Green Freight in Cambodia
Opportunities for Market-Based Interventions

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Green Freight in Cambodia: Opportunities for Market-Based Interventions

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Sebastian Philipps
June 2014
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<td>ADB</td>
<td>Asian Development Bank</td>
</tr>
<tr>
<td>ASEAN</td>
<td>Association of Southeast Asian Nations</td>
</tr>
<tr>
<td>ASI</td>
<td>Avoid-Shift-Improve Approach</td>
</tr>
<tr>
<td>BAU</td>
<td>business as usual</td>
</tr>
<tr>
<td>BCI</td>
<td>Biodiversity Conservation Corridors Initiative</td>
</tr>
<tr>
<td>CAI-Asia</td>
<td>Clean Air Initiative for Asian Cities</td>
</tr>
<tr>
<td>CAMTA</td>
<td>Cambodian Trucking Association</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>CEP-BCI</td>
<td>Core Environment Program and Biodiversity Conservation Corridors Initiative</td>
</tr>
<tr>
<td>CM</td>
<td>countermeasure</td>
</tr>
<tr>
<td>CNTC</td>
<td>Carbon Neutral Transport Corridors</td>
</tr>
<tr>
<td>COO</td>
<td>Chief Operating Officer</td>
</tr>
<tr>
<td>EEA</td>
<td>European Environment Agency</td>
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<td>EOC</td>
<td>Environment Operations Center</td>
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<tr>
<td>FRETA</td>
<td>Freight Transport Association</td>
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<tr>
<td>GHG</td>
<td>greenhouse gas</td>
</tr>
<tr>
<td>GMS</td>
<td>Greater Mekong Subregion</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>Lao People's Democratic Republic</td>
</tr>
<tr>
<td>MOE</td>
<td>Ministry of Environment (of Cambodia)</td>
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<td>MOJ</td>
<td>Ministry of Justice (of Cambodia)</td>
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<tr>
<td>MOU</td>
<td>memorandum of understanding</td>
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<tr>
<td>MPWT</td>
<td>Ministry of Public Works and Transport (of Cambodia)</td>
</tr>
<tr>
<td>MRV</td>
<td>measurement, reporting, and verification</td>
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<tr>
<td>NAMA</td>
<td>Nationally Appropriate Mitigation Action</td>
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<tr>
<td>NGO</td>
<td>nongovernment organization</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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</tr>
<tr>
<td>NPV</td>
<td>net present value</td>
</tr>
<tr>
<td>PM</td>
<td>particulate matter</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
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<tr>
<td>RETA</td>
<td>regional technical assistance</td>
</tr>
<tr>
<td>ROE</td>
<td>return on equity</td>
</tr>
<tr>
<td>SEC</td>
<td>Southern Economic Corridor</td>
</tr>
<tr>
<td>SMEs</td>
<td>small and medium-sized enterprises</td>
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<tr>
<td>TEU</td>
<td>twenty-foot equivalent unit</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
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<td>United Nations Environment Programme</td>
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Note: In this report, “$” refers to US dollars
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EXECUTIVE SUMMARY

Climate change will significantly affect the Greater Mekong Subregion (GMS). It threatens to undermine development achievements of past and future years (ADB 2014). Resource depletion and biodiversity loss represent similar threats. GMS countries will need to find ways to develop in a climate-smart and sustainable way, if they want to create better lives for their people (ADB 2014).

This report under the GMS Core Environment Program (CEP) outlines for the Cambodian freight sector that economic development and climate protection can go hand in hand, and that regional economic integration can act as a driving force behind this. The analysis indicates the climate-smart business case for private companies. It describes the investment case for green freight from the company, donor, and government perspectives, and explains how investments in market-centered interventions can support long-term policy change.

The freight sector is vital for Cambodia from an economic and a climate perspective

The Cambodian freight transport sector offers major potential to support the country’s ambitions in trade, development, and regional integration. In theory, Cambodia could be the main beneficiary of transport along the Southern Economic Corridor (SEC), due to its geographical location. In practice, the country faces the threat of losing the top segment of its freight sector, in the case of full GMS integration, due to low competitiveness. At present, the freight sector represents a bottleneck on the way to reaching government export targets.

For climate protection in Cambodia, freight transport is of central importance. Out of all business sectors other than agriculture and land use, freight could deliver the highest contribution to greenhouse gas mitigation in Cambodia until 2030 (35%) and the second-highest contribution until 2050 (29%), according to calculations from the Ministry of Environment of Cambodia and Kyoto University (Mao 2014, 22). Reductions stemming from energy efficiency account for around 90% of this estimate until 2030 and 2050. This clearly renders fuel efficiency as the main leverage for low-carbon transport development in the country.

Current investment patterns fail to address major challenges

Public investment in the freight sector focuses on infrastructure development, which is vital for competitiveness. However, it does not focus on carbon emissions reduction and carries limited short- to mid-term potential with regard to low-carbon development. While a modal shift toward rail and water transport remains important in the long run, additional investments in road freight assets and asset utilization are necessary. Such investments offer relevant co-benefits in the fields of trade facilitation, road safety, energy security, and local pollution reduction.

Private investment in Cambodia is at a crossroads. The low profitability of trucking activities impedes substantial investments, which in turn stifles competitiveness and thereby discourages new investments. Specific interventions can help stop this downward spiral and increase the Cambodian capacity to cater to the logistics market along the SEC. This could support a new narrative to motivate large-scale change in the sector.

Fuel efficiency is the leverage point for climate-smart competitive trucking in Cambodia

Fuel efficiency represents the key leverage point for enhancing competitiveness and climate protection in the Cambodian road freight sector. Fuel costs constitute more than 40% of the total and 50% to 70% of the variable costs of trucking in Cambodia. Fuel efficiency in the top segment of the Cambodian trucking market is considerably lower than in Thailand and Vietnam, where most competition arises. Higher fuel prices in Cambodia further deepen this imbalance.
Technology updates, driver training, and transparency toward – and interaction with – global value chain operations are the key entry points to improve fuel efficiency in the road freight sector in Cambodia. The institutional and financial setting strictly limits the operationalization of these entry points. Interventions, therefore, need to focus on certain market segments, promote a more effective division of labor between actors, and use existing incentive structures.

The report recommends a focus on the top market segment and game changers

This report applies a new categorization for companies in the Cambodian trucking market. The suggested segmentation allows focused approaches to the sector. Interventions for technology upgrades should target the top segment. This segment still falls behind Thai and Vietnamese fuel efficiency standards, although it is the most efficient in Cambodia. It has the biggest growth potential along the SEC, is the only officially organized segment in Cambodia, and appears more ready to absorb and manage capital than others.

Service providers, international buyers and drivers are very important game changers within the trucking and logistics sector in Cambodia. They can play a crucial role in the transition to a better division of labor, and they need more attention and inclusion in interventions than they have enjoyed so far. In particular, approaches that focus on truck drivers could set free additional capacities on the side of companies.

Three market-centered interventions could lay the foundation for long-term policy change

Financial interventions should unlock market-based solutions, in order to work independently of long-term subsidization and government services. Very difficult law enforcement, high monitoring costs for large-scale micro-managed interventions, and the incentive structure within the trucking business model put tight limits on conventional technical assistance and grants. Long-term policy change benefits from preceding market-centered interventions to prepare the private sector.

This report suggests three approaches to increasing average fuel efficiency in the Cambodia trucking market: first, a market-based driver training scheme to link greenhouse gas (GHG) mitigation to solving driver scarcity, the most burning issue of the trucking industry; second, a leasing scheme to create more profitable business models that spur an appetite among companies to invest in efficient trucks; and third, the involvement of international buyers via standards or labeling.

Notional rates for carbon reduction offer a basis for comparing proposed interventions with alternatives. A combined stylized projection for the first two interventions yielded a reduction potential of around 300,000 tons of CO₂ until 2030 at a notional rate of $41 (2014 dollar value) per ton of carbon reduction, excluding co-benefits.

The report suggests scaling up interventions regionally with the help of co-investors

The proposed investments do not only unlock the business case and curb carbon emissions; they also reduce local emissions and dependency on energy imports, further improving road safety and the institutions for vocational training in Cambodia. Ultimately, they enable stricter policy-making in the transport sector and pave the way to fight corruption. This makes them interesting for public interest co-investors.

Other GMS countries share with Cambodia many of the major challenges related to green freight. The entire region needs initiatives and large-scale change in order to become more competitive in international trade and embark on a climate-smart and sustainable development path. This makes implementing interventions on a regional level a very attractive option for scaling up and replication, particularly in Lao PDR and Vietnam. The EOC starts interventions in these GMS countries.
I. Introduction

Companies, the Government of Cambodia, and international donors would benefit from a move toward low carbon and resource efficient freight sector development in Cambodia. Freight transport is essential for national development and regional economic integration via economic corridors in the GMS. It needs to develop in a way that supports the international competitiveness of Cambodia and the region. An improved logistics system can create increased road safety and social value through market inclusion for rural areas. Economic corridors can heal hotspots of greenhouse gas emissions, depletion of natural resources, and biodiversity loss. A green freight system is necessary to prevent development threatening its own achievements through these negative impacts.

Figure 1  The Inquiry Focuses on Politico-economic Potential for Green Freight in Cambodia

This assessment follows a carbon-centric perspective on green freight in line with the ambition to address climate change as the major common threat to the GMS. However, it systematically includes domestic and local co-benefits in other areas such as health and fuel dependency. It identifies ways to reduce the average age of the Cambodian truck fleet, improve driver skills, and create a sustainable investment climate for the Cambodian logistics sector.

The analysis of the Cambodian freight sector contributes to a wider Green Freight Initiative organized by the Asian Development Bank Greater Mekong Subregion Environment Operations Center (EOC) as part of the GMS Core Environment Program (CEP). It applies knowledge gained from assessments in Thailand, Lao PDR and Vietnam and draws on experiences from green freight pilot projects.

Previous work under the Green Freight Initiative has produced substantial findings on the size of the technical potential for freight-related greenhouse gas (GHG) mitigation throughout the Greater Mekong Subregion (GMS). Building on these results, this report focuses on economic potential as a subset of technical potential and tries to identify and describe ways of tapping into it (Figure 1).

A Outline and Main Objectives

This report supports green freight development in Cambodia and along the GMS Southern Economic Corridor (SEC). It suggests ways to reduce the average fleet age while keeping logistics costs low and enabling market-based positive returns on investment. This happens against a rough baseline of anticipated development in a scenario without intervention.
The remainder of this first part explains the methodology behind the report and presents its main sources, pointing out the limitations of the inquiry and explaining its extrapolations and conjectures. It attempts to answer the following questions:

(i) How does the report define mitigation potential in the Cambodian freight sector, and which heuristic does it apply to arrive at the recommendations for action?

(ii) On which main sources does the report draw to substantiate its recommendations?

(iii) How does the report fit into the bigger picture of green freight in the GMS and which learning from other sector assessments and initiatives does the inquiry apply?

Part II (see Box 1) of the report maps the freight market in Cambodia, the underlying actor network and entry points for green freight developments under the current situation. This part performs the ambitious task of translating technical potential into politico-economic potential to arrive at potential interventions.

**Box 1  Research Objectives for Part II**

**Part II: Identify Entry Points for Green Freight Development in Cambodia**

1. Is there mitigation potential in the Cambodian freight sector?
2. What determines the translation of technical into applied politico-economic potential?
3. Which entry points exist for unlocking applied politico-economic potential?

Part III (see Box 2) shows potential investment cases for companies, the Government of Cambodia, and donors, focusing on self-sustaining models for each category: viable business models for companies, low-cost, stable solutions for government, and focused options for donor engagement.

**Box 2  Objectives for Presenting Recommendations in Part III**

**Part III: Making the Investment Case for Green Freight in Cambodia**

1. How can Cambodian freight companies use green freight as a competitiveness strategy, and how can they convince their banks and value chain partners of this strategy?
2. How can the Cambodian government use green freight development to drive and secure economic development, sustain natural resources and create social benefits?
3. How can the ADB Core Environment Program and other donor organizations effectively invest in tapping into the potential of green freight in Cambodia?

**B  Methodology**

This analysis applies a heuristic rather than a rigorous methodology. The heuristic evolved around a major funding gap for climate-smart solutions (see Figure 2), and seeks to operationalize a working definition of entry points for green freight development in Cambodia.

The methodology aims to unlock the following constellation in the Cambodian road freight sector: first, nobody is willing to pay for emission reductions. Second, there is willingness to pay for addressing other challenges in the system. Third, some CO₂ mitigation possibilities offer sufficient co-benefits to satisfy those willing to pay for such co-benefits. The challenge remains that systemic barriers disable these investments from happening. Figure 4 shows the methodological ambition to identify ways of removing these barriers, i.e. to link business and public concerns for climate-smart solutions.
B.1. Defining Entry Points for Green Freight

Entry points are constellations where a donor intervention can link public concern (CO₂ mitigation) and business concerns. A key entry point allows for the utilization of existing enabling factors and eliminates barriers in a focused way. Intervening at such a key entry point positively impacts all key proxy indicators, as listed by Figure 3, while limiting the donor role to a one-time intervention.

Green freight, as part of green logistics, has been subject to various definitions (Keuschen & Klumpp 2011). This report follows the definition by an official Rio+20 Voluntary Commitment:

Figure 3  The Definition of Green Freight Programs and How This Report Operationalizes It

A definition of green freight programs

"Green Freight Programs (...) reduce fossil fuel dependency, improve air quality and minimize CO₂ emissions (...) without hindering economic development." (ESC et al. 2012)

Operationalization

The data situation in Cambodia makes it necessary to operationalize this definition with proxies:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Target indicator</th>
<th>Applied proxy indicator</th>
</tr>
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<tbody>
<tr>
<td>Environmental and social</td>
<td>Overlap</td>
<td>Average age of truck fleet</td>
</tr>
<tr>
<td></td>
<td>Economic Development</td>
<td>Supply of skilled drivers</td>
</tr>
<tr>
<td></td>
<td>CO₂ emissions</td>
<td>Average age of truck fleet</td>
</tr>
<tr>
<td></td>
<td>Fossil fuel dependency</td>
<td>Supply of skilled drivers</td>
</tr>
<tr>
<td></td>
<td>Logistics competitiveness</td>
<td>Logistics cost per TEU-km</td>
</tr>
<tr>
<td></td>
<td>Economic sustainability</td>
<td>Return on investment</td>
</tr>
</tbody>
</table>

**TEU** = twenty-foot equivalent unit
Operationalizing the ambitions behind the green freight concept is difficult in the Cambodian context. Low data availability on the macro and company levels, an opaque and fragmented trucking industry, and a large informal sector make the application of very imprecise proxy indicators necessary. Figure 3 relates them to target indicators that stem from the above definition of green freight. Even these proxies rely on extrapolation and informed guessing.

B.2. The Three-Step Heuristic

The core heuristic for arriving at actor-based recommendations follows a three-step logic. Step 1 assesses technical mitigation and business interest. Step 2 analyzes whether framework conditions facilitate an alignment of interests and their operationalization. The result is a selection of key entry points for curbing emissions. Step 3 validates and details these key entry points to support proxy indicators, and translates them into specific recommendations.

Figure 4 The Three-Step Heuristic Behind the Inquiry

| Enabling factor = ☑, barrier = ☐ |

C Sources and Limitations

Data on the Cambodian freight sector, its actors, and future development is difficult to obtain and often incomplete and inconsistent. In most cases, quantitative data only point out a direction or inform a rough estimate. Accordingly, most suggestions below that are based on data indicate directions rather than providing specific information on volumes or effect sizes. Box 3 gives an example of how difficult the data situation is.

Box 3 Truck Data Gaps in Cambodia

The Phnom Penh Post (25 March 2013) stated 12,006 (in black) commercial heavy trucks were on the streets according to MPWT. Registration data lists 30,756 cumulated one-time registrations (in purple) of heavy trucks since 2003. Extrapolated data on the compulsory yearly inspection (in yellow), however, suggests a number of 10,137 heavy trucks. Combining the latter two numbers implies a data gap of 20,619 trucks (in red). These vehicles may have left the market within the last ten years or they may run still but avoid the compulsory inspection.

The research failed to clarify the situation and therefore sticks to the number from Phnom Penh Post, as it appears to be a reasonable and conservative estimate for mainstream trucking in Cambodia that interventions could seek to address.
Figure 5  Data Challenges: Vehicle Registration vs, Vehicle Inspection Data (see Box 3)

More extensive analyses of the green freight situation in Lao PDR, Thailand, and Vietnam facilitated by the EOC (2011), Crishna-Morgado et al. (2012), and the Blue Book by Ksoll and Brimble (2012) allowed for extrapolations and transfer of assumptions in many cases. This work was of great help, as it enabled a focus on translating assumed potential into specific opportunities.

The input by various experts and actors from the freight sector represents another indispensable source of information (see interview list in the appendix). Due to the small number of actors per category, these interviews are all of qualitative nature. Table 1 lists all major sources by category, and names related challenges.

Table 1  Overview of Main Source Categories and Related Challenges

<table>
<thead>
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<th>Data Sources</th>
<th>Challenges</th>
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<tbody>
<tr>
<td>49 talks with experts and practitioners (policy, industry, banking, stakeholders)</td>
<td>Due to small n only qualitative assessment possible</td>
</tr>
<tr>
<td>Data from MPWT, MOE, and the GMS EOC statistics system, policy documents</td>
<td>Data gaps and inconsistency of indicators over time</td>
</tr>
<tr>
<td>25 selected studies, academic publications, and project outputs</td>
<td>Few scientifically rigorous analyses due to difficult raw data situation</td>
</tr>
</tbody>
</table>

Primary Sources

Secondary Sources

MPWT = Ministry of Public Works and Transport of Cambodia, MOE = Ministry of Environment of Cambodia, GMS EOC = Greater Mekong Subregion Environment Operations Center
II. Entry Points for Green Freight Development in Cambodia

The technical CO$_2$ mitigation potential in the Cambodian freight sector is immense. However, it translates into modest applied potential when considering economic, political, and other structural framework conditions. Understanding this translation is vital for designing effective interventions.

In 2010, freight transport was the biggest non-land-use-related emitter. Freight-related emissions could see a 2.4-fold increase by 2030, and a 8.3-fold increase by 2050 in a business as usual scenario (BAU). A countermeasure scenario (CM) foresees a reduction by 30% by 2030 and a 2.5-fold increase by 2050, against a 2010 baseline (see Figure 6).

Chapter A names and describes the potentials of the three major influencing factors: driving behavior, vehicle technology, and logistics management. Tapping into technical potential in these fields in 2010 theoretically would have lowered the non land-use related emissions of Cambodia by 7.4% in comparison to actual 2010 emissions. Emissions from freight transport would have been 44.4% lower.

Figure 6  Technical Potential for Absolute and Relative CO$_2$ Mitigation in Freight Transport

![Figure 6](image)

Source: Based on data from Mao (2014)

BAU = Business as Usual Scenario, CM = Countermeasure Scenario

This technical potential is a necessary precondition for designing interventions, but it is not sufficient to evaluate the actual potential of an intervention. Chapter B describes how much remains of the technical potential after consideration of institutional and economic factors that frame the business case for logistics and trucking in Cambodia. Figure 7 illustrates this step.

According to the institutional and economic analysis, reductions of only 12% (equal to 3.5% of all non-land-use-related emissions) of all freight emissions are likely to be feasible. Out of this 12%, potential related to logistics management remains extremely difficult to tap into in the short run. Understanding the limitations leading to this moderate applied potential is crucial for actualizing it.

Chapter C indicates entry points for intervention. It identifies forces that act in favor of, or run counter to, a change toward more fuel efficiency. This analysis suggests that most relevant forces relate to or stem from the predominant revenue model for trucking and its entrenchment in the institutional setting.
A Does Green Freight Offer Climate Change Mitigation Potential?

In 2010, freight-related emissions accounted for 29% of all non-land-use-related CO$_2$ emissions in Cambodia, according to a current research project by the Ministry of Environment (MOE) of Cambodia and Kyoto University (Mao 2014). The study further states that road freight was not only the biggest emitter in 2010 but also carries the greatest non-land-use-related CO$_2$ mitigation potential until 2030, and the second largest potential until 2050. Figure 8 shows the distribution of mitigation potential, as derived from the underlying socio-economic scenario.

All these estimates build on data from an ongoing research project between the Cambodian MOE and Kyoto University. They may change in the future, but provide a strong indication for the high technical potential of the Cambodian road freight sector.

Under the model, around 90% of the estimated emission reductions stem from energy efficiency measures from improvement and avoidance strategies (see Box 4). Only around 10% of the reductions result from modal shift, i.e. from a substitution of road transport by rail and waterway
transport.\textsuperscript{1} The data clearly indicate that road freight represents a major emission reduction potential in the short and long runs, even when assuming a more substantive modal shift.\textsuperscript{2}

The model shows how big freight related mitigation is in theory. However, it does not tell whether road freight also represents the biggest mitigation prospect from an institutional and economic point of view. It is important to note that this section only analyzes the specific technical potential. It does not tell which reductions are actually feasible due to the politico-economic context.

\textbf{Box 4 The Avoid-Shift-Improve Approach}

\textbf{The Avoid-Shift-Improve Approach (ASI)} allows a categorization of measures for transport sector improvements. \textit{Avoid} measures reduce the need for travel, \textit{shift} measures facilitate a shift to more efficient modes or fuels, while \textit{improve} measures seize the efficiency potentials within given modes and trips. \textit{ASI} is a very common approach. It can serve as backbone for various applications. One is example is CAI-Asia (UNC RD & CAI-Asia 2011).

The Carbon Neutral Transport Corridor (CNTC) report by EOC (2011) identifies three major factors that determine the fuel efficiency of road freight in the GMS:\textsuperscript{3} driver behavior, vehicle technology, and logistics management systems. This analysis conjectures that findings for Vietnam, Lao PDR, and Thailand also hold for Cambodia. Interviews generally support this conjecture.

**A.1. Driver Behavior**

More fuel-efficient truck driving could have reduced all non-land-use-related emissions in Cambodia by 2.5 percent (15.1% of all freight-related emissions) in 2010. This rough estimate based on the aforementioned MOE model (Mao 2014) underlines the potential behind capacity building in the trucking sector. It does not refer to all the co-benefits that stem from better driving.

Driver behavior can cause variations in fuel consumption of up to 25\% depending on vehicle technology and external factors (GTZ 2007). In most cases, efficiency potential ranges from 10\% to 15\%. Arguably, potential in the field of driver behavior is high in a low-tech environment, where most drivers have little to no theoretical training on fuel efficiency.

If the above assumptions hold, fuel efficiency potential related to driver behavior should be around 15\% or higher in Cambodia. The country does not have schools for truck drivers. All interviewed trucking companies lamented the lack of trained personnel. Drivers reported to have bought their license without practical lessons. On top of all this, onboard technology to support the driver is often minimal except for few examples.

Potential co-benefits of better driving are big in Cambodia. Speeding, unnecessary braking, and the wrong use of gears also drive up local pollution (by increasing levels of particulate matter, or PM, that is between 10 and 2.5 micrometers in diameter) and impact road safety. Cambodia suffers from an increasing number of road fatalities (MPWT 2012). Hence, improved driver behavior not only promises significant emission reductions but also offers co-benefits to the public good.

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\textsuperscript{1} The model assumes an increase of rail freight from 0.02\% in 2010 to 20\% (15.02\% BAU) in 2030; and a decrease of freight carried by trucks from 57.06\% in 2010 to 42.1\% (47.06\% BAU) in 2030. Expectations for 2050 are identical with those for 2030. Waterway transport remains fixed (7.7\%) across all models and periods.

\textsuperscript{2} At the same time, this focus on road freight implies the need for further investigations into the potentials of modal shift in Cambodia in the long run. Fully utilized water and rail transport capacities operate at a level of carbon efficiency that road transport can hardly reach (McKinnon 2007, 6). Connecting railway systems would also drive regional integration.

\textsuperscript{3} This does exclude road infrastructure, which plays an important role for fuel efficiency but falls into a different category of interventions. Investments in road infrastructure are not a subject of this analysis.
A.2. Vehicle Technology

Truck technology upgrades carry the largest theoretical fuel saving potential in Cambodia. In 2010, the large-scale application of newer trucks would have reduced the entire country’s non-land-use-related emissions by 3.2% (19.3% of all freight-related emissions). This does not include the co-benefits stemming from lower local emissions and improved road safety.

The reported fuel efficiency of trucks in the top segment of the market ranges from 2 to 2.1 km per liter of diesel fuel. Currently, the carbon intensity of truck freight in Cambodia, measured in gram CO₂ per ton kilometer, is more than eight times higher than in the European Union (EEA 2014). This indicates what best-available technology could change. Even affordable technology makes a big difference: brand-new truck models that one company has considered buying would have an expected fuel economy of 2.6 km per liter, which equals a 19% efficiency gain.

Cambodia has a fleet of roughly 12,000 commercial trucks (see Box 3), excluding pickup trucks. In the absence of a domestic manufacturer, Cambodia imports all trucks or assembles them from imported scrap vehicles. According to the Cambodian Ministry of Public Works (MPWT), 90% of trucks are second hand vehicles. Most of them come from other Asian markets like Japan, Korea, and China. However, particularly in the container segment, more and more trucks from the United States pour into the Cambodian market.

Extrapolating from the in-depth analyses of the Laotian and Vietnamese situations by EOC (2011), the Cambodian truck fleet should be outdated. Indeed, qualitative statements obtained during interviews with Cambodian associations and the government show an image that very much resembles the fleet of Lao PDR, where only 2% of vehicles are 0-5 years old and more than 50% are at least 15 years old. The sample of roughly 700 Cambodian trucks covered by the interviews reflects this extrapolation: although the interviewed companies belong to the top market segment (see Table 2), a third of their trucks are around 10 years old with few later models among them. The remaining two thirds date back to the 1990s and even the 1980s.

This analysis ignores some potential. The modification of trucks (for instance, the application of aerodynamics equipment) carries additional efficiency potential. Furthermore, interviews suggested an influence of maintenance skills on the fuel efficiency of engines. The effects of both aspects are minor compared to the three major levers. Cambodian roads slow down trucks in a way that limits aerodynamics. EOC research (EOC 2011) suggests that upgrading trucks older than 15 years makes little sense. Maintenance variations likely have a smaller effect than driving variations, and donors can easily hook capacity building for maintenance staff to driver training schemes.

A.3. Logistics Management Systems

Logistics management can reduce empty hauls and overloading of trucks. Multi-company logistics infrastructure can effectively curb empty runs by up to 15 percentage points, as the example of Henan Anyang Modern Logistics Information Development has demonstrated (UNCRD & CAI-Asia 2011, 30). In Cambodia, a 10% reduction of empty hauls would have reduced all non-land-use-related emissions in the country by 1.66% (10% of all freight-related emissions).

Logistics management approaches do not play a role in this analysis because they need certain technology levels, driver capacity, and company-level management systems to work. Cambodia currently lacks all these prerequisites. Once they are in place, logistics management approaches

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4 A Chief Operating Officer (COO) said he hired Vietnamese mechanics to take care of his newer vehicles to sustain their efficiency and reliability.

5 Assuming a third of all hauls in 2010 to be empty and an increase of the utilization rate from 66% to 76.
will become the focus of interventions, as empty hauls are common in Cambodia. In the absence of systematic data, this inquiry extrapolates from the utilization rate of Lao PDR and Thailand (Chrisnha-Morgado et al. 2012) and assumes 40% of all hauls to run empty. Interview partners confirmed this on the micro level. Cambodia’s current account deficit of 10.9% of GDP (Brimble 2014) suggests an imbalanced flow of goods on the macro level.

B What Determines the Realization of Green Freight?

The design of the Cambodian trucking market does not facilitate fuel efficiency investments or other low-carbon measures. Thanks to the importance of fuel costs and the availability of affordable technology, there is a business case for fuel-efficient trucking on the company level. However, other framework conditions produce disincentives and deadlocks in the market. At the top, Association of Southeast Asian Nations (ASEAN) and GMS integration add uncertainty and influence the evaluation of the situation by individual actors.

Figure 9 gives an overview of framework conditions and indicates their effects on the realization of public and private interest in fuel efficiency. Both profit and mitigation interests suffer from structural deficits such as low capacity, weak policy enforcement, and low trust and compliance levels. Short-term oriented entry points will need to address or circumvent these common barriers.

In other fields, conditions for meeting public and private sector interests differ. While there is public demand for improved road safety and lower pollution levels, explicit demand for energy efficient and safe trucking is missing in the private sector. While public finance is lacking, companies could borrow to buy more fuel-efficient trucks – if investing were not unattractive due to low profit margins. Entry points will need to address this constellation and align interests.

Figure 9  Factors Supporting or Hindering the Realization of Public and Private Interests

<table>
<thead>
<tr>
<th>Interests</th>
<th>Enabling Conditions / Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Affordable technology is available</td>
</tr>
<tr>
<td>Public Concern (CO₂)</td>
<td>☑</td>
</tr>
<tr>
<td>Private Concerns (USD)</td>
<td>☑</td>
</tr>
<tr>
<td>Suggested response</td>
<td>Utilize</td>
</tr>
</tbody>
</table>

Enabling factor = ☑, barrier = ☒

B.1. Policy Framework and Infrastructure Development

“If an inspection center rejects a truck and asks the owners to repair, they just don’t do it. They stay on the road and bribe the police.” (A government official when asked about the rule of law)

The political incentive structure for green freight exists on paper, but concerted government action does not take place. Structural challenges prevent the implementation of existing strategies. Even worse, they frame the trucking business in a way that prevents investment in fuel efficiency.

Fuel-efficient, climate-smart transport can facilitate short-term development goals. The Government of Cambodia would benefit from it, even if they excluded climate change impacts from their policy rationale. Fuel dependency, road safety problems, and logistics costs are major political
concerns. Effective ways to mitigate these challenges – such as better driver capacity, better trucks, and improved logistics systems – are also typical green freight measures.

The National Strategic Plan for Climate Change Adaptation and Greenhouse Gas Mitigation in the Transport Sector (MPWT 2012) reflects the correlation between climate protection and development benefits and suggests specific strategies (Table 2). However, according to officials from MPWT, these strategies still await implementation due to a lack of funds. Measures specified in the plan do not create revenue streams to fund them. As a consequence, the business case for government officials to implement activities is weak and the feasibility for implementation is limited.

### Table 2  The National Strategic Plan by MPWT and Some Related Empirical Observations

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Proposed Actions Relevant Here</th>
<th>Empirical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1: Raise public awareness</td>
<td>Provide training and foster inter-ministerial cooperation to raise awareness; enhance acceptance of vehicle inspection</td>
<td>Lack of coordination between ministries on logistics; uncertainty about the whereabouts of two thirds out of 30,000 trucks registered since 2003</td>
</tr>
<tr>
<td>No. 2: Enhance inspection and maintenance</td>
<td>Stop modification; improve inspection rules; increase tax on imports; fine drivers for avoiding inspection</td>
<td>For inspection, see above; few and non-functional inspection stations according to international service provider; low fines for avoiding inspections</td>
</tr>
<tr>
<td>No. 4: Low carbon development</td>
<td>Build capacity for carbon financing and footprint assessment</td>
<td>Lack of basic data on freight volumes and emissions</td>
</tr>
<tr>
<td>No. 6: Efficient technology</td>
<td>Incorporate fuel-saving technologies in vehicles; upgrading the fleet; shift fuel types</td>
<td>Outdated fleet, underinvestment in upgrades; import of vehicles with high fuel consumption</td>
</tr>
<tr>
<td>No. 7: Improve fuel quality</td>
<td>Improve fuel inspection regulations; enhance technical skills for fuel inspection</td>
<td>Experts report on grey fuel imports; petroleum industry states low standards of Vietnamese refineries</td>
</tr>
<tr>
<td>No. 8: Shift from road to train</td>
<td>Reconstruct railway; strengthen capacity; reform railway system</td>
<td>MOE expects only 10% of CO₂ reduction in freight until 2050 to come from modal shift</td>
</tr>
<tr>
<td>No. 10: Fuel-efficient driving</td>
<td>Enhance and enforce less speeding, keeping space between vehicles, and avoiding idling</td>
<td>Truck drivers do not receive training prior to or have to pass a practical test for obtaining their license</td>
</tr>
</tbody>
</table>

Source: MPWT (2012); MPWT data, various interviews

At the same time, the logistics sector is of great importance for Cambodia. In 2010, it contributed 7.6% to the Cambodian GDP (van Es 2010). Its actual relevance for the economy is much bigger, as it touches upon all major sources of economic growth and prosperity. The garment industry, as a major driver of growth (Brimble 2014) and important source of urban employment, and Cambodia’s ambitious export target for milled rice (see Figure 10) both strongly depend on lean and effective logistics. Growing local consumption and the important tourism industry rely on the increasing availability of imported products delivered by trucks.

“If you avoid inspection, you pay 500 Riel per day. That adds up to a fine of 45 USD for driving a truck without inspection for one year. What do you think about this incentive scheme?” (The representative of an international certifier)

Against this backdrop, land transport slowly moves into the focus of politics, which has ignored the area for a long time, according to experts and interviewees from private sector. The government does not have one focal point or department to facilitate regulation and interventions in the area of logistics by different ministries. The rice case (see Figure 10) illustrates how an entire industry’s development plan can suffer from logistics bottlenecks. Rice transport does not only suffer from lacking capacity but also from high prices. According to Clarke (2013a), “Cambodian exporters face fees (formal and informal) of about US$11/ton, while Thai and Vietnamese exporters face about US$0.12 and US$0.05 (...).” (A World Bank Policy Note 2013)

This price spread does not (only) stem from the relative scarcity of trucking and other modes of transportation, but from the institutional embedding of trucking in the logistics system. In fact, truck-
ing itself is not much more expensive in Cambodia, but services and fees around trucking drive up the costs. These immaterial factors frame the transport market. According to Ksoll and Brimble (2012, 6) variable trucking costs per TEU-km in Cambodia (1.00 USD) are only 18% higher than in Vietnam or Thailand (0.85 USD), whereas Cambodia’s variable transport costs are 50% higher than in Thailand and 85% higher than in Vietnam. Not surprisingly, understanding the framework for trucking turns out to be the key to any improvements toward green freight.

Figure 10  The Rice Case: Where Logistics Limit Export Ambitions

Source: based on interviews with the Cambodian Ministry of Economy and Finance, trucking companies, and international experts. Map from CIA World Fact Book

More institutional coordination could help develop a comprehensive logistics strategy. Improving the rule of law and cutting back the grey economy on the streets and at the borders remain the greatest source of potential and the biggest challenge on the political level. All these are long-term processes that likely will not contribute to green freight improvement in the short term. Nevertheless, they are inevitable for enabling logistics to support the future prosperity of Cambodia, as a recent United Nations Development Programme (UNDP) report points out (UNDP 2014, 72).

B.2. The Cambodian Trucking Market

The Cambodian trucking sector is underdeveloped in comparison to neighboring countries when it comes to technology, management, and driver capacity. Weak law enforcement; overlaps between government, military, and the private sector; as well as a grey market for import and export related services characterize the domestic market. They render specific revenue models and have led to market segmentation. The first market segment is most promising when it comes to market-based fuel efficiency measures, as it is organized, more transparent than the others, and most exposed to competition arising from the ongoing GMS and ASEAN integration.

Diesel prices are one important reason for this difference. Diesel is 20% more expensive in Cambodia than in Vietnam according to World Bank and GIZ (2012) and accounts for up to 70% of variable costs of truckers. This means diesel prices can be responsible for up to 14% of variable cost differences between Vietnam and Cambodia.
“I have a truck, you need trucking. Just give me some money to feed my family today. That’s fine.” (The Chief Operating Officer [COO] of a big trucking company about the pricing models of micro truckers)

The Cambodian trucking sector is fragmented. An estimated thousand micro truckers without a registered business run ancient trucks to scrape a living. Around a hundred owners of SMEs try to grow their businesses from their kitchen tables or, allegedly, government or military offices. At the same time, the ten biggest companies, which have up to 270 trucks each, try to protect and develop their business models that center on international container freight.

Such a diverse constellation could result in healthy competition that would reward fuel efficiency, as it directly translates into cost efficiency. However, this is not the case. Instead, the market appears to be segmented (see Table 3), with each segment facing their own disincentives when it comes to investing in fuel efficient equipment, and other fuel efficiency measures, which would allow for low-carbon road freight in Cambodia. This analysis suggests a stylized segmentation for the identification of entry points. It goes as follows:

Table 3  A Proposed Market Segmentation

<table>
<thead>
<tr>
<th>Feature</th>
<th>Segment 1</th>
<th>Segment 2</th>
<th>Segment 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of operators</td>
<td>2%</td>
<td>7%</td>
<td>91%</td>
</tr>
<tr>
<td>% of trucks</td>
<td>17%</td>
<td>24%</td>
<td>49%</td>
</tr>
<tr>
<td>Status</td>
<td>Officially organized, all companies are registered, many bigger than SMEs</td>
<td>Not officially organized, usually SMEs and registered</td>
<td>No registration or representation, micro business</td>
</tr>
<tr>
<td>Customers (relations)</td>
<td>Container trucking for import (consumer goods, garment) export (garment); long-term customer relations</td>
<td>Construction, ‘grey’ exports (timber, rice); project based/ on the spot</td>
<td>“Trucking, anybody?”</td>
</tr>
<tr>
<td>Load management</td>
<td>Include empty haul in price/compensate with services</td>
<td>Include in price/wait for back load</td>
<td>“I live in my truck... may also wait here for the next load.”</td>
</tr>
<tr>
<td>Depreciation</td>
<td>Consider depreciation/return on equity</td>
<td>Usually no consideration of depreciation</td>
<td>“Can I buy food today?”</td>
</tr>
<tr>
<td>Variable cost management</td>
<td>Lump sums for drivers, i.e. no direct efficiency gains for company owner</td>
<td>Probably also working with lump sums</td>
<td>“I got money, I go and buy black market fuel.”</td>
</tr>
</tbody>
</table>

Source: own segmentation; based on interviews, MPWT, Phnom Penh Post. SMEs = small and medium-sized enterprises

Profiles of the three market segments in the Cambodian trucking sector

“Today, trucking is not profitable. People make money from negotiating formalities.” (An international adviser on the Cambodian trucking market)

“People in the business do not apply normal economic parameters; they don’t even have the balance sheet to track their own development.” (The Chief Executive Officer [CEO] of a foreign-owned freight forwarder)

The first segment consists of 20 companies (2% of all operators) owning roughly 2,000 (or 17% of all) trucks. They are organized in the Cambodian Trucking Association (CAMTA), nearly exclusively focus their business on international container freight, and have the biggest fleet owners amongst them. Segment one companies rely on customs clearance and other services to make their profit. Offering trucking services to major import and export customers is a core means to at-

Companies confirmed that fuel costs represented 40-70% of their variable costs.
tract such paperwork business. Hence, segment one companies are ready to truck at low margins and even accept losses in case of empty back hauls. They cross-subsidize low margin trucking.

Segment two includes around ninety companies of different sizes (roughly 7% of all operators), owning 2,870 (or 24% of all) trucks. Most of them qualify as SMEs, and most are registered. The second segment does not have a representative body such as CAMTA. This makes it very difficult to identify and approach companies. Allegedly, segment two companies cater to construction and agricultural businesses. Interview partners also pointed out that this segment has very good relations and even ownership overlaps with the military forces and also caters to customers involved in illegal timber and agro-commodity trading. This may be a way for them to compensate for generally low margins.

The third segment consists of non-registered micro businesses, and some SMEs, with ancient vehicles that often run without registration or inspection. Nobody can tell exactly how many there are (compare Box 3 and Figure 5). This inquiry derived that they may add up to around a thousand operators (91% of all operators) owning 7,140 (or 59% of all) trucks. This segment operates on a day-to-day basis and usually eats up their capital (i.e. they do not include asset depreciation in their pricing models) as a way to cope with low margins.

**Focusing on the first market segment**

Access to and information on the second and third segments remain limited after 49 interviews and several rounds of desk research. This is but one reason for the in-depth analysis to focus on the first segment. Fortunately – from a data gathering perspective – additional factors also suggest a focus on the most developed segment.

The first segment is still far from meeting standards of comparable Vietnamese or Thai segments, but it nevertheless plays an equally important role for the freight movements along the Southern Economic Corridor (SEC) connecting Bangkok and Ho Chin Minh City via Phnom Penh.

International buyers from the garment industry and importers of high quality consumer goods rely on segment one companies to truck containers. International freight forwarders also prefer to cooperate with this segment. Accordingly, segment one companies dominate the Cambodian part of the SEC and the route from Phnom Penh to Sihanoukville port. This allows estimating their share in all ton-kilometers shipped in Cambodia to be around 30%.

Despite the links between segment and international value chains, marketing and management capacities remain underdeveloped even in this most advanced segment, according to business owners and COOs. Management focus lies on handling drivers and cultivating bonds with customs and other administrative players. The latter largely determine the success for paperwork-focused business models. As a consequence, logistics management does not get the attention needed to move the sector forward. Together with Cambodia’s major foreign trade imbalance, this leads to a low utilization rate of trucks.

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8 In 2010, official freight traffic via the main border gates Poipet (on the SEC toward Thailand), Bavet (on the SEC toward Vietnam) and Sihanoukville accounted for 30% of all freight transport demand in ton-kilometers. Mao (2014) states overall freight demand to add up to around 2,031,000,000 ton-kilometers. According to Ksoll and Brimble (2012) the official border crossing volume was roughly 600,202,000 ton-kilometers.

9 In 2013 Cambodia had a trade deficit of $2.4 billion (Brimble 2014). This implies more import containers arriving than export containers leaving the country, with the effect that many trucks carry empty containers to the port.
ASEAN integration will likely end the status quo of trucking in Cambodia

“I don’t know how to compete with Vietnamese trucks.” (Owner and chairman of a big Cambodian trucking company)

Cambodia is an ASEAN member and therefore part of the proceeding ASEAN integration. The institutional effects of this integration are likely to threaten the status quo in the first segment of the Cambodian trucking market that largely depends on customs clearance and other paperwork businesses. This makes it difficult to predict the market for trucking in Cambodia. Demand will grow with the domestic market\(^\text{10}\) and with increasing cross-border trade, but Vietnamese and Thai truckers may take over a big share of it.

For Cambodian truckers this means that with bureaucratic barriers at the borders decreasing, they will have to compete in their original core business: trucking and logistics management. Companies, drivers, donors, and experts largely agreed on stark competitive disadvantages compared with businesses in Thailand and Vietnam, but their predictions for the future deviate (see Box 5).

Regardless of who is correct, segment one companies currently face an uncertain future and will need to come up with their strategic answer soon. Fuel efficiency plays an important role in this issue and can be improved by forward-looking strategies. The next section sheds light on the conditions for such a change.

Box 5 Where Will Cambodian Trucking Go in the Context of ASEAN Integration?

‘Quo vadis’ Cambodian trucking?

“The Netherlands and Belgium use their position to handle much of the trucking between Germany and the UK. Cambodia could become the Netherlands of the GMS.” (An international expert and former logistics manager on Cambodia’s prospect for further GMS integration)

“We are not the Netherlands of the GMS. We are rather the Ukraine of the GMS: always in the middle of trouble.” (A Cambodian corporate banker on the geographical position of Cambodia as natural logistics hub between Vietnam and Thailand)

B.3. Financing, Technology, and Driver Training at the Company Level

“It doesn’t make sense to invest in trucks at the moment, as the margins are too low.” (The COO of a big Cambodian trucking company)

Trucking is a tough and unattractive business in Cambodia. Companies of all segments share the challenge of low margins for trucking services. Companies in the three market segments have developed their own strategies to cope with this low profitability. However, by pursuing these strategies, they sustain a disadvantageous status quo and dis-incentivize investments in fuel-efficient technologies.

Interview results showed that the main levers for fuel efficiency – namely technology, driver training, and logistics management – are amongst the main issues faced by Cambodian trucking companies. Driver capacity even ranks as the top priority for some companies. While companies can fend for themselves with regard to technology upgrades, low trust levels between and within companies hinder joint logistics solutions and an improvement of driver capacity. Figure 12 shows the issues by size and sketches the current focus of segment one companies.

\(^\text{10}\) The model by Mao expects a 6%–7% growth rate until 2050, with heavy vehicles taking over 40% of all freight demand.
The business case for fuel efficiency exists in Cambodia

“Fuel makes a difference.” (Chairman of a big Cambodian trucking company)

Fuel efficiency is a major cost-cutting opportunity for truck operators in Cambodia. Fuel costs account for 40%–70% of variable costs for trucking in Cambodia, according to trucking companies. Research on Lao PDR and Vietnam shows similar results for these countries (Crishna-Morgado et al. 2012). Unlike Thailand and Vietnam, however, Cambodia does not subsidize their fuel, which leads to higher effective prices for end users in the market.11

Figure 11 The Relevance of Fuel Economy on the Overall Profitability of Trucking

Source: based on interviews and data from Ksoll and Brimble (2012). All costs in $ per kilometer and TEU. TEU = twenty-foot equivalent unit

Fuel efficiency can determine whether a truck makes money at all, according to a micro model based on variable cost data from Ksoll and Brimble (2012, 6) for Vietnam and Thailand and information on freight rates and efficiency levels from firsthand interviews (see Figure 11). In this model, a truck running on a 2.1 km per liter diesel efficiency level (the current Cambodian segment one level) faces very low or even negative margins on the track from Phnom Penh to Bangkok. However, a truck operating at a 2.6 km per liter diesel level can create a positive margin. While these figures are only estimates, the business case may also hold when assuming that numbers in reality look better for Cambodian trucks, and when applying a smaller efficiency gain.

Earning returns, not access to finance, is the problem

“Big trucking companies have the money, but they will not invest.” (An international expert and former logistics manager)

Apparently, fuel efficiency has a relevant impact on the profitability of trucking, while segment one and segment two companies both have access to financing.12 So why do companies not tap into this potential? Specific answers differ, but the first and second segments have in common that they prefer to invest in assets with higher returns.

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11 World Bank (2012) statistics report $1.27 per liter diesel for Cambodia and $1.06 per liter diesel for Vietnam, which equals a price difference of nearly 20%.

12 Company owners and managers and bank representatives independently confirmed this.
Segment one companies acknowledge that their fleets are outdated but they hesitate to invest in the latest vehicles for at least three reasons: first, amortization of loans repaid at 8%–11% takes too long compared to other priorities for investments such as dry ports and warehouses. The latter assets directly support their main sources of profit, i.e., customs clearance services and other paperwork. Second, segment two and three trucking operates at dumping prices that render it unlikely to see margins increase in the near future. Third, segment one companies are still wondering what ASEAN integration will do to their market, i.e., whether they will be around in 5–10 years to reap the benefits of their investments. Combining the second and third aspects, the first segment is trapped in a deadlock between mighty competition from abroad and dumping prices at home.

Figure 12  Main Fuel-Efficiency-Related Concerns of Segment One Trucking Companies

Some specialized segment two companies are buying new vehicles, according to bank interviews. Generally, however, segment two companies – usually SMEs – suffer from even higher interest rates (≥ 10% p.a.) and have less collateral and equity to bolster their investments. More importantly, their operations are less advanced and they find it difficult to utilize their capital in a way that justifies large investments. They would use cheaper loans for purchasing old vehicles.

Segment three companies neither have the access to affordable financing nor can they make use of advanced technology from a driving or management perspective. Their business model exploits the absence of law enforcement in Cambodia. They usually operate depreciated trucks after the end of their legal lifecycle. At the same time, they do not apply principles of capital stock management, trucking freight at rates that do not earn back their investment. Accordingly, their business model does not accommodate the concept of new fuel-efficient vehicles.

Altogether, investments in new fuel-efficient trucks are simply too unattractive (for segment one and parts of segment two) or not viable (for parts of segment two and the entirety of segment three) for truck companies in Cambodia to fundamentally renew their fleets. Exceptions are cases in which banks offer loans at special conditions (one company, for instance, obtained a loan at 7% p.a.) or managers decide to proactively prepare for GMS Integration.

13 According to the interview, these companies cater to construction, a growing area with probably high freight rates.
Why the number one issue in the first segment does not get addressed

“Finding good drivers is the first priority now.” (Chairman and owner of a major trucking company)

Finding, managing and retaining drivers are key concerns of segment one trucking companies in Cambodia. Managers of bigger and smaller companies agreed on this, and except for one company, all interviewed managers were ready to pay for driver training. Nevertheless, no training scheme has evolved, due to lack of inter-company cooperation and trust issues within companies.

Reasons for the driver scarcity are obvious. Cambodia has no institutionalized scheme in place to train drivers of heavy trucks. Instead, drivers pay $380–$500 to upgrade from a small truck to heavy truck license. Exposure to threats from organized crime, corruption, traffic, and weather reduce the attractiveness of the job. Drivers seek to improve their base salary with per diems, fuel theft, and extra jobs. At the same time, they have to engage in minor bribery on a regular basis at the port, on the road, or even within their own company.

Segment two may worry less about driver scarcity, as companies have lower requirements in terms of punctuality, skills, and interaction with management. Fatal accidents may have less of a negative effect on the reputation of segment two companies than is the case with segment one operators. As a result, segment two drivers may not even have a license.

Figure 13 Drivers in Cambodia – A Fictitious Example

![Image of a Cambodian truck driver]

Source: Rady Chhuong is a fictitious persona based on interviews. The picture taken by author shows an anonymous Cambodian driver of a major trucking company.

14 A mid-level manger was reporting on regular surveillance missions organized by the trucking company he was working for, and specific cases of gunfights with criminals trying to seize containers with high-value goods. Other interviewees indicated involvement of government and military officials in these kinds of organized crime.

15 See Figure 13 for a fictitious profile of a segment one driver.

16 One manager was describing that an entire grey economy had evolved within his company. Drivers would, for instance, have to bribe mechanics to have their tires changed or their trucks maintained.

17 Interviews with experts and with a driver who had changed from segment two to segment one suggest this.
Segment three drivers usually own and manage their truck. For them, the question of driver training is vital in the sense that they personally suffer from their own lack of ability. Their answers to this challenge, however, will be less formal than considerations in the other segments.

Segment one companies are willing to pay for having their drivers trained, but they are afraid of losing them afterwards. This lack of trust and probably a lack of cooperation in the segment have so far prevented the industry from coming up with their own solution to the qualification gap.

An international petroleum company has pressed ahead. They regularly train their drivers but even in the small group of petroleum trucking companies, the attempt to establish a school failed. Conventional trucking could learn from this. Segment one companies are testing trainings with external service providers.

C Which Forces Shape Main Entry Points for Curbing Emissions?

In the long run, government, business, and society would all profit from fuel-efficient, low-carbon trucking. Chapter A has shown that this long-term interest coincides with significant theoretical technical potential. In the short run, however, fuel-efficient trucking does not take place due to structural problems and misalignment of interests, as chapter B has elaborated (see Figure 9 for an overview). Targeted donor intervention could improve this situation.

"Throwing money at the system would not solve the issue." (The COO of a trucking company)

Following the entry point definition in paragraph 0, this chapter identifies specific constellations where alignment of public and private sector interest is possible within the current system and existing forces can support new initiatives (see Figure 14).

A long-term model for Cambodian freight policies and a paradigm shift in law enforcement are not the focus of this report. Entry points, rather, aim at short- to mid-term actions. They try to circumvent long-term structural challenges (see discussion of Figure 9), such as weak rule of law or low trust and compliance levels, and instead aim to utilize existing forces.

Figure 14 Entry Points Utilize Existing Forces to Drive Change

![Figure 14 Entry Points Utilize Existing Forces to Drive Change](symbols from freebeevectors.com)

C.1 Company Entry Points

The first market segment is the most promising for interventions. It is the only officially organized segment and offers the most efficient access to trucks: reaching out to its twenty member companies means reaching out to 17% of all trucks. This most advanced segment also appears to be more capable of handling capital than other segments, while it still offers a big technical potential to tap into, with the vast majority of its trucks being older than ten years.
Driver management and capacity building, low international competitiveness and low returns on equity are the biggest concerns in segment one. Companies are willing to pay for capacity and they are alert when it comes to opportunities for improving their asset base and management. They appear to be ready to engage in new schemes for driver training and new financing models.

**Figure 15  Potential Forces Influencing Fuel Efficiency Initiatives on the Company Level**

Beyond these managerial challenges, segment one looks for ways to better represent their interest toward the government and identify new opportunities to generate revenues in the evolving market. The Cambodian Trucking Association is looking for additional services to offer to its members and could benefit from institutionalized stakeholder dialogues and sector-level interventions.

“If there were no borders, the Cambodian truck industry would die.” (An international expert)

ASEAN and GMS integration concerns managers and experts, but expectations about these processes remain vague, while realities are already changing (see Box 6). The need to prepare for the next round of integration is likely to move up the priority list of Cambodian trucking companies.

**Box 6  Do Vietnamese and Thai Truckers Really Reach out for the Cambodian Market?**
C.2. Stakeholder and Value Chain Based Entry Points

For value chain partners and other stakeholders, the Cambodian trucking industry remains opaque. In particular, international buyers try to build up trust in the context of long-term business relationships and even co-investments.

In the medium term, changes in consumer lifestyles and export markets, as well as calls for disclosure,\(^{18}\) will result in pressure on Cambodian logistics and trucking from the side of international buyers. They will ask for an increase in management capacities, and a reduction of negative impacts on health and the environment. In particular, the first market segment, with its strong focus on international trade, will feel this change.

Service providers for certification and capacity building are important players in improving and harmonizing international standards. They have already entered Cambodia to look for entry points in the trucking and logistics sector. Their presence enables the design of market-based solutions.

“Garment factories do not care even if you hire a monkey to drive.” (COO of a trucking company)

Producers in Cambodia, however, still focus on cost aspects and, according to trucking companies, have adapted to the inefficient logistics and low-tech nature of their system in terms of their communication with trucking companies and their utilization of trucking services. One interview partner stated that clients would order containers too early – expecting delayed service – or use containers and even trucks as warehouse extensions, keeping them on the factory yard for days.

Figure 16 Potential Forces Influencing Fuel Efficiency Initiatives on a Value Chain Level

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\(^{18}\) The Carbon Disclosure Project calls for companies to publish their carbon footprints along the value chain. Participation is good among multinationals and they start passing on the pressure to disclose to their suppliers.
Fuel efficiency initiatives represent business opportunities outside the trucking sector

International truck vendors seek to increase their sales in the Cambodian market, which has been long dominated by second-hand vehicles. They offer free training for drivers and mechanics. Trainees, however, have to travel to the producing countries for this, and trucking companies hesitate to pay for this. Truck vendors would likely benefit from new schemes in Cambodia to train drivers and finance the purchase of new vehicles.19

Cambodian banks engage in trade financing for importing new vehicles. Some of them are very eager to utilize changes in the leasing law and start a vehicle leasing business. In addition, non-bank leasing companies such as RMA Group enter the Cambodian market for equipment and vehicle financing. This may spur healthy competition and result in more finance choices for trucking companies in Cambodia, where banks have tended to dominate the financial services markets.

As a last group of potential influencers, advocates of public interest such as civil society organizations, the United Nations, and bilateral programs could support the implementation of fuel-efficiency interventions. How much they would and could contribute remains unclear within the scope of this study.

C.3. Policy, Administrative and Infrastructure Entry Points

The Government of Cambodia has successfully improved the paperwork side of international trade. The recent Logistics Performance Index (Arvis et al. 2014, 16) emphasizes these improvements. Thanks to changes in customs procedures, Cambodia now ranks number 83 out of 160 countries (moving up from rank 129 in 2010).

The physical side of trade facilitation, however, only gained more attention recently when confronting transport limitations in the field of rice export.20 According to interview partners, ministries summoned banks to join an ad hoc meeting. They urged them to lend more to trucking companies, in order to close capacity bottlenecks. This attention represents an important force when it comes to driving interventions in the trucking market.

Health and security concerns are another facet of government interest with relevance to interventions in trucking. The number of fatalities from traffic accidents per year has increased from 1,292 in 2006 to 1,890 in 2011 (MPWT 2012, 8), with trucks involved in many of these. Driver capacity and truck technology can help mitigate this trend.

Dependency on fuel imports is yet another argument for government support of fuel efficiency interventions. According to the ADB Energy Outlook (2013, 299), transport is the sector with the fastest growing energy demand in Cambodia – the annual increase is expected to be 5.9%. Based on trade data from Ksoll and Brimble (2012) and this study’s research on efficiency levels, trucking companies in the first market segment could cut their fuel costs by 19% or $3.5 million per year by upgrading to affordable new trucks.21

On the fiscal level, as of May 2014, the government was debating a change of the import tax regime for trucks entering Cambodia, according to interviewees. So far, new vehicles faced higher taxes than second hand vehicles. This relation may change to favor increased imports of new trucks.

19 This is a supposition based on statements by third parties, and requires substantiation via interviews.

20 The Government of Cambodia proclaimed the target to export one million tons of milled rice in 2015 (see Figure 10).

21 This report classifies as affordable what companies currently buy for testing. The reference is a Chinese tractor with German engine and gears that costs around $70,000 and runs at 2.6 km per liter diesel.
Interviewees from various backgrounds indicated that individuals within government institutions reap significant benefits from informal payments and customs practices in the trucking current set-up in Cambodia. These vested interests help sustain a situation in which it pays for trucking companies to concentrate on the paperwork aspects of their business and underinvest in their original core business: trucking and logistics management.
III. The Investment Case for Green Freight in Cambodia

Private investors are currently not investing in green freight in Cambodia. This assessment has retraced their underlying rationales. It did not identify any new insights that would automatically result in big new investments, but it laid open incentive schemes that would allow the design of market-centered interventions (see Figure 18).

Whoever invests in green freight in Cambodia at the moment needs to be ready to pay a price for carbon, initially without the possibility to sell on emission reductions. This report suggests using notional rates for carbon reductions as one instrument for decision making. A notional rate calculates the net present costs of reducing one ton of CO\(_{2}\)e, also referred to as net present value (NPV). The notional rate for the two investment schemes suggested here is $41_{NPV, 2014}$.

These two investment options, and a third suggestion for a scoping process, share the following features: first, they do not focus on assets directly, but use market models to exploit forces at work in the system (see II.C). Second, they aim to lever additional investments. Third, they aim to support a development-minded overall narrative to lift land freight and overall logistics in Cambodia to a higher level in economic, environmental, and social terms.

**Figure 18 Donors Willing to Pay a Notional Rate for Carbon Can Improve the Situation**

![Image](source: symbols from freebeevectors.com)

It is shortsighted to tighten screws at one end of the system, while assuming the rest of it will remain constant. Ideally, all interventions will take place and happen in a coordinated fashion to support each other. To this end, the stylized calculation of a notional rate for carbon combines two of the three interventions. To identify rates for each initiative would suggest a level of precision that this analysis cannot offer in the absence of reliable data.

\[22\text{ The corresponding nominal carbon price is } $63. \text{ The difference stems from the applied discount rate of } 5\% \text{ p.a.}\]
A Three Market-Centered Interventions for Green Freight

Cambodian companies know their trade – more importantly, they know the blend of institutional arrangements, weak enforcement, and grey markets around them. They have their reasons to abstain from investments in new trucks and driver training, not to mention advanced logistics systems. Fortunately, from a climate protection perspective, interviews and desk research indicated entry points for changing their position by improving framework conditions. Climate-smarter development in the Cambodian road freight sector is possible.

In the long run, political change will be necessary to achieve this development. Strict enforcement of the traffic law and inspection regulations would change the situation fundamentally, but vested interests and personal business models will ensure that this takes time. The following intervention models circumvent such expected backlash to create win-win models.

Figure 19 shows the expected potential effects the three suggested schemes may have on the key indicators used by this analysis. These effects are tentative, as they depend on the exact design of the scheme and the support by relevant actors.

**Figure 19  Expected Tentative Effects of Schemes on Key Indicators**

<table>
<thead>
<tr>
<th>Interests</th>
<th>Enabling / Barriers</th>
<th>Key Entry Points</th>
<th>Key Proxy Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Capacity</td>
<td>Regulation</td>
<td>Finance</td>
</tr>
<tr>
<td>Public Concern (CO₂)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Private Concerns</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Research Process

Caption:  
- scheme lowers indicator;  
- scheme increases indicator;  
- scheme has unclear effects on indicator;  
- scheme does not affect indicator directly; all effects are tentative; Enabling factor = ✔, barrier = ❌

**Notional rates**

This analysis suggests the use of notional rates for comparing schemes that aim at CO₂e reductions in the Cambodian logistics sector. These notional rates offer an orientation but do not represent a promise. They indicate what an investor roughly pays per ton of CO₂e reduction stemming from a scheme that she funds, i.e. they reflect her net present valuation of carbon reductions.

From a development perspective, the applied notional rates for carbon include positive externalities. As a consequence, if road safety, local pollution, and other development benefits had a price tag, the notional rate for carbon could be lower (see Figure 20). The expected notional rate for the implementation of a leasing scheme and an education scheme is $41 in 2014. This number represents the average NPV based on a nominal rate of $63. The descriptions of the two mentioned schemes below provide more detailed information on the assumptions behind this nominal rate.

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23 Assuming it happened instantly, such a paradigm shift could deprive a thousand segment three operators of their livelihoods, recipients of bribes on different levels of the government and enforcement agencies would need to look for new sources of income, and overall land transport capacity would drop, impacting export capacity and prices.

24 Assuming inflation, $63 in the year 2020 is worth more today than $63 in the year 2030. Therefore, discounting all nominal sums offers a better base for comparison.
The two schemes jointly demand the use of around $42,682,000_{2014}$. Out of these, $12,182,000_{2014}$ are expenses, while $30,500,000_{2014}$ flow back to the donor, after taking into account interest for binding money, losses via guarantee schemes, and spending on technical assistance activities.

**Figure 20** Notional Rates for Carbon Reduction Include Positive External Effects

Figure 21 shows the expected development of emission reductions and the NPV of carbon reductions, i.e., minimum net present valuation by a donor to justify an investment.

The underlying data series assumes a step-wise initialization of the two schemes over a five-year period, and a self-sustaining continuation after the project period. The reduction potentials stem from a bottom-up estimate. It applies technical emission potentials from part II to the amount of ton-kilometer presumably covered by the first market segment, and assumes an impact factor of 50% of impact on indicators such as trucks replaced or drivers trained successfully.

The following chapters offer information on assumed leverage effects and discount rates.

**Figure 21** Expected Reductions and NPV Development

Tentative extrapolation, discount rate for net present value (costs): 5%; Caption: Red abbreviates reduction

NPV = net present value

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25 This means these interventions will only reach out to 50% of potential.
A.1. A Leasing Scheme to Reduce Average Age of Trucks and Increase Returns

Most Cambodian trucks enter the country as second-hand vehicles or even as scrap cars. Current business models do not yield sufficient returns to justify investments in brand-new trucks. As a consequence, the BAU investment path for fleet upgrades and expansion will not significantly reduce the average age of trucks.

Leasing could convince companies (see Figure 22) that are currently unwilling to bind large amounts of capital or collateral to truck investments to nevertheless opt for new vehicles and realize the business case for fuel efficiency. So far, truck companies do not have access to leasing products, as the Cambodian market for equipment leasing is still in the development stages.

Mainstreaming leasing practices in trucking and logistics could also pave the way to create energy service companies that offer leasing for fuel-saving technologies for upgrading old vehicles. These companies would play an important role in a future where the average age of the truck fleet is lower than today.26

Figure 22 A Market-Based Leasing Scheme

The year 2014 offers a window of opportunity

Due the Cambodian leasing market being still in its early stages, banks are still undecided regarding customers, products, and marketing strategies. The vice president of a major domestic bank stated they were interested in learning about sales perspectives while they were already investing in leasing personnel and drafting manuals and internal directives. Additionally, non-bank leasing companies such as RMA Group enter the market and look for entry points.

26 Leasing of vehicle parts only makes sense for vehicles of a certain age. Experience from EOC (2011) suggests an age limit of 15 years.
Donors can exploit a window of opportunity to influence the evolving leasing market. They can spur energy efficiency investments and business growth that supports sustainable development. At the current exploratory stage, interventions that include the provision of information and concessional capital promise to have significant effects. They could influence where certain actors start their learning curves and in which direction they develop products and portfolios.

**Proposed intervention design**

Providers of leasing schemes will need to develop self-sustaining leasing products in order to create a stable leasing market. Intervention can, however, accelerate their learning curves and product development by reducing costs of capital, risk sharing, provision of information, and stakeholder facilitation (see Table 4). Focusing these support measures on energy efficiency investment can influence overall market development.

**Table 4  Components of a Proposed Leasing Scheme and Their Purposes**

<table>
<thead>
<tr>
<th>Component</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concessional loan to leasing provider</td>
<td>Reducing costs of capital to back leasing schemes for energy efficient vehicles</td>
</tr>
<tr>
<td>First loss risk sharing facility</td>
<td>Mitigating lack of collaterals and issues with re-possessing leasing assets</td>
</tr>
<tr>
<td>Feasibility study and data base</td>
<td>Substantiating the business case for fuel efficiency to inform choice of vehicles</td>
</tr>
<tr>
<td>Stakeholder dialogue</td>
<td>Ensuring the utilization of co-benefits and shared potentials</td>
</tr>
</tbody>
</table>

A concessional loan to leasing providers works similarly to a conventional credit line, with the major difference that the leasing company invests and passes on the assets instead of monetary capital. A risk mitigation facility could mitigate risks for market entries and reduce the need for collateral. It would, for instance, take 50% of the first loss under an individual account. This design facilitates access to lease financing for players without a track record and, at the same time, keeps at bay the moral hazards that would evolve from full coverage of losses.

In the absence of a liquid market and a reliable database, stakeholder processes can reduce uncertainty, build trust, and trigger faster market development. To achieve this, they need to involve regulators, beneficiaries, truck vendors, and leasing providers.

**Scoping**

Most companies in segment one and some in segment two will be able to lease vehicles due to their legal status and their management schemes. They will use leasing to either expand their fleet (segment two) or substitute older vehicles in their fleet (segment one). Substituted vehicles will remain in the market (in segment two or three). Nevertheless, segment one companies would realize efficiency gains when buying new instead of second-hand vehicles.

The market assessment suggests that half the truck capacity in segment one needs substitution. According to bankers lending to companies in segment two, some of those companies consider buying new vehicles as well. This adds up to a pool of >1,000 trucks within reach of leasing.

The ambition of such a substantial scheme would be to ensure that emission reductions would grow relative to the underlying emission patterns. To achieve this, additional support during the five

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27 This assumption builds on statements by segment one companies regarding their fleet and on the macro picture of the sector as described in chapter II.B.
years of the scheme (see Table 4) would need to create a liquid market for vehicle leasing, including capacity on the banking side and competition-driven demand among trucking companies.

The land freight situation in Lao PDR also demands a leasing scheme, as a senior finance expert working on behalf of EOC suggests. An intervention could address both markets, due to their geographical vicinity and similarities with regard to their trucking fleet, competitive challenges, and financial actors.

**Impact and costs**

Predicting the quantitative impact of a leasing scheme is very difficult due to sketchy emissions data and the lack of an in-depth feasibility study. The following calculation is therefore tentative. It represents a stylized approach that aims to systematize potential impacts and, ultimately, make intervention options comparable.

Assuming a new truck costs $70,000, a $25 million leasing scheme could finance 357 new vehicles in five years. The model further assumes the scheme to achieve a leverage factor of 2.8, i.e., to stipulate leasing for an additional 643 trucks via additional funding from banks or other investors and the reinvesting of generated revenues.

Each individual leasing deal for a new truck will reduce the average age of the Cambodian truck fleet and, with it, the average fuel consumption of trucks in Cambodia. The financed vehicle would consume 19% less fuel and emit 19% less CO\textsubscript{2} per km compared to a BAU vehicle (see chapter II.A).

Table 5  Components of a Proposed Leasing Scheme and Their Purposes ($\text{2014}$)

<table>
<thead>
<tr>
<th>Component</th>
<th>$\text{Cash Flow}$</th>
<th>$\text{Costs/Loss}$</th>
<th>Underlying assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concessional loan</td>
<td>25,000,000</td>
<td>0</td>
<td>Disbursed in one rate (in practice to be disbursed in batches)</td>
</tr>
<tr>
<td>Interest subsidy</td>
<td>4,169,865</td>
<td>4,169,865</td>
<td>Interest rates: 7% (market), 3% (subsidized), discount factor: 10%</td>
</tr>
<tr>
<td>Guarantee scheme</td>
<td>5,000,000</td>
<td>750,000</td>
<td>Loss rate for guarantee scheme: 15%</td>
</tr>
<tr>
<td>Interest for guarantee</td>
<td>935,126</td>
<td>935,126</td>
<td>Interest rates: 7% (market), 3% (subsidized), discount factor: 10%</td>
</tr>
<tr>
<td>Technical assistance</td>
<td>1,000,000</td>
<td>1,000,000</td>
<td>Disbursed in one rate (in practice to be disbursed in batches)</td>
</tr>
<tr>
<td>Overhead</td>
<td>200,000</td>
<td>200,000</td>
<td>Flat rate for accounting and program management</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40,035,845</strong></td>
<td><strong>10,785,845</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Source: data based assumptions and own research*

If this efficiency gain had been realized for fifty per cent of the segment one capacity in 2010, a reduction of some 6,100 tons of CO\textsubscript{2} emissions would have resulted. Extrapolating from this, a leasing scheme could reduce 27,600 tons CO\textsubscript{2} within the five years of project implementation.\textsuperscript{29} An effective fleet renewal, the successful establishment of a fuel efficiency leasing market and respective learning curves justify further extrapolating this trend. By doing so, cumulative emissions reductions would reach 140,300 tons CO\textsubscript{2} by 2030.

\textsuperscript{28} This is the quotation one interviewee received for a Sinotruck with a German MAN engine and ZF gears.

\textsuperscript{29} Assuming 30% of objective reached in the first year, 50% in the second, 70% in the third, 90% in the fourth, and 100% in the fifth.
The actual costs of a $25 million leasing scheme depend on a variety of factors, including market interest rates, expected losses from the guarantee scheme, internal discount factors, and level of subsidization. Table 5 lists the costs and lays open the underlying assumptions.

**The next three steps toward a leasing scheme**

The successful implementation of a leasing scheme demands preparatory steps to ensure legal certainty, substantiate market demand, and forge alliances to stipulate uptake and co-financing. Based on these steps, implementation can start (see Figure 23).

Major stakeholders for implementing a leasing scheme include banks and non-banks that want to enter the emerging leasing market and currently build up Cambodia's capacity to take this step; regulators such as the Ministry of Finance, Ministry of Commerce, and the Ministry of Justice; the Cambodian trucking association and selected members; truck vendors; and potential co-financiers.

**Figure 23** Three Steps Toward Establishing a Leasing Scheme

MOU = memorandum of understanding

**A.2. An Education Loan Scheme to Improve the Supply of Skilled Drivers**

Driver shortage is one of the top priorities of the Cambodian trucking industry. Skilled drivers are also vital for mainstreaming new technologies and utilizing existing trucks in a fuel-efficient manner. Cambodia lacks institutions to train drivers of heavy vehicles, even though drivers long for training and companies are willing to pay for training and to accept higher wages for trained personnel. Private sector training providers have already entered the market and launched pilot trainings for individual companies. Apparently, all parties involved want capacity building but it still has not taken off in Cambodia.

**The opportunity to end the capacity deadlock**

Lack of trust is the core of the capacity deadlock in the Cambodian trucking industry. Companies are afraid that drivers will leave once they have received free training. Drivers, on the other side, do not trust their employers to foot the bill for trainings offered by private sector service providers. They also mistrust employer attempts to make transparent and remunerate fuel-efficient driving. Against this backdrop, private service providers hesitate to invest in local training capacity, which in turn would be important in order to scale up and mainstream trainings.
An education loan scheme could compensate this lack of trust with the help of monetarization, third-party involvement, and a risk sharing facility. Such a system could end the capacity deadlock and ultimately foster the institutionalization of driver education in Cambodia.

**Proposed intervention design**

The education loan scheme would focus on securing the cash flows and, thereby, the will to invest in training within an evolving capacity building market. Providing cheap financing is only of secondary priority.

Under the scheme, drivers take out a loan via a micro-finance institution and pay for a training course at a private service provider. The private service provider delivers the training in return for cash. Afterwards, the driver’s employer pays back the loan to the microfinance institution in rates, as long as the driver stays with the company (see Figure 24).

**Figure 24  A Market-Based Driver Training Scheme**

![Diagram of the education loan scheme](source)

If the driver decides to move on to a new employer, he takes the remaining debt with him. In this case, the driver either has to pay back the debt himself or convince the new employer to pay it back on his behalf. Thus, the overall labor pool improves without curbing labor mobility.

Cambodian microfinance institutions have extensive experience with designing education loans, tracking their recipients, and enforcing payments. Drivers arguably represent a high-risk group to lend to, with which microfinance institutions have little to no experience. To mitigate this additional risk, the scheme would include a risk sharing facility.

An official government mandate or letter of support to the private sector training provider(s) involved in the scheme would add credibility and prepare the way for a future institutionalization of a mandatory education scheme for drivers of heavy trucks.
Scoping

Overall driver capacity in Cambodia is low. Accordingly, all market segments could use capacity building. However, only segment one companies display a willingness to pay for trainings or for remunerating training in the form of higher wages. Segment two drivers may not even have licenses. Segment three drivers operate in the grey market anyway.

Segment one has an estimated pool of 1,800 drivers. Companies seek to expand this pool but face a shortage of reliable drivers. Improving the pool would likely create spillover effects or indirect quality effects on the labor market pool in segment two.

Training half of these 1,800 drivers within five years would shift the standards in the Cambodian trucking sector and implement a de facto standard that could lay the foundation for regulation and certification schemes. The scheme could even become the foundation of an institutionalized and mandatory driver education.

If needed, the loan scheme could easily expand to cover loans for logistics management trainings in segments two and three of the market, as demanded by the managing director of a trucking SME.

Impact and costs

The direct impact of driver training on effective driver behavior is difficult to calculate without extensive evaluation of real-time data on speeding and braking collected from trucks. Except for petroleum companies, no Cambodian trucking company systematically collects data at this level of detail. Accordingly, the following calculation works with estimates. It builds on the assumption that driver training can help realize 15% fuel efficiency (see II.A).

Assuming training one driver costs $1,000, a $1 million education loan scheme could reach over 1,000 drivers within five years. From the regular payments made by first-year participants, money would become available to later participants on a constant basis. Drivers will be expected to pass on knowledge within their companies through informal trainings.

Table 6 Components of a Proposed Education Loan Scheme for Drivers ($2014)

<table>
<thead>
<tr>
<th>Component</th>
<th>$ Cash Flow</th>
<th>$ Costs/Loss</th>
<th>Underlying Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concessional loan</td>
<td>1,000,000</td>
<td>0</td>
<td>Disbursed in one rate (in practice to be disbursed in batches)</td>
</tr>
<tr>
<td>Interest subsidy</td>
<td>291,891</td>
<td>291,891</td>
<td>Interest rates: 7% (market), 3% (subsidized), discount factor: 10%</td>
</tr>
<tr>
<td>Guarantee scheme</td>
<td>500,000</td>
<td>250,000</td>
<td>Loss rate for guarantee scheme: 50%</td>
</tr>
<tr>
<td>Interest for guarantee</td>
<td>153,858</td>
<td>153,858</td>
<td>Interest rates: 7% (market), 3% (subsidized), discount factor: 10%</td>
</tr>
<tr>
<td>Technical assistance</td>
<td>500,000</td>
<td>500,000</td>
<td>Disbursed in one rate (in practice to be disbursed in batches)</td>
</tr>
<tr>
<td>Overhead</td>
<td>200,000</td>
<td>200,000</td>
<td>Flat rate for accounting and program management</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,645,749</strong></td>
<td><strong>1,395,749</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: data based assumptions and own research

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30 Interviewed drivers argued that capacity was sufficient but nevertheless welcomed trainings.

31 This number represents an extrapolation of the driver-truck ratio reported by a large company and is given for orientation purposes only.

32 This assumption builds on interviews with companies and a service provider.
However, a loan-backed capacity building scheme faces constraints. Not all drivers will be willing to undergo training. Of those who are, some will fail to fulfill minimal credit-worthiness requirements. Employers’ willingness to pay may play out differently in reality from their statements during interviews. All these factors will reduce demand and impact and inflict additional costs upon the project. Considering these barriers, the following estimate applies a 50% success rate; i.e., out of 1,800 drivers, 900 would have received training and utilized their new knowledge after five years.

Based on this assumption, the project – if it had been fully in place already – would have lowered 2010 emissions by roughly 4,800 tons CO₂. Implemented from 2014 onwards, it would result in reducing around 21,800 tons of CO₂ emissions within the five-year project period. Furthermore, this proposal argues that establishing the capacity building scheme would end the capacity building deadlock in general. This would presumably result in additional reductions of 110,800 tons of CO₂ emissions until 2030 (compare Figure 21).

Another major impact of the driver-training scheme would be an overall improvement of the education situation for truck drivers and a significant increase in road safety due to the trainings. These side impacts could attract other donors or institutions to support the scheme.

**The next three steps toward a leasing scheme**

The driver scheme primarily aims at bridging trust gaps between actors who are interested in cooperating. Accordingly, the success of the program depends on preparatory action that specifies and quantifies actor needs, creates trust toward the program, and raises awareness about the win-win situation of market-based capacity building (see Figure 25).

**Figure 25  Three Steps Toward Establishing a Leasing Scheme**

MOU = memorandum of understanding

Stakeholders of the education loan scheme include microfinance institutions, MPWT, CAMTA, the Cambodian Freight Forwarders Association, truck manufacturers, and training service providers.

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33 Assuming 30% of objective reached in the first year, 50% in the second, 70% in the third, 90% in the fourth, and 100% in the fifth.

34 Some truck manufacturers offer free driver training when selling new vehicles. Trainings take place in the country of origin of the manufacturer. Contracting localized training providers could reduce costs and increase participation.
A.3. A Certification Scheme to Increase Returns and Reduce Costs

Currently there is no price for carbon in Cambodia and even fuel efficiency does not yield sufficient returns. Donors willing to pay a notional rate for carbon can try to end deadlocks and bridge gaps. However, ultimately markets must remunerate fuel efficiency and green freight. They can do so by paying more – i.e., by increasing the return on investment for fuel efficiency measures in the transport sector – or by putting pressure on companies to “act greener”.

Certification schemes can institutionalize customer pressure and/or justify green price premiums. In Cambodia, they could serve as means of communication between buyers of Cambodian products who want to buy eco-friendly products and consume more responsibly and Cambodian producers who are willing to only work with selected logistics partners that comply with certification standards.

Initial talks with experts and a major international garment procurer showed that buyers have an appetite for more transparency. They currently face an opaque logistics sector in Cambodia and thus high information costs. Stakeholders and customers are also interested in learning more about externalities: the way from factories in and around Phnom Penh to ports in Cambodia or Vietnam represents a short part of the global value chain, but compared to sea freight has various direct and visible impacts on the population.

International garment buyers have not yet established a thorough mechanism to respond to environmental and social challenges on the ground. According to an interview partner, big garment brands had to revert to cumbersome ad hoc coordination in the face of severe social issues in Cambodia in the beginning of 2014. Allegedly, some of them considered establishing a local UN Global Compact Network or a comparable platform to cope with future issues.

Proposed intervention design

Market-based labels or standards can create transparency where government-backed schemes are unlikely to materialize or where their enforcement fails. However, they rely on the active participation of stakeholders and on companies’ and consumers’ willingness to pay.

In the case of Cambodia, international garment buyers offer the greatest potential to support such a scheme. This is due to their consumer exposure and the absence of other relevant industries outside the agricultural realm in the Cambodian export sector. Figure 26 shows the schematic of a potential scheme.

Non-government organization (NGO) stakeholders play an important role in market-based schemes. They send representatives to an independent board that decides on the labeling of companies. A third party needs to organize the board meetings and the overall certification process, including the organization of audits and the subcontracting of independent analyses.

International buyers need to provide funding for this third-party organizer, auditing costs, and the expenses of NGOs (see Figure 26). In this way, the system is less prone to let logistics companies simply buy the label. Nevertheless, applicants to the labeling scheme need to invest in providing data to the board in the run of their initial formal application and for renewing the label.

This kind of private-sector-born labeling scheme already works in sectors with direct exposure to consumers, such as retail.35 The transfer to the logistics sector will demand adaptation. As a result, the label may boil down to a standard. This standard could become one of several requirements

35 One example is the Pro Planet label by REWE Holding, a major German retailer.
behind value chain labels that consumers see on the shelf. According to an interviewee, garment buyers already use freight standards in other parts of the world, in a similar fashion.

**Figure 26 A Market-Based Certification Scheme**

![Diagram of a market-based certification scheme]

Source: symbols from freebeevectors.com

NGO = nongovernment organization, TA = technical assistance

**Scoping**

This report recommends a pilot process for a labeling scheme that will span several GMS countries, with garment as a key industry to start with. The pilot process will show whether supporting the expansion of existing initiatives or creating a new setup makes more sense.

Key requirements are to test the acceptance of a market-based label of international buyers and their willingness to pay for it; the identification of feasible and truly neutral third-party organizers for the certification process; and the support of a set of international and national stakeholders focusing on advocacy and knowledge provision in the areas relevant to green freight.

Establishing a label or standard makes most sense if it follows and incentivizes other interventions on driver trainings and technology upgrades. Thus, the above design is contingent on other activities in the Cambodian market, which may precede the introduction of a standard.

**Impact and costs**

Impacts and costs of a labeling scheme will depend on the design, which in turn needs to build on the results of the scoping process. Labels have become a common instrument, with ambivalent results. Labels increase awareness and change value chains in many cases, but heterogeneity of underlying methodologies and scopes run counter to the original purpose of transparency.

To be effective, a labeling scheme needs both to cater to sustainability management approaches in global value chains and to fit into the labeling landscape in the GMS (see Figure 27). A subsequent intervention can either try to expand and deepen existing initiatives in the region, such as Green Freight Asia, or establish a specific scheme for key industries on the GMS level – such as the garment industry.
The costs of creating a labeling scheme largely depend on this decision. The impact of an existing label can be immense if the scheme becomes the umbrella for all kind of initiatives in the field of technology, driver training, fuel change, and logistics management. In such a case, the institutions and networks behind the label can serve as the infrastructure for change.

**The three next steps towards a labeling scheme**

The demand from international buyers will frame business models of higher-value goods trucking in Cambodia in the coming years. Value chain standards play an important role in this. Companies and drivers apparently are willing to undergo certification. Next steps could be as follows (also see Figure 28).

A short study could assess international buyers’ needs, expectations, and willingness to engage. This study could focus on a loose network of garment buyers that formed in reaction to sustainability challenges, according to one interview partner.

A multi-stakeholder process could make use of the results, evaluate different designs, and take first steps into the direction of institution building. The process could involve existing international buyers, international and national environmental NGOs, CAMTA, MPWT, the Garment Manufacturers Association in Cambodia, the Ministry of Commerce, Green Freight Asia, and auditors. It could facilitate cross-learning from the Thai Q-Mark label – which allegedly has yielded mixed results so far – and European standards. At the end of the stakeholder process, key players could sign an MOU and formulate an action plan.

The MOU and action plan could motivate initiatives in the field of technology and driver training, and provide an assessment framework for them. The third step should establish this link and ensure the harmonization of initiatives, while moving from MOU and action plan to implementation.
B Leveraging Investments

The suggested interventions aim to initiate large-scale change. Their core ambition is to unlock private sector spending on new technologies and capacity. In addition, they aim to leverage additional funds from potential co-investors, and look toward regional scaling up (see Figure 29).

Potential co-investors

The suggested investments do not only curb carbon but also reduce local emissions and dependency on energy imports; they also improve road safety and the infrastructure for vocational training in Cambodia. Ultimately, they enable stricter policymaking in the transport sector and pave the way to fight corruption.

Looking at this list of issues addressed, a variety of potential co-investors comes to mind. Other bilateral and international organizations already seek to improve vocational training, change energy use, or improve the health situation. They may be interested in supporting and accelerating interventions suggested in this report. One donor organization for instance explicitly asked for future updates on leasing-related activities to evaluate potential co-investments.

Other organizations may not be able to support an intervention financially, but could invest political capital or provide knowledge. Ministries and international organizations, as well as bilateral donor organizations would be interesting partners here. Any stakeholder process should actively involve them.

Private sector companies from outside Cambodia represent a third interesting group of potential co-investors. This holds for both upstream and downstream actors in global value chains. International garment buyers become more and more sensitive and develop an appetite for more transparency and capacities for coordinated actions (see III.A). They could be ready to invest.

Truck manufacturers also look into the Cambodian market according to a private sector specialist from an exporting country. They may be willing to invest, in particular when it comes to stipulating sales of first-hand trucks in the Cambodian market, but also with regard to creating domestic driver training capacity.
Defining the value added for potential co-investors

The value added of positive external effects is even more opaque than the value of carbon. Markets for road safety and local pollution do not exist in Cambodia. Energy security and trade facilitation effects are more tangible but also have no liquid market to cater to.

Table 7  Proposed Indicators for Valuation by Co-investors

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Relevance for Green Freight</th>
<th>Potential Co-Investors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy security</td>
<td>Transport will demand more oil than all other sectors in Cambodia by 2035 (ADB 2013, 299). Oil demand for transport will be 2 million tons higher than today. Green freight will reduce this demand.</td>
<td>Government, donors with energy focus</td>
</tr>
<tr>
<td>Regional integration</td>
<td>Transshipment costs at the borders increase logistics costs by $80 per truck (Ksoll and Brimble 2011, 18). Better trucks could cross borders without transshipment.</td>
<td>Trade facilitation agencies, regional assistance programs</td>
</tr>
<tr>
<td>Freight competitiveness</td>
<td>40-45% of total logistic costs are trucking costs (Ksoll and Brimble 2011, 9). Fuel efficiency is a major leverage point for lowering these costs.</td>
<td>Industry development agencies, government</td>
</tr>
<tr>
<td>Clean air</td>
<td>Sulfur levels for diesel in Cambodia are still high at 1,500 ppm, according to UNEP (2012), compared to Thailand’s 350 ppm and Singapore’s 50 ppm.</td>
<td>WHO, government, donors with local pollution focus</td>
</tr>
<tr>
<td>Road safety</td>
<td>According to MPWT, fatalities in traffic have increased by 46% between 2006 and 2011. Over 90% of fatalities were due to human error (MPWT, 2012). Driver training could change that.</td>
<td>WHO, government, health-related donor programs</td>
</tr>
</tbody>
</table>

MPWT = Ministry of Public Works and Transport, ppm = parts per million, UNEP = United Nations Environment Programme, WHO = World Health Organization

Green freight interventions as suggested here would improve all these indicators. However, ultimately, potential co-investors need to reveal their individual valuations of these common goods. They will need to decide whether a co-investment yields better results than individual programs. Table 7 lists potential indicators to understand what co-investors could be interested in and how to assess their valuation of intervention results.
Scaling up to the regional level

Other GMS countries share major green freight challenges with Cambodia and should seek integration to facilitate regional trade (Clarke 2013b). The region needs initiatives and large-scale change in order to become more competitive and embark on a climate-smart and sustainable development path. This makes regional interventions an attractive option. Regionalization potential for Cambodia-centered interventions differ from country to country in the GMS. Table 8 offers an overview. Some countries are the focus of interventions already (EOC 2013).

<table>
<thead>
<tr>
<th>Opportunities for Regionalization</th>
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<tbody>
<tr>
<td><strong>Cambodia</strong></td>
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<tr>
<td>Leasing scheme</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Driver education scheme</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Certification scheme</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

With regard to the leasing scheme, overlapping country activities of banks, as well as similar financing needs (between Cambodia and Lao PDR in particular) could become strong drivers of regionalization. For a certification scheme, regionalization would be necessary to attract international buyers (particularly in the garment industry) to Vietnam, Cambodia, and to a minor extent also to Lao PDR (UNCTAD2014, 7). An education loan scheme, finally, may also span different countries. However, making an informed guess would require additional information.

C The Overall Investment Narrative: Investing in Policy Change

Why shouldn’t we invest in policy making instead of market-centered interventions? (A senior official from a multilateral organization)

Policy change is an indispensable trigger for improving Cambodian logistics. In the long run, only policy change can ensure a climate-smart and sustainable development path. However, directly investing in policy change is difficult when it comes to a combination of policy making and policy enforcement. Too many actors benefit from the status quo, too many decision-making and enforcement patterns follow opaque mechanisms, and too deep-rooted is the lack of trust in society.

Preparing policy changes

This report argues that incentive-driven approaches utilizing existing (market) forces need to come first. They are more likely to realize mid-term effects. Ultimately, they can pave the way for long-term policy change. Only a situation that allows key actors to protect their gains – or offers them opportunities to develop – will enable a green logistics system that facilitates climate-smart development, regional integration, and export competitiveness.

The business model of trucking companies is at the core of this consideration. As of now, companies rely on paperwork business as a major source of income. This renders transparency initiatives
that focus on export procedures difficult: they would not only deprive officials of their grey income, but also take away paperwork business from trucking companies, thereby lowering their profitability. Therefore, anti-corruption efforts could reduce the Cambodian transport capacity and harm the real economy, while interventions that strengthen the core business of trucking companies would help prepare the transport sector for major policy initiatives.

Similar rationales hold for tighter regulation of driver accreditation and vehicle inspection. Once the business sector feels more ready to fulfill its requirements, policymakers will find it much easier to regulate these aspects and, first of all, enforce existing regulations. Altogether, market-based approaches appear most promising when it comes to preparing the sector for policy change.

Figure 30 shows the underlying logic. Without private sector capacity to comply with policy change, it will be much more difficult to put forward positive development strategies and establish enforcement mechanisms. Both are fundamental requirements for policy change.

Enhancing development strategies

“The reality of Multi Modal Transport in the GMS is that it serves the import of consumer products from non GMS countries. Multi modal transport is not serving the needs of SMEs in the GMS.” (Apthorp 2013, 23)

This assessment by the Vice Chairman of the GMS Freight Transport Association (FRETA) suggests that long-term policy change needs to go beyond the application of green freight policy tools. It rather demands enhancement of development strategies, giving more priority to the development of an export-oriented logistics system.

The Government of Cambodia is very active in this direction in the specific context of its rice export ambitions. However, general logistics costs, reliability, and transparency consideration are necessary. These indicators directly influence considerations to invest in or buy from Cambodia.

The proposed interventions in the transport sector aim to support the actors in the market to respond to political strategy change in this direction. Once a strategy change takes place, it will reinforce interventions and open up additional possibilities. Ultimately, a second generation of interventions could come into reach. They could help Cambodia to go beyond green freight and strive for a green logistics system, offering further-reaching climate protection and development benefits.
APPENDIX

The appendix provides an overview of primary and secondary sources used for compiling this report. For a discussion of the overall data situation, see 0.

**Primary Sources**

Due to the complicated data situation, interviews and discussions with international experts, government officials, private sector representatives and third parties represent the major source of information behind this report. Interview partners remain anonymous, except for those mentioned in the Acknowledgements.

The majority of the interviews were in English. Interviews 23 and 39-46 required an interpreter, as they were in Khmer. Most interviews were semi-structured with open questionnaires.

**Table 9  Overview of Interviews and Discussions**

<table>
<thead>
<tr>
<th>#</th>
<th>Origin</th>
<th>Position</th>
<th>Organization</th>
<th>Day</th>
<th>Location</th>
<th>Duration</th>
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<tbody>
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<td>Development Bank</td>
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<td>Phnom Penh</td>
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<td>COO</td>
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<td>9 Apr</td>
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<td>35</td>
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<td>36</td>
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<td>Technical Assistance Organization</td>
<td>18 Feb</td>
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<td>Phnom Penh</td>
<td>30 min</td>
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<td>43</td>
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<td>48</td>
<td>Both Camb-</td>
<td>Vice President; Vice President</td>
<td>Bank</td>
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<td>Phnom Penh</td>
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<td>49</td>
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<td>Development Bank</td>
<td>7 May</td>
<td>Phnom Penh</td>
<td>45 min</td>
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**Bibliography**


European Shippers’ Council (ESC), EVO Dutch Shippers’ Council, Clean Air Initiative for Asian Cities (CAI-Asia), Sustainable Supply Chain Centre Asia Pacific (SSCCAP). (2012). *Promoting Green Freight in Europe and Asia*. Rio+20 Voluntary Commitment.


