cultivation to control weeds has been replaced by herbicides. Insecticide applications have been replaced by resistant seeds.

Many row crops are planted using no till operations. The number of farm operators has decreased and the size of the average farm operation has increased. This has created a demand for higher-powered equipment which is more efficient and provides for more productive operations.

Unlike the other nonroad sectors at the farm site level – the level at which a pilot for the nonroad sector is being recommended – the greenhouse gas emissions profile drastically changes and the additional greenhouse gases of CH<sub>4</sub> and N<sub>2</sub>O need to be considered if meaningful GHG emissions reductions from the agricultural sector are the program objective. Considering all greenhouse gas emissions within the agricultural sector, CO<sub>2</sub> emissions are not the most prevalent greenhouse gas.<sup>47 48</sup>

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<sup>47</sup> [http://www.sourceuk.net/article/12/12018/greenhouse\\_gas\\_emissions\\_from\\_farms.html](http://www.sourceuk.net/article/12/12018/greenhouse_gas_emissions_from_farms.html). UK averages for agriculture: 51% N<sub>2</sub>O, 35% CH<sub>4</sub>, and 20% CO<sub>2</sub>.

In addition, unlike the other nonroad sectors, there are already numerous and diverse energy efficiency activities present in the agricultural sector led by other U.S. government agencies, non-governmental agencies, grower groups, European agricultural machinery and engineering groups, and universities. These activities range from data collection, baseline energy indicators by crop, calculator tools, pilot carbon footprint projects, other voluntary programs, and financial assistance for energy efficiency improvements. For additional detail on the unique aspects of the agricultural sector as it relates to the SmartWay program please see Appendix E.

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<sup>48</sup> <http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-ES.pdf> and <http://www.epa.gov/climatechange/ghgemissions/sources/agriculture.html>, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011*. Agricultural sector is 0.6% of U.S. CO<sub>2</sub> emissions compared to 8% of total U.S. Greenhouse Gas Emissions by Economic Sector based entirely on its N<sub>2</sub>O and CH<sub>4</sub> contribution.

### **The SmartWay Legacy Fleet workgroup recommends the following:**

- Determine appropriate roles and responsibilities between the USDA and EPA in regards to a voluntary program to improve efficiency and emissions within the agriculture sector. The USDA has already completed extensive preliminary work on various climate-related programs (NRCS, regional climate hubs), tools (RUSLE2, COMET-FARM), and research (Agricultural Resource Management surveys). The EPA should be pragmatic about the added value an EPA-led SmartWay initiative targeting the agricultural sector would bring. The EPA should consider letting the USDA take the lead in this activity because it is foreseen that a crop production-based model, much like the activities USDA is already involved with, is a better approach to promoting and accurately quantifying reduced fuel consumption in the production of agricultural products.
- Beyond the USDA, benchmark existing energy programs and pilots which include energy efficiency and GHG emissions reductions, such as Field to Market<sup>49</sup>, to understand what work has already been done to avoid duplication and maximize investment of EPA time and resources.
- If after determining roles with other governmental agencies and benchmarking existing work in this area, the EPA were to still take the lead on a SmartWay-like initiative within the agriculture sector, consider the following:
  - Clearly define program goals and objectives to avoid confusion due to the complexity of greenhouse gas emissions associated with this sector and to maximize the environmental benefit of any voluntary program. For the agricultural sector, the scope of any program at the farm site level needs to be clear – is the objective to reduce fuel usage, reduce all greenhouse gas emissions, or reduce only CO<sub>2</sub> emissions.
  - Explore the market mechanism of agricultural sustainability value chain pull in pilot design as the market mechanism of fuel costs being a primary production cost are not the same as on-road and other nonroad sector.

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<sup>49</sup> <http://www.fieldtomarket.org/>

- Engage appropriate stakeholders such as the American Farm Bureau to ensure their understanding of the EPA's intentions, Grower Groups such as the United Soybean Board, equipment manufacturers with engines along with implement manufacturers, and established/effective local community agricultural networks.
- Consider limiting the scope of a SmartWay-like pilot in the agricultural sector to the 'goods movement', i.e. transport from farm gate to market. Examine via a pilot if an expansion in marketing and awareness of the transport/goods movement model could increase participation in the current SmartWay program among agricultural producers from farm gate to market where there is already similarity with the heavy duty on-road SmartWay program.
- Use agriculture-specific marketing and attention.
- Ensure a consistent and rigorous evaluation method of energy and cost savings in the program.
- Harmonize any U.S. government voluntary program to reduce emissions in the agricultural sector with those activities already occurring in Europe. Since equipment manufacturers in the US and EU are mostly the same and the only difference is the government agencies administering regulations, it is critical that these regulatory agencies work together to ensure alignment of any voluntary GHG/CO<sub>2</sub> reduction programs.

## Surface Coal

The surface coal sector is focused on productivity and operating costs. It analyzes fuel usage per unit of production, not simplistically "fuel consumption." It engages in a high number of operating hours per year, with high average duty cycles and load factors. It is not transient in nature and is typically located in remote areas. Substantial variation is observed across the sector, dictated by coal seam geology, specific site conditions, rate of production and capital availability. The sector's fuel burn rate is affected by the age of the machine, manufacturer, engine design and Tier classification, and operator efficiency. Ongoing equipment upgrades and replacements make it difficult to establish a single baseline emission level from which to measure trending and progress toward lowering emissions. Furthermore, advances in systems, processes and availability of

valid data to measure and estimate fuel use require a flexible approach to accurately measure emissions reductions.

Fuel efficiency improvements are possible through recent technological advancements. Engaging in a voluntary, economically viable Demonstration which incorporates flexibility into the metrics, processes and procedures for maximizing fuel efficiency measures, could lead to a reduced equipment carbon footprint at the jobsite level. A successful Demonstration could ideally lead to more reliable metrics and sector Best Management Practices.

**The SmartWay Legacy Fleet workgroup recommends the following:**

- Establish a pilot project to evaluate the prospects for broader initiative
- Develop highly adaptable system for the sector, accommodating site variation.
- Promote the following techniques and activities that have potential to lower the sector's carbon footprint:
  - Equipment Idle Time Management: establish standard defining when to idle/run vs. idle/shut-off equipment
  - Haul Road Audit: review long-term haul roads at sites to ensure of the most direct route, the least stops, and good construction practices
  - Communicate Fuel Conservation (e.g., Tires): engage in top-down management initiative to establish Conservation Best Practices
  - Tire Program: implement program to monitor all pneumatic tire pressures and temperature – Smart Valve Stems
  - Fuel Additive: use fuel additive mixed with diesel to improve energy efficiency and reduce consumption
  - Fuel Management System: create a fueling data system that might automatically send fuel amounts into a database when equipment is fueled to identify possible engine issues or bad practices.

## Quarry & Aggregate

The aggregates sector has have long established operational metrics that are used to measure productivity. Fuel consumption on a Cost per Ton (CPT) basis has been looked at for years. In the last ten to twelve years industry has seen improvements in the areas of operator training, larger and more productive machines that burn less fuel,

worksite efficiencies, and fuel tracking programs. Yet, these tools have not been utilized widely in partnerships or with one another to deliver a consistent outcome.

An opportunity with a SmartWay Pilot, as described above, is to better align these long established metrics with the effect they can have (positively and negatively) on emissions. Done correctly, especially at a large site, a focused program could lead to improvements that result in reduced fuel consumption. Once this is achieved and is proven to be sustainable, companies can begin to build on the successes and influence other positive outcomes in this arena.

**The SmartWay Legacy Fleet workgroup recommends the following:**

- Establish a pilot project to evaluate the prospects for a broader initiative
- A defined focus on the carbon footprint of mobile equipment that primarily burns diesel fuel.
- Establish baseline GHG emissions at quarry locations.
- Establish a methodology that can help operators develop a metric to minimize fuel consumption for the work that they perform.
- Work with equipment manufacturers to find a balance between emissions reduction and fuel efficiency for equipment in this sector.
- Identify an economic driver for this sector.
- Develop a highly customizable system. No two quarry sites are the same, so flexibility needs to be built into the system.

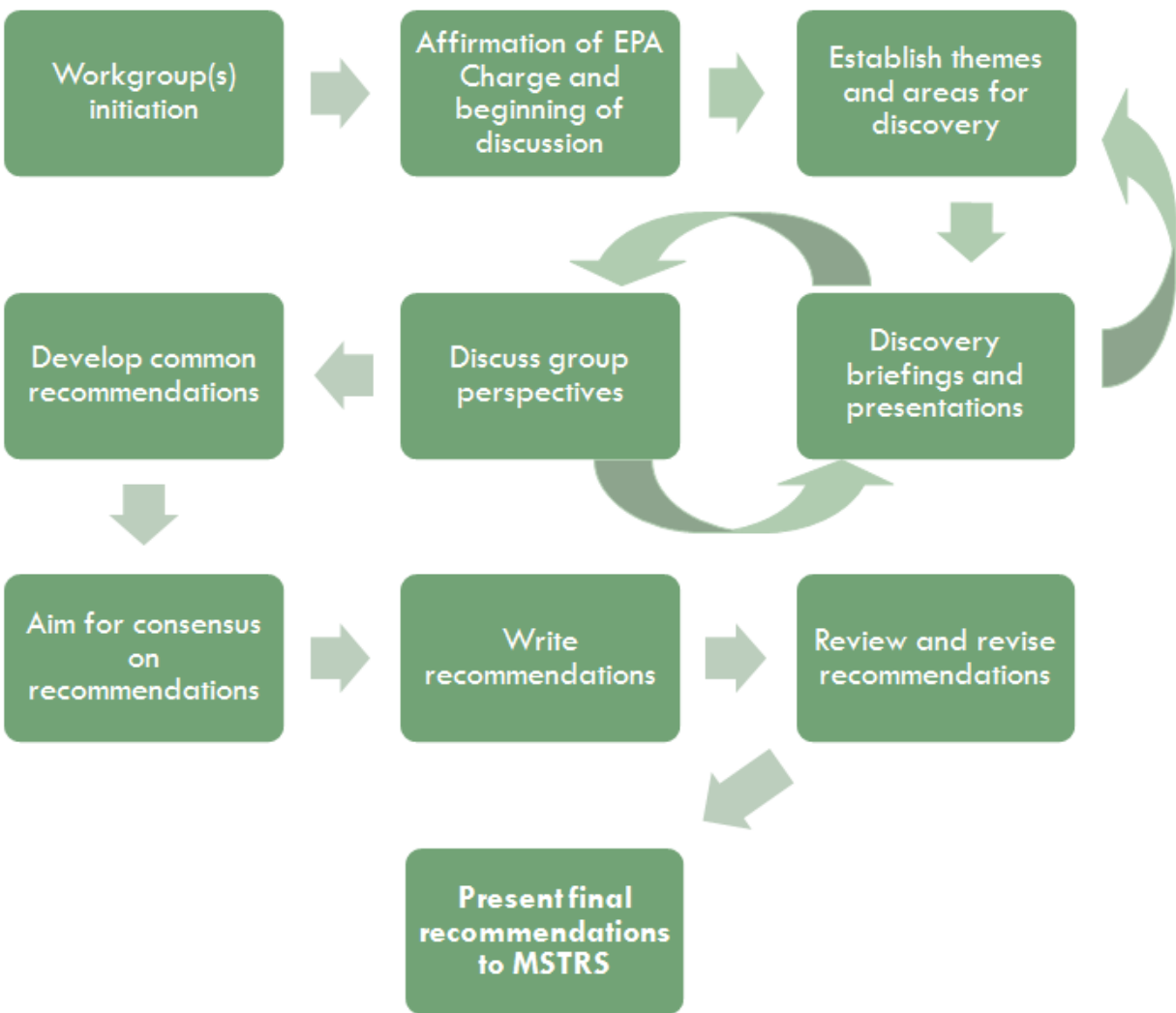


## Appendices

## A) Workgroup Members and Participants

| <b>Name</b>                | <b>Organization</b>                                       | <b>Workgroup Member</b> | <b>Supporting Participant</b> |
|----------------------------|---|-------------------------|-------------------------------|
| <b>Berry, Dave</b>         | <i>Swift Transportation</i>                               | x                       |                               |
| <b>Bird, Alison</b>        | <i>FedEx</i>  | x                       |                               |
| <b>Blanco, Dr. Edgar</b>   | <i>Massachusetts Institute of Technology</i>              | x                       |                               |
| <b>Bowling, Mike</b>       | <i>Peabody Energy</i>                                     |                         | x                             |
| <b>Burget, Wanda</b>       | <i>Peabody Energy</i>                                     |                         | x                             |
| <b>Coyle, Gerard</b>       | <i>Evans Delivery</i>                                     | x                       |                               |
| <b>Craft, Dr. Elena</b>    | <i>Environmental Defense Fund</i>                         | x                       |                               |
| <b>Craig, Jason</b>        | <i>CH Robinson</i>  | x                       |                               |
| <b>Flint, Steve</b>        | <i>New York State Dept. of Environmental Conservation</i> |                         | x                             |
| <b>Fry, Eric</b>           | <i>Peabody Energy</i>                                     | x                       |                               |
| <b>Gautam, Dr. Mridul</b>  | <i>University of Nevada, Reno</i>                         | x                       |                               |
| <b>Gehring, Jack</b>       | <i>Caterpillar</i>  |                         | x                             |
| <b>Goff, Terry</b>         | <i>Caterpillar</i>  | Co-Chair                |                               |
| <b>Grimshaw, Jacky</b>     | <i>Center for Neighborhood Technology</i>                 | x                       |                               |
| <b>Howard, Joanne</b>      | <i>Deere &amp; Co.</i>                                    | x                       |                               |
| <b>Iannotti, Joseph</b>    | <i>New York State Dept. of Environmental Conservation</i> | x                       |                               |
| <b>Kamakate, Fanta</b>     | <i>International Council for Clean Transportation</i>     | x                       |                               |
| <b>Kassel, Rich</b>        | <i>Gladstein Associates</i>                               | x                       |                               |
| <b>Kedzie, Glen</b>        | <i>American Trucking Associations</i>                     | x                       |                               |
| <b>Kindberg, Dr. Lee</b>   | <i>Maersk Line</i>  | x                       |                               |
| <b>Kliesch, James</b>      | <i>American Honda</i>                                     | x                       |                               |
| <b>Kubsh, Dr. Joseph</b>   | <i>Manufacturers of Emission Controls Association</i>     | x                       |                               |
| <b>Lemmons, John</b>       | <i>Waste Management</i>                                   | x                       |                               |
| <b>Lutsey, Nic</b>         | <i>International Council for Clean Transportation</i>     |                         |                               |
| <b>Mann, Roy</b>           | <i>Case New Holland</i>                                   |                         | x                             |
| <b>Meese, John</b>         | <i>Waste Management</i>                                   |                         | x                             |
| <b>Mormino, Brian</b>      | <i>Cummins</i>  | x                       |                               |
| <b>Nath, Rick</b>          | <i>CSX</i>  | x                       |                               |
| <b>Norsworthy, Marcelo</b> | <i>Environmental Defense Fund</i>                         |                         | x                             |
| <b>Polovick, Buddy</b>     | <i>Environmental Protection Agency</i>                    | Co-Chair                |                               |
| <b>Sakai, Ichiro</b>       | <i>American Honda</i>                                     | x                       |                               |
| <b>Siegel, Adam</b>        | <i>Retail Industry Leaders Association</i>                | x                       |                               |
| <b>Symon, James</b>        | <i>New York State Dept. of Environmental Conservation</i> |                         | x                             |
| <b>Van Ness, Jim</b>       | <i>Luck Stone Quarry</i>                                  | x                       |                               |
| <b>Mitchel, Randal</b>     | <i>Waste Management</i>                                   |                         | x                             |
| <b>Walters, Chris</b>      | <i>Case New Holland</i>                                   |                         | x                             |
| <b>Yeager, Jackie</b>      | <i>Cummins</i>  |                         | x                             |

## B) Workgroup Process Roadmap



C) Sector Evaluation Filtering Tool - Worksheet Template

**MSTRS Sector Evaluation Process**

Evaluator: (name here)

**Step 1: Identify Sector (or subsector) for assessment: Vocational Truck**

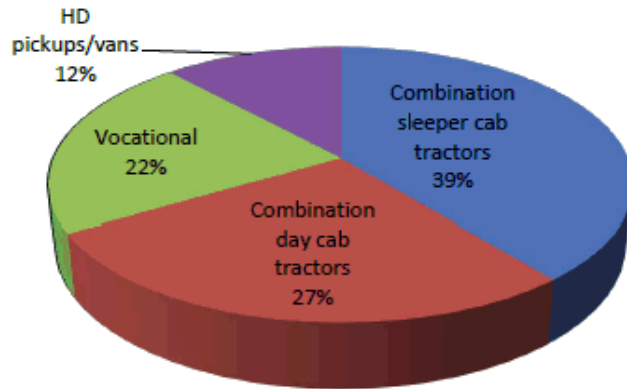
**Step 2: Begin Evaluation with *Filtering Questions***

|                         | <i>Filtering Questions</i>  | Does answer Support EPA Engagement? | Notes   |
|-------------------------|---|-------------------------------------|---|
| Market Characterization | <p><b>Example:</b><br/> <b>What is a key question or consideration for this sector?</b></p> <ul style="list-style-type: none"> <li>• <b>What is a brief answer(s) or example?</b></li> </ul>  | <b>X or No?</b>                     | <b>Other important considerations related to this question?</b>   |
|                         | <p>What are the Market Characteristics of this sector?</p> <ul style="list-style-type: none"> <li>• Specialized Vehicles</li> <li>• Few Large Fleets contracts (mostly refuse &amp; delivery), Many Owner-Operators</li> <li>• Some long term, Many job-by-job work orders</li> </ul>           | Limited                             | Refuse & delivery fleets provide an opportunity, with some major players (e.g., Waste Management, FedEx, UPS) already participating in SmartWay |
|                         | <p>Are there generally accepted “segments” in this sector to drive uniform technologies and practices across it?</p> <ul style="list-style-type: none"> <li>• Refuse &amp; delivery</li> <li>• Haul Trucks (e.g., dump trucks)</li> <li>• Specialty Trucks (e.g., Oil Field Service)</li> </ul> | Limited                             | As above  |
|                         | <p>Is there evidence of a market failure that is limiting the use of fuel saving technologies?</p> <ul style="list-style-type: none"> <li>• Application variability complicates and diminishes the value of fuel efficiency in some sub-sectors</li> </ul>                                      | Limited                             |   |

|             |   |         |   |
|-------------|---|---------|---|
|             | <p>Is information not freely flowing between manufacturers and end-users?</p> <ul style="list-style-type: none"> <li>No for new equipment purchasers</li> </ul>   | No      |   |
|             | <p>Are there useful market similarities between this sector and others?</p> <ul style="list-style-type: none"> <li>Similarities with nonroad in specialized nature and use of vehicles</li> </ul>   | No      |   |
|             | <p>Are shipper/carrier market dynamics present? Is there a notable market mechanism where carriers hire shippers to move goods or work on their behalf?</p>   |         |   |
| Fuel Issues | <p>What is the share of fuel use from this sector? Compared to all mobile sectors?</p> <ul style="list-style-type: none"> <li>Section 1.2 of the RIA (<a href="http://www.epa.gov/otag/climate/documents/420r11901.pdf">http://www.epa.gov/otag/climate/documents/420r11901.pdf</a>) has some basic statistics on vocational vehicle GHG and sales. See below.</li> </ul> | Limited | <p>Within the general vocational truck segment, it can be presumed a further breakdown of fuel use would show refuse and delivery are a large portion of the vocational fuel use.</p> |

Figure 1-5 below shows the relative contributions of GHG emissions from the different vehicle categories in 2005. Sleeper cab tractors contributed the most GHG emissions of these categories at about 39 percent of the total heavy-duty CO<sub>2</sub> emissions, as shown.

Figure 1-5 CO<sub>2</sub> Emissions from Heavy-Duty Truck Category in 2005<sup>7</sup>



### 1.2.1 Heavy-Duty Vehicle Sales

Although not first in terms of GHG emissions, Class 2b and 3 pickup trucks and vans are first in terms of sales volumes, with sales of over 1.3 million units in 2005, or nearly 66 percent of the heavy-duty market. Sales of Class 2b-8 vocational vehicles are the second most numerous, selling over one-half million units in 2005, or nearly 25 percent of the heavy-duty market. Since 2005, sales of all heavy-duty trucks have decreased as the economy contracted, and EPA's MOVES model, using sales growth from the 2011 Annual Energy Outlook for combination tractors and vocational vehicles along with CSM Worldwide forecasts for HD pickup trucks and vans, reflects a slow recovery in sales. Figure 1-6 and Figure 1-7 show the sales volumes used in MOVES for 2005 and projected sales for 2014 respectively, reflecting the market slowdown and recovery, while Table 1-2 shows sales projections by market segment for 2014-2018.<sup>6</sup>

Table 1-2 Sales Projection by Market Segment 2014-2018

| SALES ESTIMATES | 2B/3 PICKUPS/VANS | VOCATIONAL VEHICLES | COMBINATION TRACTORS | TOTAL     |
|-----------------|-------------------|---------------------|----------------------|-----------|
| 2014            | 784,780           | 563,004             | 179,087              | 1,526,871 |
| 2015            | 729,845           | 529,533             | 157,103              | 1,416,481 |
| 2016            | 712,328           | 508,856             | 144,533              | 1,365,717 |
| 2017            | 708,054           | 511,068             | 148,286              | 1,367,408 |
| 2018            | 716,549           | 531,001             | 160,979              | 1,408,529 |

|                        |   |         |   |
|------------------------|---|---------|---|
|                        | <p>What Fuel Efficiency improvements have been made in last 10 years?</p> <ul style="list-style-type: none"> <li>• 5% at the engine, but highly variable in application</li> <li>• Additional improvements in vehicle system efficiency, particularly in refuse due to the larger cost contribution of labor</li> </ul>   | Limited |   |
|                        | <p>Cost Alignment</p> <ul style="list-style-type: none"> <li>• Fuel represents % of cost varies across the sector with higher % of cost presumed in the delivery sector</li> </ul>  | No      | Not as high as Class 8 over-the-road fleets |
| Pollutants/Emissions   | <p>Does pollution profile from this sector differ from other sectors under consideration? e.g., is it a primary source of GHG, black carbon or criteria pollutants as compared to other mobile sources? What are target concerns?</p> <ul style="list-style-type: none"> <li>• Near zero criteria emissions 2007 &amp; later</li> </ul>   | No      |   |
|                        | <p>Have emissions performance improved notably in last 10 years?</p> <ul style="list-style-type: none"> <li>• Fleet is subject to near zero On-Highway Standards</li> </ul>   | No      |   |
|                        | <p>Are regulations on horizon that would address emissions notably in next 10 years?</p> <ul style="list-style-type: none"> <li>• On-Highway GHG rule</li> </ul>  | No      |   |
|                        | <p>What is profile of Legacy fleet in this sector, e.g., how long does fleet stay in operation before retrofit, repower or fleet turnover?</p> <ul style="list-style-type: none"> <li>• Relatively long life with diminished utilization</li> </ul>   | No      |   |
| Technology/Operational | <p>Are readily available technologies with verifiable efficiency and emission improvement not widely adopted?</p> <ul style="list-style-type: none"> <li>• Traditional SmartWay technologies often inappropriate or ineffective in this applications (e.g. aerodynamics, low rolling resistance tires)</li> <li>• At current new product emission levels, natural gas conversion does not provide an emissions advantage for new products .... Retrofits can provide an advantage for older products</li> </ul> | No      |   |
|                        | <p>What is the Equipment Development Cycle?</p> <ul style="list-style-type: none"> <li>• Longer than Class 8 Over the Road due to application specific development requirements</li> </ul>  | No      |   |
|                        | <p>Are operational or best management practices with verifiable efficiency and emission improvement not widely adopted?</p> <ul style="list-style-type: none"> <li>• Within fleet operations such as refuse &amp; delivery fleets, best practices are well-</li> </ul>  | Limited |   |

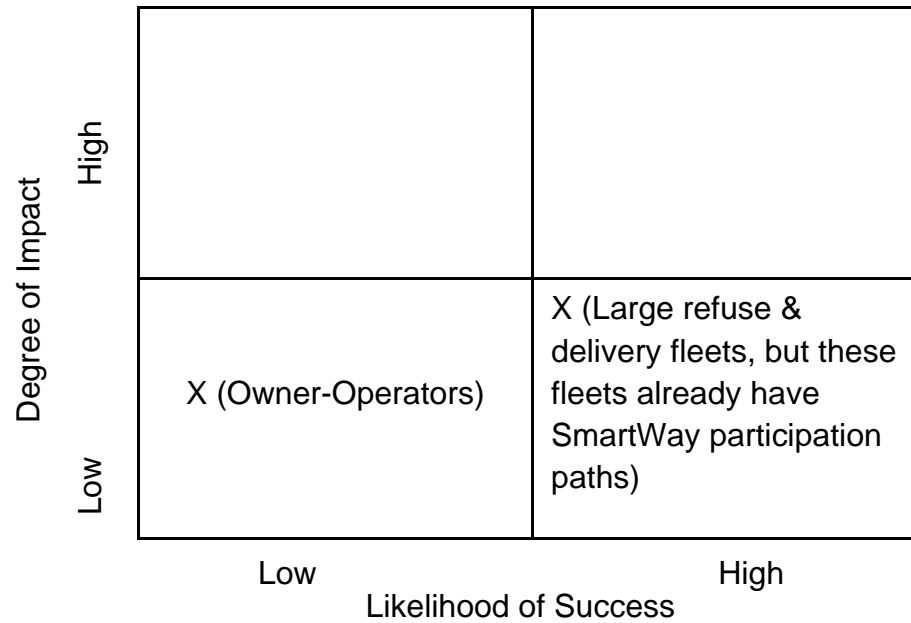
|                 |  |         |   |
|-----------------|--|---------|---|
|                 | known and well-adopted, less so with owner-operators and in the typical owner-operator operation, fleet best practices may not be relevant   |         |   |
| Current Efforts | Are there well established methodologies to estimate improvements in efficiency and emissions?<br><ul style="list-style-type: none"> <li>Fleet efficiencies, x, but little for job-by-job operators other than driving techniques</li> </ul> | Limited |   |
|                 | Could a Pilot Program be designed which adequately demonstrates appreciable, measureable reduction in fuel consumption?<br><ul style="list-style-type: none"> <li>Unlikely due to variation of application except in large fleets</li> </ul> | No      | Refuse & delivery fleets already participate in SmartWay, so little advantage for an incremental program pilot for these fleets |
|                 | Are reporting tools in place that create transparency currently?<br><ul style="list-style-type: none"> <li>To the extent fleets are in SmartWay x ... nothing for smaller users</li> </ul>   | Limited |   |
|                 | Are there any other organizations or industry led initiatives to address efficiency?<br><ul style="list-style-type: none"> <li>No</li> </ul>   | Limited |   |
|                 | Do other organizations or industry led initiatives address efficiency, better or more reliably as compared to SmartWay?<br><ul style="list-style-type: none"> <li>No</li> </ul>  | Limited |   |
|                 | Are there opportunities for partnerships with industry stakeholders?<br><ul style="list-style-type: none"> <li>Very limited ... the majority of vehicles are in small businesses with limited industry association involvement</li> </ul>    | Limited |   |
|                 | What are the potential barriers to success?<br><ul style="list-style-type: none"> <li>Limited to non-existent "back office" capabilities for owner-operators</li> </ul>  | Limited |   |



### Step 3: Continue assessment with *Prioritization Matrix*

| <i>Prioritization</i>                | Assessment | Considerations/Observations and notes  |
|--------------------------------------|------------|--|
| Impact (Low/Med/High)                | Low        | Consider magnitude of reductions and/or % of improvement in efficiency or reductions |
| Likelihood of Success (Low/Med/High) | Low        | Consider barriers to success   |

Place one “X” in the appropriate quadrant in any position, corner or side that represents assessment.



## Step 4: Make *Decisions on Type of Engagement*

| <i>Decisions on Type of Engagement</i>                        | Assessment | Considerations/Observations  |
|---|------------|--|
| Recommend including this Sector in SmartWay?                  | No.        | Large refuse & delivery fleets already engages, bulk of owner-operator users have limited resources to engage and benefit is limited |
| Recommend a Pilot or Demonstration?                           | No         | As above   |
| If neither, what other type of engagement may be recommended? |            |  |
|   |            |  |

## Step 5: Assess current *Maturity of Effort* to plan next steps

| <i>Maturity (Phase 1, 2 or 3)</i> | Assessment | Considerations/Observations |
|-----------------------------------|------------|-----------------------------|
| <b>Current?</b>                   | None       |                             |
| <b>Projected/preferred?</b>       | None       |                             |

### Phase 1: Launch and General Involvement

- This initial step should aim to include as many partners as possible in the sector
- Explore activities and services which *could* be established or developed for the sector to improve efficiency and reduce emissions

### Phase 2: Expanded, Practical Tools and Information

- The next step in maturity should be focused on enhancing and simplifying the tools to be user friendly and validating accurate and science-based information
- Value added elements may be included such as technology verification and supply chain sustainability initiatives
- Goal is to accelerate development and adoption of cost-effective technologies and best practices

**Phase 3: Technology and Operational Leadership –**

- The final evolution of the program should drive technology and operational excellence by creating classes of industry and sector leaders

## D) SmartWay Reciprocity Agreement with Clean Cargo Working Group

Clean Cargo and SmartWay share a commitment to having consistent and transparent methodologies for freight transport. CCWG is an international group formed in 2001-2002, and includes carrier members handling 60-70 percent of the global container movement.

- Annual Clean Cargo reporting and benchmark studies started in 2005, with methodologies developed by the carriers and reviewed and tested by the shipper members. The 2012 benchmark study included over 2000 vessels.
- Verification protocols were developed and tested in 2009-2010, and now most CCWG carrier members' CO<sub>2</sub> emissions factors are third-party verified.
- CCWG has worked recently to align and harmonize supply chain calculations across modes and across the world.

Opportunity: By establishing a cooperative agreement with CCWG, SmartWay could gain quick access to verified marine data, trade lane industry averages and other information. Possible options for data and tool sharing include:

- BSR could provide aggregate trade lane figures for CO<sub>2</sub> (already public) and potentially other metrics (SO<sub>x</sub> in particular)
- Upon a carrier's agreement, BSR or the carriers could provide some form of that carrier's data to SmartWay (e.g. entire data set, data from specific vessels/trade lanes/indicators, some or all of the KPI/scoring outputs)
- SmartWay could accept carrier data in CCWG format directly from carriers (without BSR involvement) so that carriers don't have to re-format their data; some adjustments to tools and methodology to facilitate this could be discussed

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| <p>Strengths:</p> <ol style="list-style-type: none"> <li>1. Both groups are committed to understandings and reducing the environmental impact of cargo movement.</li> <li>2. Discussions have shown good alignment in purpose and approach.</li> <li>3. Both groups have proven methodologies for their modes (truck/rail vs. marine)</li> </ol> | <p>Weaknesses</p> <ol style="list-style-type: none"> <li>1. SmartWay has been US-focused, whereas CCWG has always been global.</li> <li>2. Some international companies have concerns sharing business-sensitive data with a US governmental entity.</li> </ol> |
| <p>Opportunities:</p> <ol style="list-style-type: none"> <li>1. CCWG data, verification protocols and experience could jump-start initiatives SmartWay has hoped to provide.</li> <li>2. BSR can serve as a trusted intermediate to address any concerns about data confidentiality by international carriers.</li> </ol>                        | <p>Threats</p> <ol style="list-style-type: none"> <li>1. If methods are not aligned by leading groups like SmartWay and CCWG, competing methodologies will spring up creating confusion.</li> <li>2.</li> </ol>   |

## E) Agricultural Sector Additional Detail

### SCOPE CLARITY NEEDED ON PROGRAM OUTCOMES

The charge for the MSTRS SmartWay Legacy Fleet Workgroup is to improve upon ways to “cut fuel use and emissions in goods movement”. Specifically for the nonroad sector, the purpose of the request was to drive further “emission reductions and enhanced energy security”. If considering greenhouse gas emissions from only nonroad agricultural equipment, CO<sub>2</sub> would be the most prevalent. However at the farm site level- the level at which a pilot for the nonroad sector is being recommended-the greenhouse gas emissions profile drastically changes and the additional greenhouse gases of CH<sub>4</sub> and N<sub>2</sub>O need to be considered if meaningful GHG emissions reductions from the agricultural sector are the program objective. Considering all greenhouse gas emissions within the agricultural sector, CO<sub>2</sub> emissions are not the most prevalent greenhouse gas.<sup>50 51</sup>

Activities within the agricultural sector – the cultivation of crops and livestock for food – contribute to greenhouse gas (GHG) emissions in a variety of ways:

- Carbon dioxide (CO<sub>2</sub>) emissions from on-farm energy use, including both stationary and mobile sources such as operation of farm equipment, pumping irrigation water, crop drying utilizing various energy products (diesel, electricity, gasoline, natural gas, and liquefied petroleum gas), and transport from farms to point of sale.
- Nitrous oxide (N<sub>2</sub>O) emissions through various agricultural soils practices such as fertilizer application, and methods of irrigation and tillage.
- Methane (CH<sub>4</sub>) from livestock enteric fermentation
- CH<sub>4</sub> and N<sub>2</sub>O from manure management
- CH<sub>4</sub> from rice cultivation
- CH<sub>4</sub> and N<sub>2</sub>O from burning crop residues

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<sup>50</sup> [http://www.sourceuk.net/article/12/12018/greenhouse\\_gas\\_emissions\\_from\\_farms.html](http://www.sourceuk.net/article/12/12018/greenhouse_gas_emissions_from_farms.html). UK averages for agriculture: 51% N<sub>2</sub>O, 35% CH<sub>4</sub>, and 20% CO<sub>2</sub>.

<sup>51</sup> <http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-ES.pdf> and <http://www.epa.gov/climatechange/ghgemissions/sources/agriculture.html>, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2011*. Agricultural sector is 0.6% of U.S. CO<sub>2</sub> emissions compared to 8% of total U.S. Greenhouse Gas Emissions by Economic Sector based entirely on its N<sub>2</sub>O and CH<sub>4</sub> contribution.

In addition, some agricultural practices have the potential to sequester carbon dioxide in the soil such as intensification of crop production by limiting the use of bare-summer fallow in semi-arid regions, increased hay production, adoption of conservation tillage, improved forest and timber management practices, and the further use of wood products resulting in the long-term storage of carbon.

## **MARKET MECHANISMS CONSIDERATIONS**

Agriculture is an incredibly complex system and analysis of market context and drivers within this sector are equally complex.

For other subsectors of the nonroad sector, it has been reported that fuel costs are second only to labor costs at most job sites. This is not the same for the agricultural sector and farm sites. According to the 2007 USDA Census of Agriculture, energy expenses (gasoline, fuels, and oils purchased for the farm business) accounted for only 5.4% of U.S. farmers' total production expenses.<sup>52</sup>

In context, comparing that to 2002 census data where energy expenses accounted for 3.9% of U.S. farmers' total production expenses, this represents a 93% cost increase in energy expenses (from \$6.7B in 2002 to \$12.9B in 2007). Considering that for small farms especially, operating margins are typically less than ten percent; these rising energy costs can have an impact on the survival of many small farms.<sup>53</sup>

Looking at it from a different data set than the USDA Census of Agriculture energy expenses, the TIAX study discussed in the nonroad overview section, estimated agricultural fuel consumption in farm site mobile sources that consumed diesel at 3.84 billion gallons/year. A subgroup member used United States Department of Agriculture (USDA) data for the year 2006 to calculate agricultural fuel consumption from the crop and livestock perspective. The crop data were US cropland acres and the fuel consumption per acre for specific crops. In addition livestock production data were also used. The result was 3.22 billion gallons/year. The top three crops consuming the greatest total fuel were hay, corn and soybeans. A recent Purdue University study reported the fuel consumption per acre to grow corn was less than one-half that previously reported by the USDA. Using this estimate of 3.22 billion gallons/year and

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<sup>52</sup> [http://www.agcensus.usda.gov/Publications/2007/Online\\_Highlights/Fact\\_Sheets/Economics/economics.pdf](http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Fact_Sheets/Economics/economics.pdf)

<sup>53</sup> <http://www.aceee.org/research-report/ie051> ACEEE, Brown, Elliott, and Nadel "Energy Efficiency Programs in Agriculture: Design, Success, and Lessons Learned", January 2005, Report Number IE051.

an average net cost of diesel fuel of \$2.50/gallon, the total annual agricultural fuel cost would be \$8.05 billion. This would be only 2 percent of USDA reported annual agricultural cash farm receipts.

Both data sources highlight that unlike the other nonroad sectors being discussed, fuel costs are not a primary production cost at farm sites.

In addition, considering that a farm's revenue can be affected by many variables from federal support mechanisms, to food safety and nutrition policies, to macro and micro economic trends, to weather, farmers have more direct control over their costs than revenues and continuously seek the optimal use of all their inputs including fuels. The nonroad equipment marketplace has consistently demanded machine productivity and efficiency improvements because fuel consumption is a primary operating cost and concern. There are many examples of how concern for fuel efficiency drives agricultural equipment manufacturers to design and produce fuel efficient and productive equipment across their diverse product lines.

An emerging market mechanism for the agricultural sector is the issue of agricultural sustainability which is creating pull from food, fiber and retail companies across their value chains and calling for farm sites to optimize their usage of natural resources and minimize their environmental footprints.

## **CURRENT EFFORTS**

The purpose of this section is to highlight the numerous and diverse energy efficiency activities already present in the agricultural sector to avoid duplication with any future EPA program. The items noted are not an exhaustive list. These present opportunities for the EPA to evaluate existing tools and lessons learned to determine if the resources, technical knowledge base, and established local networks should be leveraged in an EPA program.

### **U.S. Activities**

In 2005, an American Council for an Energy-Efficiency Economy (ACEEE) report<sup>54</sup> identified and reviewed a total of 52 programs nationwide that promote energy efficiency in the agriculture sector. These programs varied based on geographic scope, focus (technology, farm-type, or both), energy focus (efficiency or renewable), program scope,

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<sup>54</sup> <http://www.aceee.org/research-report/ie051> ACEEE, Brown, Elliott, and Nadel "Energy Efficiency Programs in Agriculture: Design, Success, and Lessons Learned", January 2005, Report Number IE051.

and type. This report highlighted the numerous and diverse activities already underway in the agricultural sector focused on energy efficiency.

The ACEEE report analyzed these 52 programs and made the following recommendations for what made an energy efficiency program successful in the agriculture sector and should be considered for any future energy programs in this sector. We include these recommendations here for consideration of any SmartWay pilot design:

- Clearly define program goals and objectives. Agriculture programs that promote energy efficiency often also have other non-energy goals.
- “Know thy implementer”: Agriculture programs that met their goals most often were locally implemented or were designed to appear that way. Local community networks are extraordinarily important for program credibility within the agriculture sector.
- Multi-sector programs were able to make progress in the agriculture sector but they need agriculture-specific marketing and attention.
- Evaluation of energy or cost savings benefits of the programs is critical.

Overall, the programs evaluated in the report contained flexibility and a mixture of benefits resulting from them. In the agriculture sector, energy efficiency was often presented as part of a group of benefits that benefit the farmer.

### ***Field to Market***

Field to Market is a collaborative stakeholder group of producers, agribusinesses, food, fiber and retail companies, conservation organizations, universities, and agency partners that are working together to define, measure, and develop a supply-chain system for agricultural sustainability.<sup>55</sup> This organization has developed three main outputs to learn from:

- Baseline indicators<sup>56</sup> for six crops (corn, cotton, potato, rice, soybeans, and wheat) from 1980-2011 which include energy use and greenhouse gas emissions. The Energy Use Indicator was developed using data from several

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<sup>55</sup> <http://www.fieldtomarket.org/>

<sup>56</sup> Field to Market (2012 V2). Environmental and Socioeconomic Indicators for Measuring Outcomes of On-Farm Agricultural Production in the United States: Second Report, (Version 2), December 2012. Available at: [www.fieldtomarket.org. http://www.fieldtomarket.org/report/national-2/PNT\\_NatReport\\_A27.pdf](http://www.fieldtomarket.org/report/national-2/PNT_NatReport_A27.pdf)



USDA sources including Agriculture Resource Management (ARMs) surveys and Agricultural Chemical Usage reports, as well as other sources such as university crop enterprise budgets, the Greenhouse Gas Regulated Emissions and Energy Use in Transportation (GREET 1.8d) model from Argonne National Laboratory, the Farm and Ranch Irrigation Survey, and the Agricultural Census. In the case of equipment operation, a combination of ARMs data on tillage practices as well as national level data for tillage practices from the Conservation Technology Information Center (CTIC) were used with data on energy consumption from NRCS and ERS. The results of this baseline indicators study from 1980-2011 showed energy use and greenhouse gas emissions per unit of production decreasing for all six crops.

- The FieldPrint Calculator<sup>57</sup> which is a simple tool designed to help farmers look at how their crop production operations impact the sustainability of their farms. It provides general information based on the practices that are most likely to influence energy use, climate impact, soil loss, and water use at a farm site. The output FieldPrint value can be compared to county, state and national averages and different scenarios can be run. The Energy Use Resource metric within the FieldPrint Calculator accounts for the total (direct and embedded) energy in crop production. The Energy Use Resource Fieldprint is in units of energy amount per unit of production, such as BTU per bushel in the case of corn. The Energy Use Resource consists of direct and embedded energy subtotals. The direct energy subtotal includes tillage and equipment operation, manure application, irrigation systems, transportation, and drying. The embedded energy subtotal includes seed, fertilizer and lime, and crop protectants. The direct energy values for tillage and equipment operation and manure application are from the RUSLE2 model, while irrigation systems, transportation, and drying are calculated from published formulations that require user entries. The embedded energies for seed and crop protectants are calculated, while the energy for fertilizer and lime is from the “Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET)” model.
- Pilot Projects. Currently, Field to Market has five projects<sup>58</sup> in the field and several pilots that are just getting started that have been created through

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<sup>57</sup> <http://www.fieldtomarket.org/fieldprint-calculator/info/#energy>

<sup>58</sup> <http://www.fieldtomarket.org/from-the-field/>

partnerships among member companies, organizations, and growers. One example of these pilot projects to provide context is one sponsored by Bunge and Kellogg Company to work toward completing the carbon and water footprint for Kellogg's Frosted Flakes. Working with corn farmers in Nebraska, the project is capturing the environmental inputs and impacts of growing the corn used in the Kellogg's Frosted Flakes supply chain through collecting multiple years of data using the Fieldprint Calculator. Results from the initial pilot year informed Fieldprint Calculator improvements, in addition to giving farmers an opportunity to compare their inputs, outputs, practices and environmental impacts in a confidential but meaningful format. Bunge and Kellogg continue working directly with farmers, as well as local partners, such as National Resource and Conservation Service (NRCS), National Corn Growers Association (NCGA), Nebraska Corn Board and the University of Nebraska Extension Service, to gather data for additional years while continually increasing the value of the Field to Market work for both the growers and the entire supply chain. These demonstration projects provide valuable insight on the hurdles, limitations, and benefits of growers developing a sustainability baseline of their fields.

## **Energy Title of the Farm Bill**

The Energy Title of the Farm Bill includes the Rural Energy for America (REAP) program. The REAP program provides financial assistance to agricultural producers to purchase, install, and construct renewable energy systems and make energy efficiency improvements. This, for example, is leveraged in another EPA voluntary program entitled AgSTAR<sup>5960</sup> which is a voluntary outreach and educational program that promotes the recovery and use of methane from animal manure.

## **USDA**

In any further exploration of a public-private market based partnership model in the agricultural nonroad sector, we recommend the USDA's tools and resources be investigated fully.

In addition to USDA data sources such as RUSLE2, ARMS, and census reports being used in Field to Market research, calculators such as Energy Estimator - Tillage<sup>61</sup>

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<sup>59</sup> <http://www.epa.gov/agstar/>

<sup>60</sup> <http://www.epa.gov/agstar/tools/project-dev/index.html>

<sup>61</sup> <http://ecat.sc.egov.usda.gov/>

provided by the National Resources Conservation Service (NRCS) estimates diesel fuel use and costs in the production of key crops by area and compares potential energy savings between conventional tillage and alternative tillage systems. The crops covered were identified by NRCS agronomists along with the estimated typical fuel use associated with common tillage systems. The Energy Estimator provides a magnitude of diesel fuel savings under different levels of tillage.

A USDA example which is closer to the EPA's SmartWay on-road activities is Oregon's USDA NRCS Conservation Stewardship Program which contains an Energy Enhancement Activity for Fuel Use Reduction for Field Operations<sup>62</sup>. Participants in this Conservation Stewardship Program can document their baseline fuel consumption for all field operations using the USDA's RUSLE2 program. This baseline is compared with fuel consumption for the planned reduced field operations, also calculated with RUSLE2. Activity credit is given if the estimated reduction in fuel use between the present and the planned is greater than 20%.

In addition to these existing USDA programs and tools, Agriculture Secretary Tom Vilsack outlined the following additional climate solutions that the USDA is developing on 5 June 2013:

- Regional Climate Hubs<sup>63</sup>: Working in partnership with producers and foresters and other agencies, the hubs will serve as a source of regional data and interpretation of climate change forecasts for hazard and adaptation planning for agriculture and natural resource management. The Hubs will build capacity within USDA to deliver information and guidance on technologies and risk management practices at regional and local scales.
- "Carbon Management and Evaluation Tool," also known as COMET-FARM<sup>64</sup> which is a free online tool that will help producers estimate the 'carbon footprint' for all or part of their farm/ranch operation and then allows evaluation of different options for reducing GHG emissions and sequestering more carbon. The system uses information on management practices together with spatially-explicit information on climate and soil conditions from USDA databases (which are

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<sup>62</sup> [http://www.or.nrcs.usda.gov/programs/csp/csp\\_data/2013/Enhancements/ENR/ENR01\\_FY13.pdf](http://www.or.nrcs.usda.gov/programs/csp/csp_data/2013/Enhancements/ENR/ENR01_FY13.pdf)

<sup>63</sup> [http://www.usda.gov/oce/climate\\_change/regional\\_hubs.htm](http://www.usda.gov/oce/climate_change/regional_hubs.htm)

<sup>64</sup> <http://cometfarm.nrel.colostate.edu/>

provided automatically in the tool) to run a series of models for each potential source of greenhouse gas emissions.

- Uniform, Science-Based Cover Crop Guidance based on local climate data, tillage management and soil information to account for daily crop growth and use of soil moisture. With this information, experts determined the latest possible time to terminate a cover crop to minimize risk to the cash crop yield. RMA, NRCS and FSA will all uniformly refer producers to these guidelines, and will use them to administer programs.

### **American Farm Bureau**

In response to President Obama's Climate Action Plan released 25 June 2013, the American Farm Bureau updated their climate change issue document<sup>65</sup>. Key points relative to a SmartWay-like program follow:

- The Farm Bureau supports the following:
  1. Market-based solutions, rather than federal or state emission limits, being used to achieve a reduction in GHG emissions from any sources
  2. Alternative energy sources, which will minimize atmospheric pollution
- In regards to the USDA's new regional climate hubs, the Farm Bureau believes that having the technology, traits and production practices will be more beneficial than burdening the economy with additional regulations.

### **Nebraska Tractor Test**

From the equipment side, test data on tractor performance is available through the Nebraska Tractor Test Laboratory in Lincoln, NE. This data provides customers baseline information on tractor performance on a laboratory power-take-off dynamometer and on a tractive effort dynamometer. The real world relevance of this data can be considered only anecdotally, but not directly indicative of real-world performance.<sup>66</sup>

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<sup>65</sup> <http://www.fb.org/issues/docs/climate13.pdf>

<sup>66</sup> Robert Grisso, *Nebraska Tractor Test Data Shows Current Models Are 10-15% More Efficient* ("Your tractor is likely more efficient than models bought 20 years ago. ... Bobby Grisso ... found that models tested in 2000 averaged 16.5 horsepower-hours per gallon compared to an average of 14.5 for models tested in 1980."); see Robert Grisso et al., *Predicting Tractor Fuel Consumption*, 20 *Applied Engineering in Agric.* 553, 558 (2004) ("During the past 20 years of tractor testing, improved fuel efficiency from NTTL reports was shown. A 4.8% decrease in average annual specific volumetric

## **European Union Activities**

CEMA, the European association representing the agricultural machinery industry, supports the reduction of energy consumption and greenhouse gas emissions in the agriculture sector through a voluntary approach that takes into account the complexity and diversity of the sector. CEMA advocates that energy savings in the agricultural sector come from the combination/interaction of improvements in the following four areas:

1. Machine Efficiency: Optimization of engine, transmission, hydraulics, tires, etc.
2. Process efficiency: Selecting the best machine or combination of machines for application.
3. Operations efficiency: Training of machine operators and providing enhanced information to minimize fuel used to complete the work.
4. Alternative Energy Sources: Use of biofuels, electric drives, solar panels, hybrid drives, etc.

CEMA, along with VDMA – the German Engineering Federation, is investigating sponsoring a university research project that will collectively study each of these four areas for a particular crop for a particular region in Europe, for example wheat. The research would employ commercial software to calculate equipment CO<sub>2</sub> emissions in each agricultural step in producing the crop. The desired output is a CO<sub>2</sub> per ton of crop, i.e. wheat, baseline for that crop in that region. The vision is that this process will be repeated to model additional regions to ultimately develop a typical value for that crop in the EU. Once a baseline typical value is determined, simulation would be used to model the effects of new technology offered by industry with the plan that the baseline would be updated every four years.

## **Current Efforts Summary**

The overall efforts of the agricultural sector to improve efficiency and reduce emissions are at an all-time high.

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fuel consumption, for the data used in the *ASAE Standards*, was estimated.”); Noel D. Uri & Kelly Day, *Energy Efficiency, Technological Change and the Dieselization of Agriculture in the United States*, 16 *Transp. Planning & Tech.* 221, 224-25 (1992) (“Beginning in 1975, there is an identifiable improvement in diesel fuel powered equipment energy efficiency. Using annual data ... from the Nebraska Tractor Tests ... significant trends in energy efficiency across horsepower categories are apparent.”).

- Tools to track operational activities are becoming more and more widespread. These tools show promise and could be a strong starting point for reviewing the key hurdle of reporting in extending SmartWay into this sector.
- Information on land use and fuel use is available from USDA.

Many barriers can be envisioned that will need to be evaluated when deciding on the opportunity the agricultural sector provides to SmartWay. The variation in farming operations could make it challenging to implement a single program/tool that works for all farm sites. Market-based mechanisms that could drive further emission reductions in the agricultural sector will not be the same mechanisms as the on-road or other nonroad sectors and still needs to be developed further.

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