INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

STRATEGIC PLAN 2009-2011

FALL 2008

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TABLE OF CONTENTS

FIGURES

TABLES

5th Meeting of the ICCT
Hong Kong, China
November 2007

1. INTRODUCTION

The International Council on Clean Transportation (ICCT) was formed in 2001 as an international network of government officials and experts actively engaged in setting policy for the control of air pollutant emissions from motor vehicles and transportation fuels.

The work of the Council is supported by an independent, non-profit organization, which engages in a variety of activities to advance the Council's mission, including developing high-quality policy research and technical analysis on a broad range of transportation issues.

This plan describes the ICCT's strategy for reducing public health and climate change impacts from vehicles and fuels over the next three years (2009–2011). We have focused our plan on those segments of the transportation sector and on those countries, regions and regulatory forums that offer the greatest potential to achieve significant reductions in air pollution and to shape the direction of future regulations. Except where specified, the term "air pollution" is used throughout this document to mean local air pollutants and greenhouse gas emissions.

This document is arranged as follows. Section 1 provides an introduction to the ICCT, outlining our history, mission, and structure while highlighting notable accomplishments from our first three years. Section 2 describes how we allocate resources based upon the potential to reduce air pollution and our expected contribution to policy making. Section 3 identifies the policy goals and proposed initiatives for each of our five program areas. Section 4 outlines how we intend to strengthen key organizational capacities over the next three years, including the creation of a climate change roadmap for the transportation sector. Section 5 discusses our plans to expand communications both internally and externally. Finally, Sections 6 and 7 describe the management structure and priority initiatives that will be necessary to support our programmatic and institutional goals.

1.1 BRIEF HISTORY OF THE ICCT

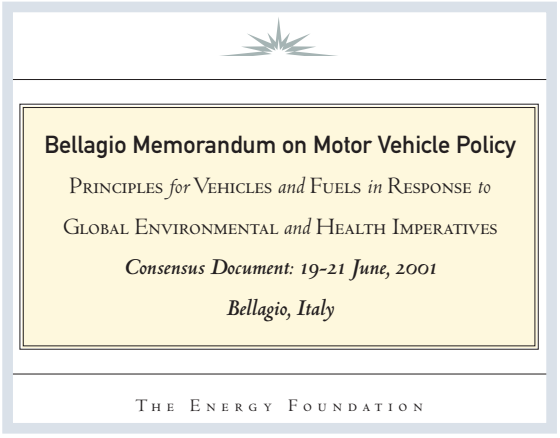
In June of 2001, leading air quality and transportation regulators and experts met in Bellagio, Italy to develop policy guidelines for the future regulation of motor vehicles and transportation fuels. The meeting was convened by the Energy Foundation with the guidance of Michael Walsh, who served as director of the Office of Mobile Sources at the U.S. Environmental Protection Agency (EPA) in the 1980s and has since consulted for governments around the world on reducing air pollution from the transportation sector. The eighteen participants at that meeting reached consensus on a set of strong, overarching principles, published as the Bellagio Memorandum on Motor Vehicle Policy (Table 1).

Recognizing the important implications of what they had done by laying out the policy future for motor vehicles and transportation fuels, the most forward-thinking Bellagio participants established the International Council on Clean Transportation. In regular meetings since 2001, this small, determined group of regulatory leaders and experts has continued working across national borders to advance the best policies worldwide. Between meetings they have also continued collaborating on a more informal basis by sharing information, strategies, and insights. Currently, the Council includes leading regulators and transportation experts from Brazil, Canada, China, Europe, India, Japan, Mexico, South Korea, Thailand and the United States (Table 2). Each participates in the Council as an individual, lending his or her personal experience and expertise.

Table 1. Overarching Principles from ICCT Bellagio Memorandum (2001)

BELLAGIO PRINCIPLES
1. Clean vehicle strategies should promote air quality (including air toxics) and greenhouse gas goals in parallel. Noise pollution should be considered as well.
2. Vehicles and fuels should be treated as a system.
3. New vehicle standards for greenhouse gas emissions and conventional pollutants should be fuel-neutral.
4. Policies should be based on full life-cycle emissions, including vehicle and fuel production, distribution, and disposal.
5. Cost-effectiveness should be considered in achieving the goals.
6. Economic instruments should be used to promote adoption of clean, efficient vehicles and fuels.
7. Policies for clean vehicles should be mutually re-enforcing, not conflicting. For example, economic policy should support standards.
8. Clean transportation strategies should promote inherently clean vehicles.
9. New vehicle industry in developing countries should be based on new technology, and not be a dumping ground for old technology.

Source: Energy Foundation 2001.



The ICCT incorporated in May 2005, bringing in full time staff to support the goals and efforts of the Council. The organization has grown quickly,

from two to thirteen full-time staff in two offices: in Washington D.C. and San Francisco, California. Dr. Alan Lloyd, former secretary of California's Environmental Protection Agency and chair of the California Air Resources Board, serves as president of the ICCT. The staff collaborates closely with the Council to set priorities and strategies in meeting our goals to dramatically reduce global and local pollution from the transportation sector.

1.2 OUR MISSION

The mission of the ICCT is to dramatically improve the environmental performance and efficiency of cars, trucks, buses, and transportation systems in order to protect and improve public health, the environment, and quality of life. Because the transportation sector is a major and rapidly growing source of greenhouse gases and air pollution, accelerating the transition to sustainable transportation systems is urgently needed to protect and improve public health, the environment, and everyday quality of life for billions of people around the world. The ICCT's work spans all modes of transportation—including motorcycles, passenger cars, trucks, non-road engines and equipment (construction and agriculture equipment), buses, trains, airplanes, and ships—and is focused on major motorized nations and regions. As already noted, the work of the ICCT is guided by principles developed at the Council's founding meeting in June 2001 in Bellagio, Italy.

TABLE 2. List of Current ICCT Participants*

COUNTRY/REGION	ORGANIZATION
Brazil	•Rudolf de Noronha, Federal Environment Ministry •Andre Ferreira, Instituto de Meio Ambiente e Energia
Canada	•Steve McCauley, Environment Canada
China	•Kebin He / Lixin Fu, Professor, Tsinghua University •Maodong Fang, China Automotive Technology and Research Center (CATARC) •Dongquan He, Energy Foundation China •Wai-Chuen Mok, Hong Kong Special Administrative Region
Europe	•Martin Williams, United Kingdom Department for Environment, Food and Rural Affairs •Guenter Hormandinger / Ian Hodgson, European Commission •Axel Friedrich, German Federal Environmental Agency (retired)
India	•Anumita Roychowdhury, Center for Science and Environment
Japan	•Yasuhiro Daisho, Waseda University •Teruyuki Ohno, Tokyo Metropolitan Government
Mexico	•Adrian Fernandez, National Institute of Ecology •Mario Molina, Centro Mario Molina
S. Korea	•Youngil Jeong, Korea Institute for Machinery and Materials •Wha-Jin Han, Senior Research Fellow, Korea Environment Institute
Thailand	•Supat Wangwongwatana, Pollution Control Department
United States	•Margo Oge, Environmental Protection Agency •Mary Nichols, California Air Resources Board

*Most ICCT Board of Directors are also ICCT Participants, see list in Table 3.

1.3 ORGANIZATIONAL OUTLINE AND BASIC OPERATIONS

The ICCT's organizational structure includes an 8-member board of directors, a council of ICCT participants, and staff located in two offices in Washington, D.C. and San Francisco, CA (Table 3). The Board of Directors, chaired by Michael Walsh, holds conference calls with ICCT staff once a quarter and meets in person once a year to review the organization's performance and provide strategic suggestions and general guidance. In the future, the Board will meet two or three times a year for full day in-person meetings, supplemented by conference calls as needed.

ICCT participants are carefully selected by the Board of Directors based on their dedication and commitment to solving both the local and regional problems that they face each day in their work and also to addressing the global problems that are shared among them. Second, Council participants are selected on the basis of their ability to influence transportation policy in their home countries and often internationally, either because of their direct role in government (typically as regulators or in some other official capacity), their affiliation with an organization with significant policy influence, or as a result of their widely-recognized expertise. These individual are referred to as "participants" rather than "members" to reflect the fact that there are frequent changes to the roster due to changes in job responsibility and also to give the key regulators an ability to participate to the fullest extent without requiring them to "own" each report or publication.

The number of ICCT participants has grown from 18 in 2001 to 28 at our most recent meeting in Hong Kong in 2007. Council participants meet once every 18 months in locations around the world to provide input to ICCT staff concerning programs and projects and to exchange ideas. Past meetings have been held in Bellagio, Italy; Napa Valley, California; Chantilly, France; and Hong Kong, China. Participants are contacted regularly when members of the ICCT staff are working in their country or region; they are also asked to review and sign-on to ICCT reports and to participate in workshops.

TABLE 3. ICCT Board of Directors and Corporate Officers

NAME	BOARD OF DIRECTORS	CORPORATE OFFICERS	ICCT PARTICIPANT
Michael Walsh	Chairman of the Board		√
Alan Lloyd	Board member	President	√
Drew Kodjak	Board member	Executive Director and Treasurer	
Hal Harvey	Board member		√
Charlotte Pera	Board member		√
Leonora Rojas	Board member		√
Dan Greenbaum	Board member		√
Michael Wang	Board member		√
Kate Blumberg		Corporate Secretary	

The ICCT staff brings a broad set of skills in key policy-making disciplines, including engineering, economics, law, and public health. Staff members are fluent in many relevant languages: Japanese, Chinese, Hindi, German, Spanish, French, Korean, and Portuguese. The organization is strongly committed to maintaining its diversity in

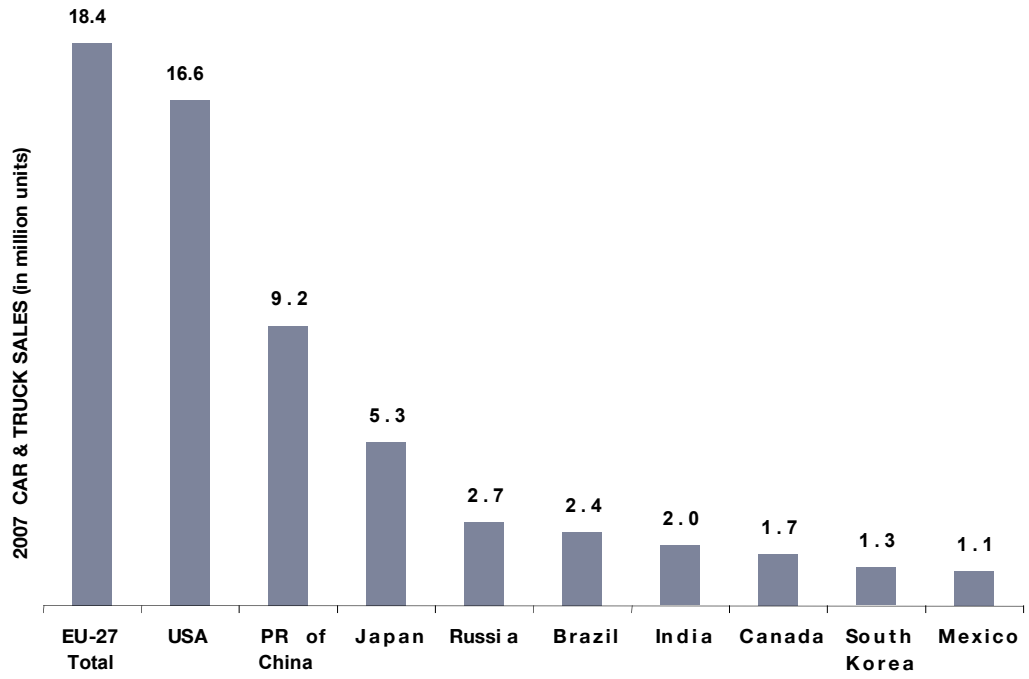
gender, ethnicity, race, and country of origin; a commitment that fits naturally with our emphasis on language skills and international experience when making new hires. For more information on each staff person, please see Appendix A.

1.4 THE ICCT'S THEORY OF CHANGE

Our theory of change rests on the proposition that government regulators and policymakers with better information and access to a global network of support and experience will move more quickly and more effectively to adopt clean transportation policies. History has shown that these relatively few individuals are in a position to exert enormous leverage over the future direction of transportation policy and technology worldwide. The government officials that develop policy for these key jurisdictions are essentially setting the global policy for air pollution from vehicles and fuels. By working together, ICCT participants have greater power in negotiating with the global vehicle and fuels industries they regulate.

The top ten markets for passenger vehicles and trucks in 2007 accounted for 84 percent of global sales (see Figure 1) and generally reflect – by design – the composition of the Council. When the ICCT was first constituted in 2001, Thailand was in the top ten markets. But recently, Thailand's ranking has slipped out of the top ten, and Russia is the newcomer. We will need to consider these changes in future discussions of the ICCT Board of Directors.

FIGURE 1. Top Ten Markets for Cars and Trucks in 2007 (Source: Automotive News 2008.)



The ICCT provides an excellent conduit for sharing the most up-to-date research findings, innovative and effective best practices, and technical resources for addressing the most intractable problems. At each ICCT meeting, Participants and staff work together to define the priority projects and issues in the coming year and to start to lay out the solutions. The workplan that emerges requires ICCT staff to work closely with participants and their agencies. The needs may include research, modeling and analysis to understand the magnitude of a problem or to better define how to address it; workshops and face-to-face meetings with key stakeholders in specific regions; and production of materials—brochures, papers, and reports—that share best practices, innovative solutions, and issues in regulatory design.

As an organization, the ICCT brings a global perspective to transportation policy while also empowering regulators in individual countries to accelerate progress toward cleaner transportation systems. ICCT participants and staff work together and with peers around the world to exchange information, share best practices, and identify important regulatory opportunities. The ICCT staff are often called upon to weigh in on time-sensitive issues and to provide much needed input into an ongoing regulatory process. While we work to be proactive in identifying key opportunities well in advance, the organization is also careful to retain the "swing capacity" to ensure that we can take rapid advantage of changing circumstances and new opportunities as they arise.

At the same time, the Council's staff and participants are keenly aware of the regulatory, resource, and political constraints that must be addressed in different jurisdictions. Because our ultimate aim is the successful implementation of good policy, the ICCT strives for a pragmatic, flexible, and collaborative approach toward realizing its organizational goals. To bring about change in individual countries or jurisdictions and at the international level, the ICCT's work takes several different forms:

1) ***Regulatory support.*** At a time of shrinking governments and growing economies, the ICCT lends resources and provides technical expertise to support important regulatory activities in key nations. ICCT staff can help regulators meet short deadlines, provide compelling justification for improved policies, and design strong and implementable programs.
2) ***International voice.*** The ICCT is well positioned to provide an international voice to push progressive transportation policies in major countries and in international policy-making bodies such as the International Maritime Organization.
3) ***Conduit for model programs and best practices.*** The ICCT collects, assimilates, and disseminates information to accelerate the diffusion and adoption of best practices. The ICCT also develops its own policy recommendations.
4) ***Strategic guidance.*** In areas ripe for policy advancement that have stalled for lack of credible technical research or well-designed policy proposals, the ICCT helps to fill these gaps by sponsoring studies and research and by helping to forge consensus on regulatory next steps.

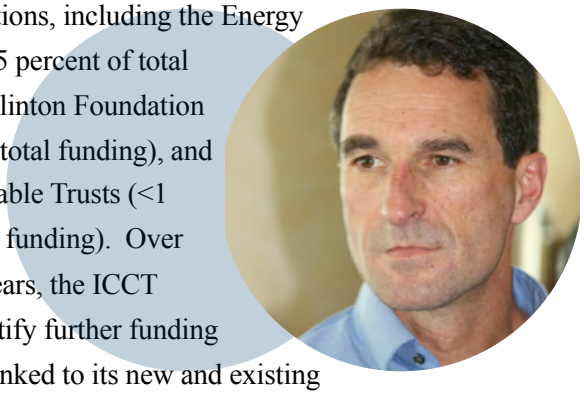
The ICCT's success depends on close cooperation among Council participants, staff, and a diverse

array of external stakeholders, including other NGOs, advocacy organizations, industry leaders, the media, and the scientific/academic community. Like the work of the ICCT itself, these collaborators and constituencies span the range from local and national to regional and international. Frequently, the organization's work at one level of government creates opportunities to access other levels. In some areas, the ICCT is engaged in collaborative efforts with other NGOs, such as the Molina Center in Mexico and the Center for Science and Environment (CSE) in India. Thus, while the ICCT occupies a distinct niche, it also functions as part of a broader network of organizations and institutions engaged in policy analysis and advocacy.

1.5 FUNDING

The ICCT's annual budget has averaged approximately $1.8 million per year over the organization's first three years of operation. During that period, two-thirds (66 percent) of the budget was devoted to core program areas, 10.4 percent was spent on major meetings; 13.5 percent went to administration, and an additional 10.1 percent was directed to development and outreach. Across specific program areas, 2007 budget expenditures were divided as follows: 34 percent for passenger vehicles, 19 percent for fuels, 23 percent for California-focused climate change work, 16 percent for aviation and marine, and 8 percent for heavy-duty vehicles.

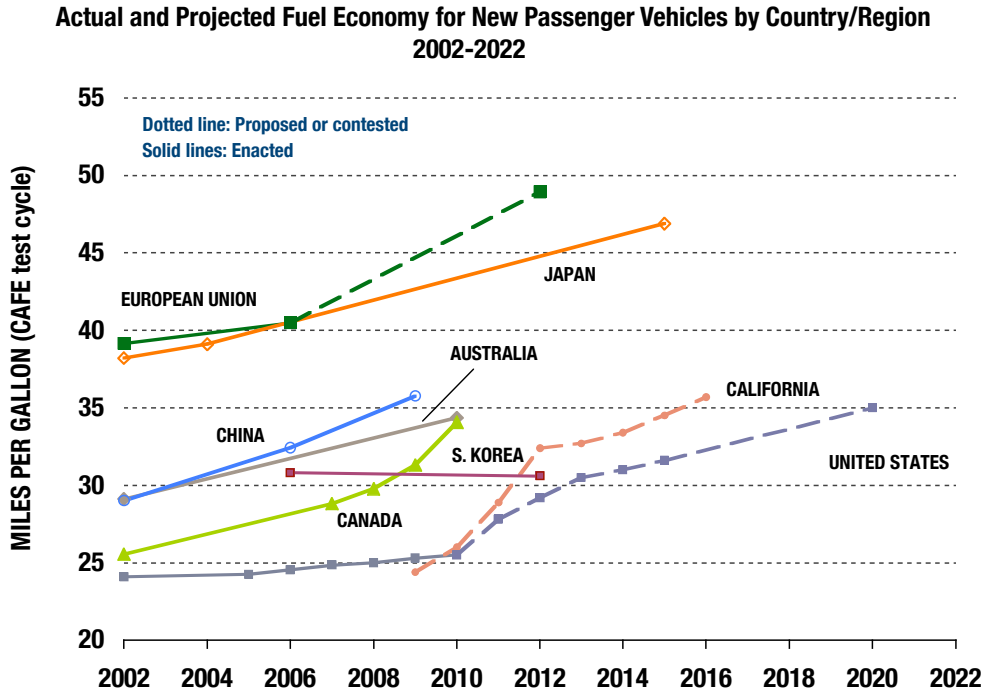
The core of the ICCT's funding (90.5 percent of the total) to date has come from the Hewlett Foundation. Over the last three years, the organization has received additional grants from several foundations, including the Energy Foundation (6.5 percent of total funding), the Clinton Foundation (2.3 percent of total funding), and the Pew Charitable Trusts (<1 percent of total funding). Over the next five years, the ICCT expects to identify further funding opportunities linked to its new and existing program initiatives and to broaden its funding base. The ICCT expects an important new source of funding – as well as institutional and technical support – to come from the newly formed ClimateWorks Foundation.



1.6 HIGHLIGHTS FROM ICCT'S FIRST THREE YEARS (2005-2008)

PASSENGER VEHICLE FUEL ECONOMY AND CO_2 STANDARDS

Improving vehicle fuel economy has been a longstanding focus of the ICCT's work. A report released by the ICCT in 2007, titled Passenger Vehicle Greenhouse Gas and Fuel Economy Standards: A Global Update (An et al. 2007; Figure 2), played a major role in making the case for tougher passenger vehicle CO_2 and fuel economy standards in the European Union and the United States. Aggressive new requirements have since been proposed or adopted in both jurisdictions. The implementation of tougher standards in these major vehicle markets has the potential to reduce carbon dioxide emissions by as much as 4.2 metric gigatons (Gt) by 2030



Source: *Passenger Vehicle Greenhouse Gas and Fuel Economy Standards: A Global Update*, International Council on Clean Transportation, updated 7/2008.

FIGURE 2. Passenger Vehicle Greenhouse Gas and Fuel Economy Standards (ICCT 2007.)

(ACEEE 2007; EC 2007b) and to clear the way for substantial progress in other nations with large and/or rapidly growing vehicle markets, including India, China, Mexico, and Brazil.

REGULATION OF INTERNATIONAL SHIPS

The international nature of the shipping industry has long created a major hurdle to effective regulation. Policy recommendations put forward in a major ICCT study issued in March 2007, *Air Pollution and Greenhouse Gas Emissions from Ocean-going Ships* (Friedrich et al. 2007), were widely covered in the international media and have helped give the ICCT a voice in the ongoing policy debate over shipping emissions at the International Maritime Organization (IMO), which has primary responsibility for regulating the shipping industry. Under the auspices of the U.S. delegation, the ICCT has participated in IMO committees charged with developing new regulations for nitrogen oxides (NOx) and sulfur oxides (SOx). At the end of 2008, the IMO is expected to reach consensus on an unprecedented tightening of environmental requirements for ships operating in heavily impacted coastal areas (such as around North America, Europe, and Japan) by 2016. Specifically, new IMO rules are expected to require an 80 percent reduction in NOx emissions from new vessels and a 95 percent reduction in fuel sulfur levels in these areas.

LOW SULFUR AND LOW CARBON FUELS

With the almost complete phase-out of lead in motor vehicle fuels worldwide, the virtual elimination of sulfur from fuels is the critical next prerequisite for enabling the use of advanced emissions controls to address local air pollution. In December 2006, the ICCT released a report titled *Costs and Benefits of Reduced Sulfur Fuels in China* (Blumberg et al. 2006). Developed in collaboration with Tsinghua University, this report quantified and monetized the public health benefits that would result from the adoption of stringent emission standards and low sulfur fuels. China has announced that it will reduce sulfur levels in gasoline to 150 parts per million (ppm) but has not yet committed to comparable sulfur reductions in diesel fuel.

In the fall of 2006, the ICCT formed a working group of government regulators from Canada, Brazil, Europe and the United States interested in developing the technical basis for a low carbon fuel standard. Over the course of more than a year, ICCT staff collaborated with this group to compare the outputs of major lifecycle greenhouse gas (GHG) emission models in Europe, Canada and the United States. The ICCT's technical work helped provide the groundwork for a regulatory proposal by the European Commission published in January 2007. Since that time, the ICCT has continued to play a critical role facilitating communication and collaboration between government regulators in Europe, the United States, California and the UK—all jurisdictions that are in various stages of developing low carbon fuel standards based on lifecycle emissions. The annual GHG reductions potentially associated with the implementation of such standards have been estimated to total 300 million metric tons.

EUROPEAN EMISSION STANDARDS FOR HEAVY-DUTY TRUCKS

The ICCT has played a key role in influencing the design and stringency of the European Union's pending Euro VI emission standards for heavy-duty vehicles. These precedent-setting proposed standards—which set stringent control requirements for NOx and particulate emissions, incorporate separate requirements for ultra-fine particles, and include aggressive measures to control in-use emissions—will drive further substantial improvements in heavy-duty vehicle pollution control, not only in Europe but in many other countries that typically follow the EU's regulations. The ICCT's ability to participate effectively in this regulatory arena has been greatly enhanced by its development of model regulatory program for reducing exhaust and evaporative emissions from heavy-duty vehicles and engines (Walsh et al. 2007). Issued by the ICCT in November 2007, this document provides a foundation for future efforts to promote globally harmonized standards that can be adopted by developing as well as developed countries. The emissions reduction from Euro VI standards were estimated by the European Commission as 3,290 tons per year of particulate emissions and 227,000 tons per year of NOx emissions in 2020 in the EU alone (EC 2007c).

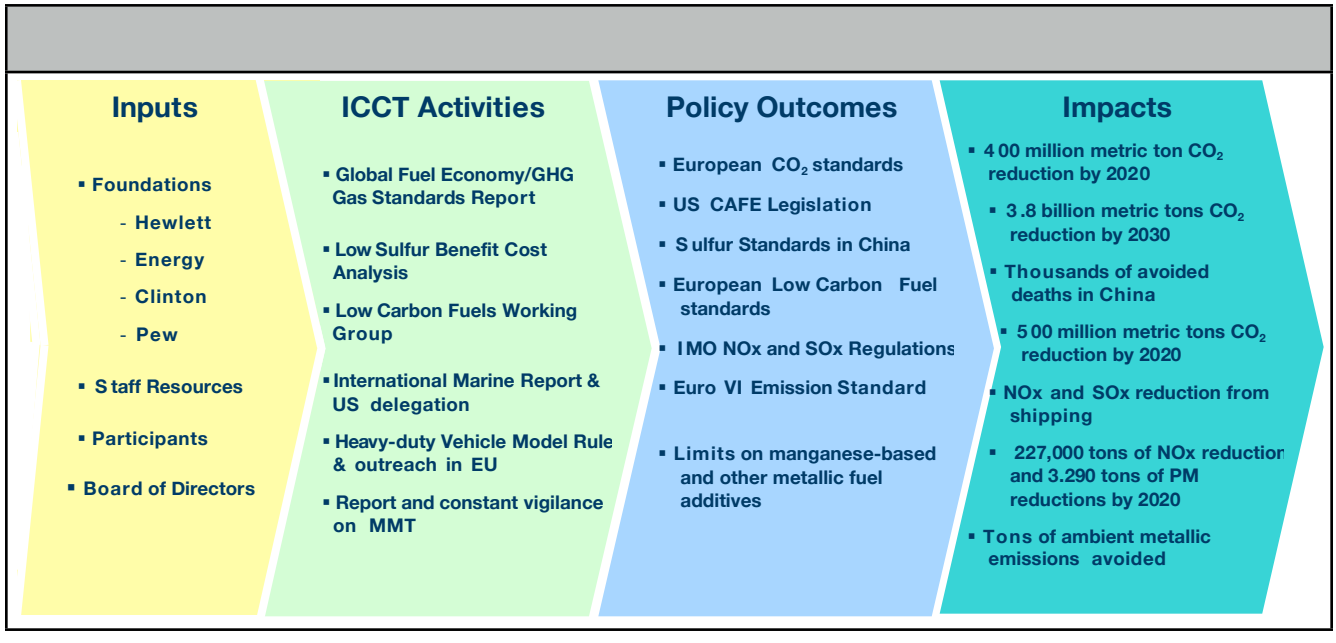
HEAVY METAL ADDITIVE IN GASOLINE

Methyl cyclopentadienyl Manganese Tricarbonyl

The ICCT has been one of the only honest brokers seeking to provide reliable information on MMT (methyl cyclopentadienyl manganese tricarbonyl), a manganese-based octane boosting gasoline additive developed to replace leaded additives. ICCT outreach, especially by Board Chair Michael Walsh, has helped disseminate reliable information on MMT, which has been especially critical in developing countries where marketing of the fuel additive is particularly aggressive. In 2007, the ICCT joined with occupational and environmental health experts in Brescia, Italy to draft and adopt an international declaration to immediately eliminate all metallic fuel additives. The ICCT has continued to work with this group of experts to draft and send letters to European ministers of the environment in support of an amendment in the European Parliament that would ban manganese-based fuel additives like MMT beginning in 2010. Many ministers have agreed to support the amendment and a vote is expected later in the year. In addition, ICCT publications and outreach have helped convince the Chinese government to lower limits for the use of manganese in gasoline and have provided support for a 2008 Canadian proposal to dramatically tighten limits on ambient concentrations of manganese, the first such action in 14 years. Armed with material provided by the ICCT staff, Anumita Roychowdhury – a prominent expert who works for the Center for Science and Environment in Delhi and long-standing ICCT Participant – succeeded in convincing the India government to ban MMT in India.

The activities described above have contributed to regulatory efforts (often by ICCT Participants) that will substantially reduce emissions of air

FIGURE 3. Examples of ICCT Effectiveness



pollution over the next several decades. Figure 3 illustrates how previous inputs (e.g., funding, staff and participant efforts) have led to activities (e.g., publications, analyses, workshops), which in turn lead to policy outcomes (e.g., changes in regulation/policy), and ultimately impacts (e.g., reductions in air pollution and improvements in public health and environment).

2. RESOURCE ALLOCATION

Resource allocation is critical to maximizing the ICCT's ability to fulfill its organizational mission. This allocation is based upon the following criteria: (1) What regions and modes are responsible for the largest share of current and future emissions of carbon dioxide and air pollutants, and where are reductions most needed? (2) Where can the ICCT have the greatest influence on policy making?

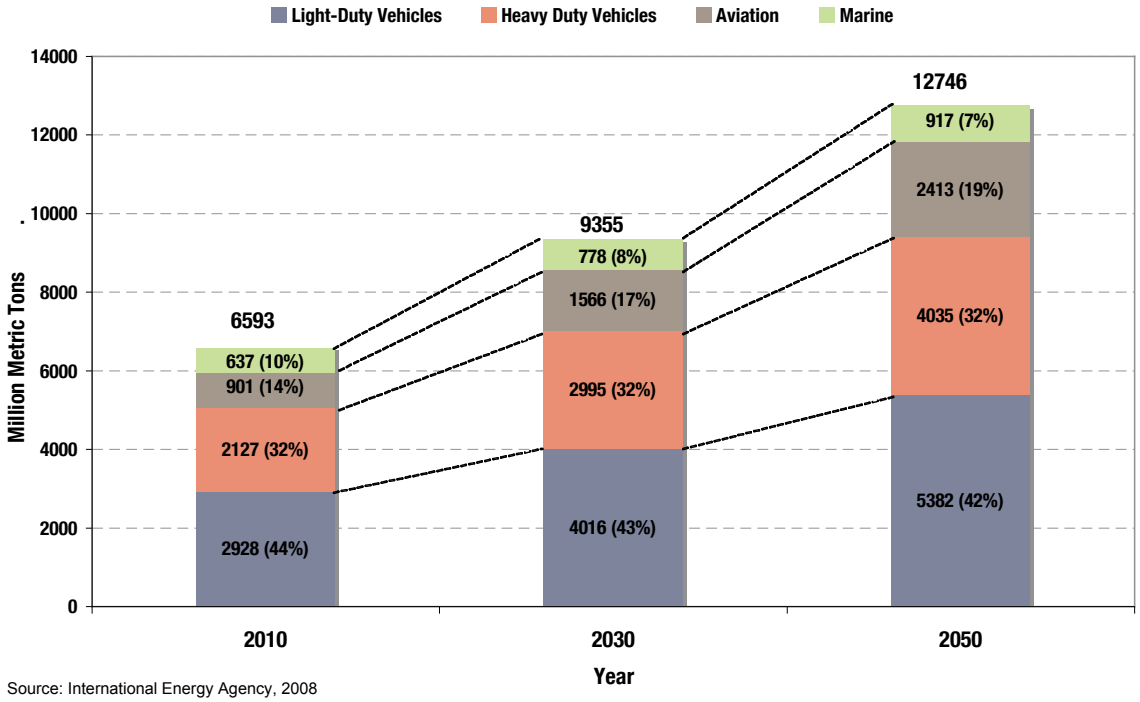
2.1 MAGNITUDE OF EMISSIONS BY MODE AND REGION

CARBON DIOXIDE

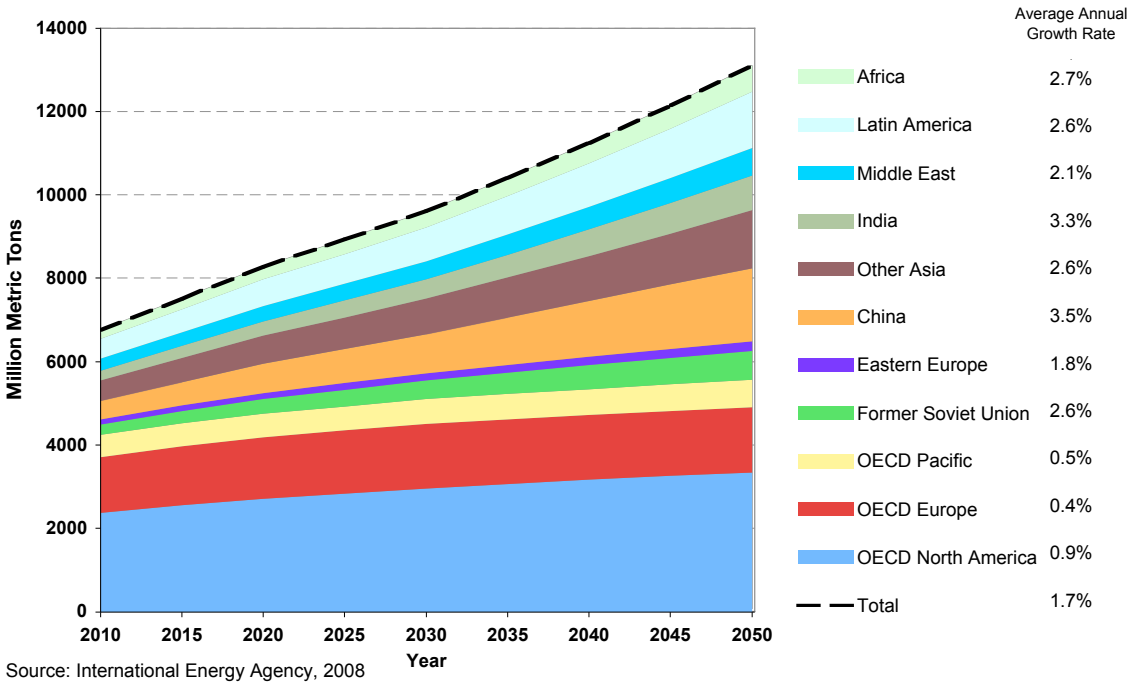
Transportation is the fastest growing source of greenhouse gas emissions and accounts for a majority of conventional pollutant emissions and health impacts in most large cities. Current projections suggest that transport sector carbon dioxide emissions will continue to rise at an average rate of 2 percent per year, which would almost double the emissions from 2010 to 2030 to 2050 as shown in Figure 4. Under a business as usual projection, on-road vehicles will continue to account for the largest share (approximately 75%) of transportation emissions over the next several decades.

Figure 5 shows the breakdown of projected global CO_2 emissions and average annual growth rate by region from 2010 to 2050. While the rate of

FIGURE 4. Global CO_2 Emissions by Transport Mode in 2010, 2030 and 2050 (IEA 2008)



Source: International Energy Agency, 2008



Source: International Energy Agency, 2008

FIGURE 5. Global CO_2 Emissions by Region between 2010 and 2050

growth in emissions is likely to be small in the developed part of the world, the OECD countries will still account for 42% of the emissions in 2050, down from 60% in 2010. On the other hand, countries with the highest rates of growth (China and India) will see their share of emissions rise from 11% in 2010 to 20% in 2050.

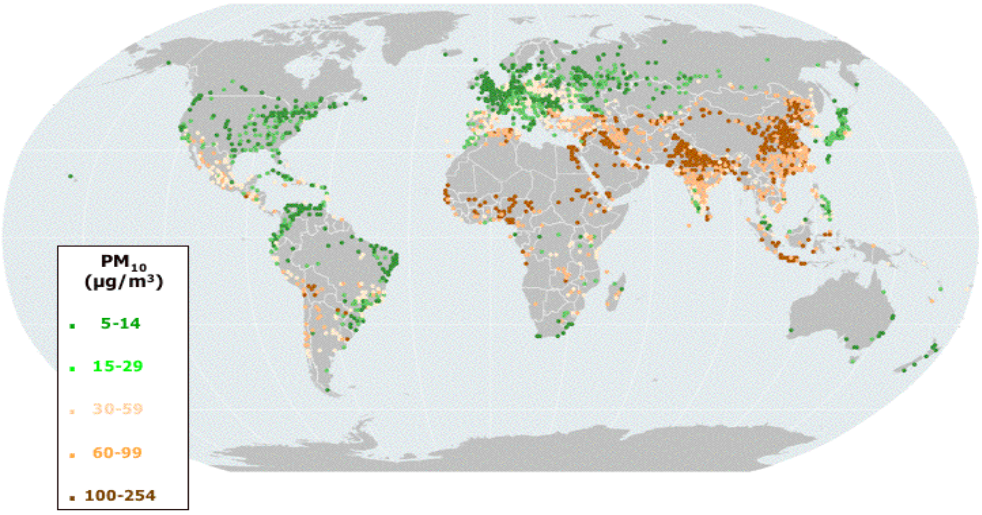
The cumulative emissions of CO_2 emissions from 2010 to 2050 will likely be split roughly evenly between the developing and developed world (OECD countries). This highlights the need for emission reductions to take place globally. At the same time, since the emissions of OECD countries continue to dominate well in to 2030s, these countries will have to take a lead in reducing emissions.

Projecting beyond 2050 would reveal that the developing countries would contribute the bulk of the emissions, and grow at a higher rate than the OECD countries. Therefore, it is equally necessary that appropriate policy measures to check the growth of emissions in these countries are put into place.

CONVENTIONAL POLLUTANTS

On-road vehicles, oceangoing vessels, and aircraft are a major source of pollution worldwide, and cause or contribute to serious air quality problems in urban areas throughout the globe. Transport-sector emissions include ozone precursors, such as NOx and volatile organic compounds (VOCs); particulate matter (PM) and PM precursors, such as NOx and SOx; and toxic and carcinogenic compounds, such as formaldehyde. As the World Health Organization

FIGURE 6. Estimated Annual Average Ambient PM_{10} Concentration in Select World Cities (Pop>100,000)



Source: Cohen et.al. 2004

(WHO) notes, these pollutants are the cause of a wide variety of adverse health effects and in some cases even premature death. It is estimated that in 2004 alone, urban air pollution still caused approximately 800,000 premature deaths and 6.4 million years of life lost worldwide, with the highest burden of death and disease falling on the citizens of developing countries (Figure 6). Without aggressive efforts to reduce emissions from vehicles, people in cities throughout the world will continue to breathe polluted air for the foreseeable future.

Table 4 presents one recent estimate of global emissions of conventional air pollutants and non-CO_2 greenhouse gases by transport mode. Road vehicles—a category that includes motorcycles, passenger vehicles, and heavy-duty trucks and buses—dominate global inventories of all pollutants. Shipping is notable for its large contribution to NOx, sulfur dioxide (SO_2), and, to a lesser extent, black carbon (BC) and organic carbon (OC) inventories. Aviation is responsible for a smaller share of emissions, but as highlighted later, those emissions occur at altitudes that significantly magnify their climate impact.

Carbon dioxide has typically been the focus of most policy debates on climate change, but nearly

TABLE 4. Estimated Emissions by Mode and Species, 2000

Mode	Emissions (million metric tons)							
	CH_4	N_2O	NOx	VOCs	CO	SO_2	BC	OC
Road	0.86	0.11	29	34	190	3.7	0.97	1
Aviation	0.0064	0.020	2.0	0.10	0.50	0.070	0.0038	0.0010
Shipping	0.030	0.0046	14	0.40	1.4	8.3	0.20	0.061
Rail	0.0048	0.0013	2.3	0.40	3.0	2.8	0.054	0.051
Total	**0.91**	**0.13**	**47**	**35**	**190**	**15**	**1.2**	**1.2**

All figures rounded to the least significant digit
Source: Fuglestvedt et al., 2008

all transport-sector pollutants also have direct or indirect effects on the radiative forcing properties of the atmosphere and hence on climate. NOx, hydrocarbon, and PM emissions from vehicles contribute to anthropogenic climate change—NO_x and hydrocarbons by promoting the formation of ground-level and tropospheric ozone, and diesel soot particles directly by reradiating visible light as heat and indirectly by lowering the albedo (reflectivity) of snow and ice-covered regions.

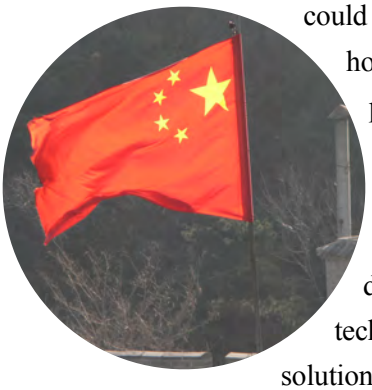
Emissions from ships and aircraft likewise impact the global climate in important ways. Contrails formed high in the atmosphere by water vapor emissions from passing aircraft contribute to warming, and may spur the development of cirrus clouds, another important climate forcer. The situation for SO_2 and NOx emissions, by contrast, is more nuanced. In balance, nitrogen oxides from conventional aircraft at cruise altitudes warm the earth by contributing to tropospheric ozone, while NOx emissions from supersonic aircraft have a (smaller) cooling effect by depleting ozone in the stratosphere. Sulfate particles formed in the atmosphere from SO_2 emissions have a negative (cooling) effect on radiative forcing, while NOx —especially if it is released under conditions that do not lead to ozone formation—can cool the earth by hastening the destruction of atmospheric methane, a potent warming gas. For these reasons, NOx and SOx emissions from international shipping may have a countervailing effect on global warming.

Besides the direct warming impacts of several important classes of local pollutants, many of the advances in technologies and fuels that will likely be needed to address climate change could also provide significant air quality co-benefits, and vice versa. Electric vehicles, for example, can reduce pollution in urban areas and deliver substantial greenhouse gas reductions if the electrons are generated by low carbon sources. Even in the case of SO_2, where—as already noted —climate and air quality objectives might seem to be at odds, efforts to reduce emissions on public health grounds can indirectly produce important climate co-benefits. For example, the use of ultra-low sulfur diesel fuel enables the use of advanced pollution control technologies, directly reducing black carbon emissions and allowing the use of more efficient diesel engines. The availability of effective control technologies for many local pollutants means that they offer an important and relatively immediate opportunity to mitigate near-term radiative forcing.

2.2 ASSESSMENT OF THE ICCT'S ABILITY TO INFLUENCE POLICY

A second, and equally important, consideration in deciding where the ICCT should devote its resources concerns the likelihood of influencing policy. Substantial emissions and market size alone do not necessarily translate to a large potential for realizing environmental and public health benefits when the likelihood of influencing

policy is low. In some countries or for some modes of transportation, significant resources could be expended without much hope of achieving significant progress due to a lack of political leadership, strong opposition on the part of entrenched interests, or a dearth of viable technological or policy solutions.



The ICCT also seeks to apply its resources where the causal link between our contribution and regulatory or policy change is likely to be clear and concrete. We tend to ask ourselves: what is the added value of ICCT engagement? A regulatory opportunity may exist, but if there are other competent NGOs engaged in the area already, the added value of ICCT engagement may not be high. Alternatively, we tend to seek out those government agencies that have a dearth of technical capabilities and are thus in need of the additional technical horsepower that can be provided by the ICCT. This includes most of the world's environmental agencies – particularly in developing countries. And even in the United States, California and Japan, technical staff may be stretched too thin to address the full scope of an issue. In Europe, there is significant environmental staff in major countries (Germany, France, UK), but policies to control air pollution and climate change emissions from the transportation sector are set by the thinly staffed European Commission in Brussels.

In devoting resources, the ICCT identifies modes and regions with:

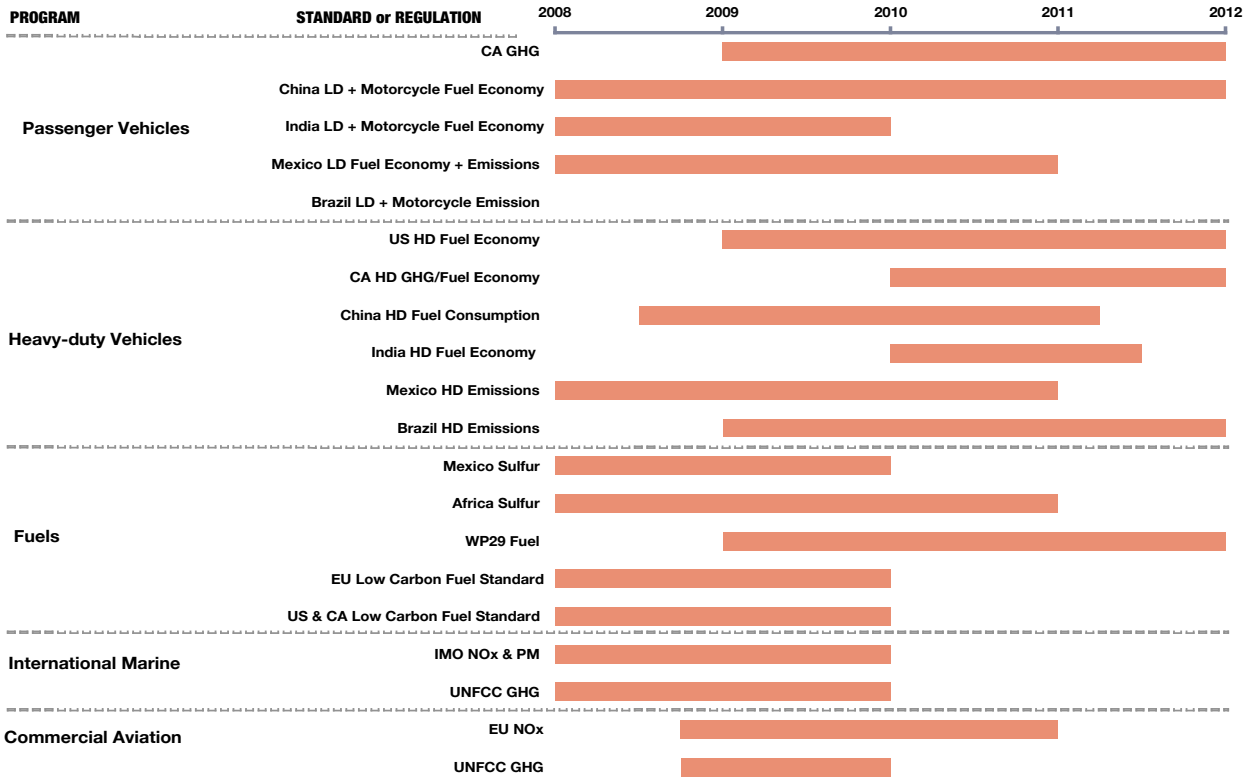
1. ***Regulatory or legislative opportunities.*** There is either an immediate opportunity for policy action, or an opportunity to lay the technical groundwork for future regulatory action,
2. ***Access to policy makers***. We have strategic access to key policy forums and policy makers, typically through our council of participants, or in some cases through regional climate foundations.
3. ***Technical barriers***. The barriers to policy action are technical in nature and can be overcome with the unique skills and capacities provided by the ICCT.

By rigorously applying these criteria, the ICCT can maximize its effectiveness and ensure the best use of its resources.

3. PROGRAM AREAS

The ICCT's current work is organized in five program areas: (1) passenger vehicles (including motorcycles), (2) heavy-duty vehicles, (3) fuels, (4) international marine and (5) commercial aviation. This section describes the importance of each area, gives some background on the ICCT's work to date, and highlights key strategic opportunities in the next three years. Supporting activities (called Core Capacity) and new initiatives -- including specific efforts targeted to accelerating the major technology advances that will be needed to address climate change -- are described in Section 4. Figure 7 shows a timeline of the key regulatory processes that will be targeted during the 2009-2011 time frame and highlighted in the following five sections.

FIGURE 7. Timeline of Key Regulatory Processes



It is important to emphasize that while ICCT staff in each program area have a work plan for the year, which typically includes commitments to specific activities and/or work products based on previously funded grant proposals, the organization is careful to retain the "swing capacity" needed to respond to new opportunities as they arise. Because the ICCT works in so many areas and different parts of the world and because the political and regulatory context in which transportation policy decisions are made is inherently fluid, we believe flexibility is essential to the organization's effectiveness. This means that in the course of any given year, as much as 25–50 percent of staff time and budget may be reprogrammed to address needs or seize opportunities that were unanticipated at an earlier stage of the planning process.

3.1 CARS AND LIGHT-TRUCKS

The ICCT includes motorcycles within the category of passenger vehicles, but in the interests of clarity for this presentation, we begin by discussing passenger cars and light trucks. Motorcycles are covered separately in the next section.

BACKGROUND AND CONTEXT

There are more than one billion motorized passenger vehicles in the world today: approximately 800 million cars and approximately 300 million two- and three-wheeled vehicles. Worldwide, approximately 50

million new cars and light trucks and 20–30 million motorcycles and scooters are sold each year.

In most major industrialized cities, cars and light trucks are a major source of urban air pollution. Globally, passenger vehicles are the largest source of greenhouse gas emissions within the transportation sector. The number of passenger vehicles sold each year has increased from 5 million just after World War II to 72 million in 2007, worldwide. Despite a leveling off of sales in North America and a declining market in Europe, global sales are expected to continue growing strongly over the next 30 years because of rapidly expanding demand for passenger vehicles in large developing regions of the world such as China, India, and Latin America. Moreover, current projections are likely to understate future sales growth as they do not account for the entry of new low-cost models such as the Tata Nano in India, which is expected to sell for about $2,500 per vehicle.

The regulation of cars and light trucks—primarily for safety and emissions characteristics—has a long and in many ways successful history. Three-way catalytic converters and sophisticated control of air-fuel ratios have reduced emissions of criteria pollutants (e.g., NOx, hydrocarbons, and carbon monoxide) from new passenger vehicles by upwards of 99 percent (compared to a vehicle with uncontrolled emissions) at an incremental cost that amounts to only a few percent of the sales price. Because they impose strict pollution control requirements on new vehicles, Europe, Japan and the United States enjoy the air quality benefits of these technological advances. In many other parts of the world, however, emissions standards are outdated and even new vehicles may have only rudimentary or non-existent control systems. Moreover, local fleets in much of the developed world include a large percentage of older, used vehicles from Europe, Japan and the United States. Many of these vehicles are not equipped with the latest pollution control technologies, and/or have emissions systems that no longer function correctly or have been disabled.

Similarly dramatic progress has been lacking on the side of fuel economy and GHG emissions—indeed, the fuel economy performance of new vehicles has been largely stagnant across nearly all major vehicle markets for most of the last 30 years. This is in spite of the fact that engineering studies have repeatedly found that substantial improvements in vehicle fuel economy are not only technologically feasible but also cost-effective (in the sense that the costs associated with these improvements are more than recovered in fuel savings to the consumer over the life of the vehicle). Since the early 1980s, improvements in engine efficiency have largely been directed toward offsetting the fuel consumption penalties that would otherwise be associated with increasing vehicle size, weight, and horsepower.

HISTORY OF ICCT INVOLVEMENT

The ICCT has published several major reports on passenger vehicle regulation and provided technical support for updating pollution control and fuel economy requirements in various nations and regions. These reports had a major impact on the public policy debate surrounding new fuel economy and CO_2 performance standards in the United States and Europe, and in the development of new fuel economy standards in India and Mexico. The ICCT was also directly engaged in recent efforts to advance a next iteration of passenger-vehicle emission standards in the European Commission.

Specific ICCT work products and activities in the area of car and light-duty truck regulation are summarized below:

- The ICCT developed detailed comments on the European Union's proposed Euro 5 standards for light-duty vehicles, some of which were incorporated in the final legislation.
- In 2006, the ICCT completed a draft fuel economy analysis of the Mexican passenger vehicle fleet that was presented at a press conference with substantial media coverage. The report found that without policy intervention, projected oil consumption by Mexico's growing passenger vehicle fleet would shift Mexico's status from an oil exporter to an oil importer by 2030. The ICCT is currently working with the National Institute of Ecology (INE), Centro Mario Molina (CMM), and the National Commission for Energy Saving (CONAE) to develop fuel economy standards for Mexico.
- *Sipping Fuel and Saving Lives: Increasing Fuel Economy without Sacrificing Safety* (Gordon et al. 2007). This report sought to respond to, and move beyond, old debates about the trade-off between fuel economy and vehicle safety.
- *Passenger Vehicle Greenhouse Gas and Fuel Economy Standards: A Global Update* (An et al. 2007). This report found a substantial disparity in new passenger vehicle fuel economy standards and performance in different countries and regions of the world. In 2006, new passenger vehicle fleets in Europe and Japan averaged 150–160 grams (g) of CO_2 emissions per kilometer (km)—equivalent to 40 miles per gallon (mpg) – with new vehicles sold in Japan projected to emit on average only 125 g CO_2 per km in 2015. By comparison, the new passenger vehicle fleet in the United States averaged 250 g CO_2/ km or 25 mpg. This disparity strongly suggested a substantial opportunity for improvement in the United States as well as Europe.
- Starting in January 2008, the ICCT has acted as a knowledge partner of the Bureau of Energy Efficiency (BEE) in India on the issue of fuel economy standards for motor vehicles.

TECHNICAL CHALLENGES AND POLICY BARRIERS

Cap-and-trade systems are largely ineffective at promoting vehicle efficiency improvements

Greenhouse gas cap-and-trade systems, which set a sector or economy-wide limit on emissions and allow regulated entities to comply with reduction requirements through the purchase of emission credits generated from excess reductions

elsewhere, have been adopted or are under consideration in many parts of the world. Improving the energy efficiency of passenger vehicles is among the most cost-effective strategies available for reducing GHG emissions. As was already noted, engineering studies almost universally find that CO_2 reductions can be achieved at no cost to the consumer once fuel savings are accounted for. (By comparison, the revealed price per ton of CO_2 reductions based on recent trades in European allowance markets ranges from $10 to $30 per ton.) In vehicles, however, as in other sectors of the economy, consumers in most industrialized countries place a low value on fuel savings and/or place significantly greater value on other vehicle attributes that typically run counter to maximizing fuel economy (e.g. size and power). Thus, when economists model the impacts of an economy-wide constraint on GHG emissions, the demand response to a moderate carbon price signal from the transportation sector is generally minimal. Conversely, these findings suggest that a very large carbon price signal would be required to elicit substantial emissions reductions from the passenger vehicle fleet. This result demonstrates that an economy-wide cap and trade system – while useful in sending a price signal in the right direction – is inadequate to take full advantage of low-cost efficiency improvements in vehicles without supplementary regulations.

Consumer preferences for increased vehicle size, weight and horsepower

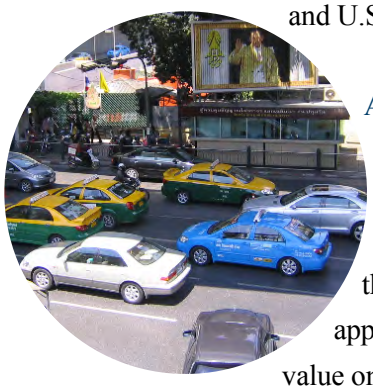
In the absence of countervailing incentives, such as high fuel prices or targeted fiscal policies, consumer preferences have historically favored increased size, weight, and horsepower over improved fuel economy. Over the last two decades, the average weight of U.S. passenger vehicles increased by almost 1,000 pounds—a 30 percent increase—while average horsepower for cars and light trucks reached a record level of 223. The U.S. EPA has calculated that if 2007 model year trucks were the same weight as the average for 1981, their fuel economy rating would be 35% better as a result of this difference alone (EPA 2007). Similar trends have been observed in other rapidly expanding vehicle markets, including China, India, and South Korea. For example, the weight of China's new passenger vehicle fleet increased 10% from 2002 to 2006.

TABLE 5. Influence of Mass and Horsepower on Vehicle Efficiency in Japan, Europe, and the United States (ICCT unpublished analysis)

FLEET AVERAGE	JAPAN (2004)	EU (2006)	US (2006)
Vehicle Mass (kg)	1245	1334	1769
Engine Size (liter)	1.5	1.7	3.4
CAFE mpg	39.3	40	24.7
NEDC CO_2 g/km	152	161	254

REPRESENTATIVE CARS	HONDA FIT M5, PETROL,1.5 L	FIAT SEDICI M5, PETROL,1.6 L	FIAT DOBLO M5, DIESEL,1.9 L	CHRYSLER 300 TOURING A5, PETROL, 3.5 L
Vehicle Mass (kg)	1215	1320	1320	1754
Engine Size (liter)	1.5	1.6	1.9	3.5
CAFE mpg	41.2	35	44.5	23.4
NEDC CO_2 g/km	145	173	153	269

Table 5 illustrates differences in average vehicle mass and engine size in the Japanese, European and U.S. new car markets.



A sharp upward trend in world oil prices over the last two years has recently had a moderating effect on these trends and consumers appear to be placing greater value on fuel economy characteristics in their purchase decisions. How much of an effect this consumer response will have on new vehicle offerings and how lasting the effect will be remains open to question.

Regulations that favor dirty passenger diesels

European standards for criteria pollutant emissions are significantly more lenient for diesel passenger vehicles than they are for petrol vehicles. Moreover, most developing nations follow the European standards. At the same time, other market factors and government policies tend to favor diesel passenger vehicles in some major markets (including Europe, India, and South Korea). This situation gives rise to an unfortunate and unnecessary trade-off between vehicle efficiency and public health; one that could be remedied by harmonizing European emissions standards for diesel and gasoline-fueled passenger vehicles.

Concerns about domestic industry competitiveness

Concerns about how new fuel economy or GHG regulations will affect the competitiveness of domestic auto manufacturers – particularly in the face of globalization – are a chief concerns among political leaders and policy makers. Progress on fuel economy standards in the United States stalled for nearly three decades because of concerns that the regulatory design of the Corporate Average Fuel Economy (CAFE) program left the domestic industry at a competitive disadvantage. (This situation was largely corrected in a 2006 rulemaking that imposed somewhat higher standards for light trucks; a change that, in turn, opened the door to action by the U.S. Congress in 2007 that will gradually boost CAFE standards for the entire light-duty fleet by 40%.) Elsewhere around the world, fuel economy or CO_2 emissions standards are being increasingly linked to vehicle size or weight as a way to address competitiveness concerns.

POLICY FORUMS AND REGULATORY OPPORTUNITIES

The institutions or political bodies involved in regulating passenger vehicles vary by country and region.

- In Europe, CO_2 emission standards for passenger vehicles are developed by the European Commission's Directorate General for the Environment. As proposed by the Commission, Europe's current standards will take effect from 2009 to 2012 and are likely to include a tentative target for 2020. The Commission proposal must undergo review by both the European Council of Ministers and the European Parliament. Efforts are underway to delay the final date of the 130 g/km target until 2015 but it is likely that resolution will not occur until late 2008. Development of the technical basis for the next set of standards in 2020 needs to start by 2010- 2011.

- In Japan, passenger vehicle emission standards are primarily set by the Ministry of the Environment (MoE), while passenger vehicle fuel economy requirements fall primarily under the jurisdictions of the Ministry of Land, Infrastructure, and Transport (MLIT) and the Ministry of Economy, Trade, and Industry (METI). There is unlikely to be a significant opportunity for further regulatory progress in either of these domains for at least the next three years as new requirements for the next several years were adopted not very long ago. A better target during the strategic plan period (2009–2011) may be Japan's policies for promoting advanced vehicle technologies, either through research and development under METI or through demonstration projects with the Tokyo Metropolitan Government (TMG), as well as policies related to the export of used vehicles exports under the Ministry of Finance (MoF).
- In the United States, three regulatory entities have jurisdiction over passenger vehicle fuel economy or climate change emissions: the U.S. EPA, the U.S. Department of Transportation (DOT), and California Air Resources Board (CARB). Further changes in vehicle fuel-economy regulation are likely to be bound up in climate change negotiations over the next two years.
- In Mexico, the ministries of Environment (SEMARNAT), Energy (SENER), and Economy (SE) will have to work together to develop and adopt fuel economy standards. Several entities are taking a leadership role in developing proposals, including INE (under the jurisdiction of SEMARNAT), CONAE (under SENER), and the Centro Mario Molina (an independent NGO with close links to the president and SEMARNAT), but there is little coordination between efforts.
- In Brazil, vehicle emissions standards are set by Conama (the National Environment Commission). Conama is led by the federal Environment Minister and composed of key government agencies and non-profit organizations. The State of Sao Paulo environmental agency – CETESB – serves as technical staff for all vehicle emissions issues and regulations.
- In Canada, Environment Canada, under the Canadian Environmental Protection Act, has the authority to regulate emissions of air pollutants from motor vehicles. Transport Canada has the authority to regulate motor vehicle fuel consumption under the Motor Vehicle Fuel Consumption Standards Act.
- In China, the China Automotive Technology and Research Center (CATARC) is the lead agency in developing fuel economy standards for passenger vehicles. The goal here is to establish a complete system of fuel economy standards to cover all vehicles types and to enable light-duty vehicles in China to catch up to international best practices with respect to fuel efficiency. CATARC coordinates closely with experts at Tsinghua University and others. There is no precise legally-binding schedule for new regulations but the tentative goal for phase 3 light-duty vehicles is around 2012. More generally, the development of vehicle standards involves close coordination with several ministries, such as the National Development and Reform Commission and the Standardization Administration of China.
- In India, the Bureau of Energy Efficiency has the lead on developing energy conservation and labeling standards for all transportation modes under the Energy Conservation Act of 2001. The BEE is in the process of adopting fuel economy and labeling standards for passenger vehicles, and expects to develop similar standards and labeling requirements for motorcycles and heavy trucks.

PROPOSED INITIATIVES

Over the next several years, the ICCT will focus the bulk of its resources in this area on providing technical assistance for the development of fuel economy and GHG emission standards. Major regulatory opportunities exist in India, Mexico, and the United States (including California). Among these venues, India is a high priority because of our close engagement over the last year in developing the technical basis and regulatory design for India's proposed fuel economy and labeling standards with the staff at India's Bureau of Energy Efficiency. The United States is a high priority given the magnitude of emissions and the regulatory opportunities that exist at the federal and California level.

To support precedent-setting fuel economy and CO_2 emission standards in the developing world and North America, the ICCT will:

- Continue to act as a knowledge partner of India's Bureau of Energy Efficiency on development of fuel economy standards and a fuel economy guide.
- Provide technical assistance and support to Mexico's INE, the Molina Center and as they develop a fuel economy and labeling program for Mexico.
- Assist China's CATARC by providing policy and technology assessments from other major countries and developing an alternative compliance mechanism that will allow vehicle manufacturers to comply on a corporate average basis rather than a per vehicle basis. The environmental benefits of such as approach are less lead time, faster implementation, lower costs, and tighter standards. CATARC is currently limited to per vehicle standards because only the Minister of Finance has the power in China to assess penalties. CATARC may also need our technical assistance in countering industry pushback on standard stringency, technological feasibility, and compliance costs.
- Work collaboratively with other U.S.-based NGOs (including the Bipartisan Policy Center, Securing America's Future Energy, the Natural Resources Defense Council, and the Union of Concerned Scientists) to provide technical support to U.S. EPA and CARB, both of which are expected to develop new GHG emission standards for passenger vehicles in the next several years. As was done effectively during the CAFE debate, the ICCT will lend a new international voice to these policy debates.
- Develop a database and regulatory analysis – in partnership with key agencies such as CETESB and the federal environment ministry – to enable regulatory action once Brazil's political situation becomes more amenable to environmental policies.

To help promote fiscal policies to encourage passenger vehicle fuel efficiency, the ICCT will:

- Publish a global review of fiscal policies related to passenger vehicle fuel economy or climate change emissions that ranks nations by total net amount spent (per capita or vehicle) to promote efficiency. This report would explore the relationship between fiscal policies (such as fuel taxes) and trends with respect to vehicle fuel economy and consumer preferences.

To support strict criteria pollutant emission standards for new vehicles in the developing world, we will:

- Produce and regularly update a report quantifying the lag time between the implementation of state-of-the art emissions standards for new vehicles in developing countries and Europe and the United States. The ICCT will also explore opportunities to reduce this lag time through in-country initiatives.

To help clean up the global trade in used vehicles, the ICCT will:

- Establish an international working group of interested participants and experts to develop strategies for improving the emissions performance of internationally traded used vehicles. Since the issue is very ripe in Mexico, the ICCT will apply significant resources towards addressing the Mexico "chocolates" problem, working closely with SEMARNAT, INE and the Molina Center.

3.2. MOTORCYCLES (2 AND 3-WHEELERS)

BACKGROUND AND CONTEXT

In many Asian cities, motorcycles rather than cars dominate the transportation landscape: two-wheelers are the primary form of personal transportation while three-wheelers are used to transport both passengers and commercial goods. Over 85 percent of new motorcycle sales are in Asia, where sales growth in some of the most densely populated countries (e.g., China, India, Vietnam and the Philippines) has been averaging more than 10 percent per year. Asia, where sales growth in some of the most densely populated countries (e.g., China, India, Vietnam and the Philippines) has been averaging more than 10 percent per year. Motorcycle usage is also growing rapidly in Latin America and Africa, due to the low purchase cost, relatively good fuel economy, and easy maneuverability of these vehicles, especially on congested roads.

Motorcycles are more fuel-efficient than cars, but they can be highly polluting. Two- and three-wheeled vehicles may be responsible for up to (or more than) 90 percent of hydrocarbon (HC) emissions, 70 percent of carbon monoxide (CO) emissions and 40 percent of PM emissions in some Asian cities (Meszler 2007). In addition, recent studies have shown that motorcycle riders are exposed to the highest levels of commute-related pollution compared to commuters using other transport modes. Coupled with high accident fatality rates, the impact of motorcycles on environmental quality, public health, and road safety in the cities where they are a primary mode of transport mode is therefore considerable. With improvements in emissions control and safety, on the other hand, motorcycles could be an invaluable asset in achieving a more fuel efficient and less GHG- intensive passenger transport sector. The challenge for regulators in countries with large motorcycle fleets is to develop and implement comprehensive programs for regulating motorcycle emissions, fuel economy, and safety. China, India, Thailand, and the European Union have taken the first steps in this direction and much can be learned from their experience.

HISTORY OF ICCT INVOLVEMENT

Motorcycles represent a relatively new area of focus for the ICCT. Recent activities in this area include the following:

- In December 2006, ICCT staff participated in a series of fact-finding meetings on two- and three-wheelers in China, Indonesia, and Taiwan, China. These meetings helped the ICCT to finalize a strategy for addressing motorcycle-related issues in Asia and identify key collaborators.
- In March 2007, the ICCT co-sponsored a workshop in Hanoi, Vietnam titled "Motorcycle Emission Control in Major Cities: International Experiences and Vietnam Conditions." The workshop was attended by over 100 stakeholders including regulators and members of the press.
- In July 2007, the ICCT published a report, titled *Air Emission Issues Related to 2- and 3- Wheeler Motor Vehicles*, prepared by Meszler Engineering Services. It provides a summary of the current regulatory environment for motorcycles, background information on worldwide motorcycle use, and a description of technology and pollution control measures.

TECHNICAL AND POLICY BARRIERS

The technical issues and policy challenges for regulating two- and three-wheeled vehicles are somewhat different than for cars and light trucks.

Most motorcycle countries do not have emission standards for motorcycles and state-of-the- art emission standards still need to be defined and internationally accepted

There has progressive harmonization of emission standards and test procedures towards stringent global norms based on the European Union standard (Euro 3) using the World Harmonized Motorcycle Test Cycle in major motorcycle manufacturing countries including China, the world's largest motorcycle manufacturer. This provides the opportunity for countries considering regulating motorcycle emissions to leapfrog to the most stringent standards. For example, Vietnam is currently developing its first set of emission standards for motorcycles and considering Euro 2 levels. Brazil is also looking to update their standards and may aim to adopt Euro 3 levels. However, India, the second largest producer of motorcycles in the world, is planning to adopt new standards by 2010 on a different cycle. As Indian standards are currently not directly comparable to Euro standards there is an ongoing debate about the relative stringency of these two regulatory systems. A comprehensive testing program could help answer this question. The next set of Euro standards will also be critical as they will set the de facto global standard. Work on these standards will begin in 2009.

Most countries do not regulate motorcycle fuel economy

Significant benefits could be achieved through the adoption of fuel economy regulations in major motorcycle countries. China, which integrates motorcycles in its national transportation energy policy, has developed such standards. India may be exploring fuel economy standards for motorcycles in the coming years. Again testing will be necessary to establish the technical basis for these regulations.

Policies to promote four-wheelers may negatively impact transportation energy demand

The competition from small low-cost cars and recent bans on motorcycle use in urban centers, particularly in China, are threatening motorcycles' market share in some countries. These trends could have a significant impact on overall energy demand from the transportation sector as motorcycles are replaced by less efficient cars. A framework is needed to integrate motorcycles in larger efforts to plan for urban mobility.

In-use emission control programs are rarely successful in implementation

There is growing interest in improving in-use emissions-control strategies for motorcycles, including inspection and maintenance programs. Taiwan, China is widely recognized as having laid a solid foundation for an effective motorcycle inspection and maintenance (I&M) program. Similar efforts in other countries, including in India and Thailand, have been deemed less successful. Evaluating the factors that have contributed to the successes and failures of different programs would useful to countries interested in improving or initiating I&M programs.

Going forward, the primary goal of the ICCT's efforts with respect to two- and three-wheelers will be to support comprehensive policy approaches for this category of passenger vehicles. Some countries (i.e., China, India, and Thailand) have already achieved significant improvements in environmental performance through regulation. Other major motorcycle nations are still in the early stages of regulatory design (i.e., Vietnam, Indonesia, and the Philippines). Continued progress in this area will require strategic partnerships—not only with the agencies and organizations to which ICCT participants have direct access, but also with other stakeholders. We are exploring co-funding opportunities with the Global Environment Fund (GEF) and the Sustainable Urban Mobility in Asia (SUMA) program of the Clean Air Initiative for Asian Cities (CAI-Asia). The Institute for Transportation and Development Policy (ITDP) is another potential collaborator in some of these co-funding opportunities.

POLICY FORUMS AND REGULATORY OPPORTUNITIES

The ICCT's efforts to promote emissions control requirements for two- and three-wheeled vehicles will focus on the following institutions and stakeholders:

- In Vietnam, the Vietnam Register is tasked with developing new standards.
- In India, emission standards for motorcycles are issued by the Ministry of Road Transport and Highways. As already noted, responsibility for fuel economy standards would most likely rest with the Bureau of Energy Efficiency.
- In China, the ICCT has worked with the State Environmental Protection Agency (SEPA) which was recently elevated to the Ministry of Environment (MEP) and supporting institutions such as the Chinese Research Academy of Environmental Science (CRAES) and the Tianjin Motorcycle Center.
- In Brazil, the Brazilian Institute for Environment and Renewable Resources (IBAMA) is the lead organization for setting emissions requirements with strong technical leadership from Technology Centre for Environment Conservation (CETESB).
- In Indonesia and the Philippines, the ICCT intends to explore opportunities with partners that already have strong links to those countries such as the Institute for Transportation and Development Policy (ITDP), Envirofit, and CAI-Asia: Better Air Quality (BAQ).
- In Africa, the ICCT will work with the United Nations Environment Program (UNEP) and the Partnership for Clean Fuels and Vehicles (PCFV) to identify appropriate policy forums

PROPOSED INITIATIVES

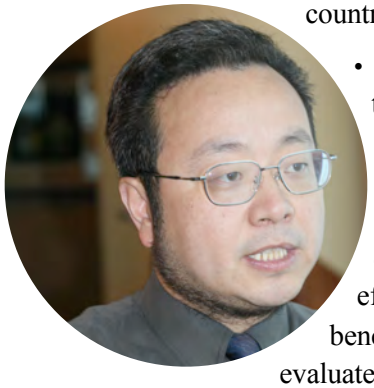
The priority over the next several years is to develop a model regulatory program for motorcycles primarily through our work with Vietnam and India, and to lay the technical groundwork for motorcycle fuel economy or greenhouse gas emissions standards, most likely in India.

To support leapfrogging

to comprehensive regulatory programs with stringent emissions standards in major motorcycle countries, the ICCT will:

- Finalize *Motorcycle Control Policies*, a summary of current practices and policy recommendations in four main areas: emissions and fuel economy standards for new vehicles; quality standards for fuel and lubrication oil; inspection and maintenance; and retrofit programs for in-use vehicles.
- Support ongoing regulatory processes in Vietnam (2008/2009), India (2010) and Brazil (2009) with targeted technical analyses and, if necessary, funding support for emissions and fuel economy testing.
- Sponsor one or two workshops with local partner organizations to focus on best practices recommendations for regulating two- and three-wheelers. The workshops will be part of a larger outreach effort to influence policy-making in Asian and Latin American countries that are poised to take the next step in controlling emissions from motorcycles. Potential workshop locations include Indonesia, the Philippines and Brazil.
- Assess the impact of exports of used two-stroke motorcycles to Africa and Latin America.

To support precedent-setting fuel economy and CO_2 emission standards in major motorcycle countries, we will:



- Assist in developing the technical basis for GHG/fuel economy regulation in India as a follow up to our work on passenger cars. This effort could include using benchmark testing to evaluate the relative fuel economy performance of motorcycles from major manufacturing countries (China, India, and European Union) as an aid in the development of future standards.

To link environmental and public health considerations with infrastructure design, we will:

- Partner with ITDP and the Indian Institute of Technology (IIT- Delhi) to develop best practices for motorcycle infrastructure designs that integrate environmental control strategies.

To support the development and deployment of retrofit and advanced technologies, the ICCT will:

- Co-fund a pilot demonstration of retrofit options for two-stroke and other technologies in India with U.S. EPA and other stakeholders. We will also assess barriers and opportunities for larger scale retrofit programs and for electric bicycles and motorcycles in other countries, including India.

To assess inspection and maintenance programs, the ICCT will:

- Evaluate factors contributing to the successes and failures of I&M programs for motorcycles and develop best practices.

3.3 HEAVY-DUTY VEHICLES

BACKGROUND AND CONTEXT

Heavy-duty vehicles are a major source of pollution worldwide, and cause or contribute to serious ozone, particulate matter and nitrogen dioxide air quality problems in urban areas throughout the globe. Heavy-duty vehicles are also responsible for a large share of overall fuel consumption in the transport sector (roughly 30 percent in the EU and 18 percent in the United States), and even larger share of overall energy consumption for freight transport (94 percent in the EU and 82 percent in the United States).

HISTORY OF ICCT INVOLVEMENT

Controlling heavy-duty emissions has been a key goal of the ICCT since its inception. Recent notable work in this area is as follows:

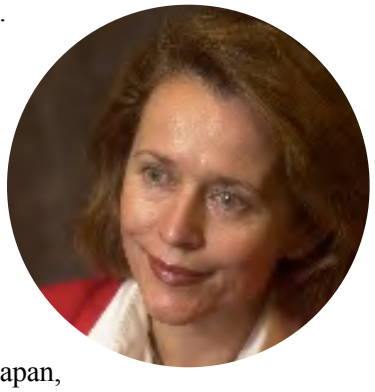
- In November 2007, the ICCT drafted *A Model Regulatory Program for Reducing Exhaust and Evaporative Emissions From Heavy-Duty Vehicles and Engines* (Walsh et al. 2007), which lays a foundation for future work to globally harmonize emission standards for trucks and buses and provides a critical roadmap to be followed by developing countries aiming to control heavy-duty emissions. The report also served as the basis of ongoing efforts to influence the design and stringency of the next stage of Europe's emission standards for heavy-duty vehicles (Euro VI).

- The ICCT has worked collaboratively with the Northeast States for Coordinated Air Use Management (NESCAUM) to hire a team of consultants (Southwest Research Institute, or SwRI, and TIAX, LLC) to perform a simulation modeling analysis of the technological potential to reduce GHG emissions from heavy-duty engines, tractors, and trailers. The goals and objectives of the technology study, scheduled to be finished by late 2008, were defined in large part through two workshops on heavy-duty fuel economy in San Diego, California in February of 2006 and 2008.
- In 2008, the ICCT initiated a "shadow rule" study laying out a proactive research agenda to address key design questions for fuel economy or greenhouse gas standards for heavy-duty vehicles in the United States. The first output of this study is a scoping paper, drafted by MJ Bradley & Associates, outlining priority research tasks for the ICCT and partner organizations.

TECHNICAL AND POLICY BARRIERS

Delayed adoption of state of the art emission standard in the developing world

Europe acts as the de facto standard setter for vehicle emissions standards for several billion people living in developing nations, which typically adopt the Euro standards several years after EU member states. Europe has lagged the US but will soon adopt its Euro VI standards, which will require advanced aftertreatment technologies for NOx and particulate matter, similar to those that would be required under both U.S. EPA's 2010 HD rule and the ICCT model rule, be installed on all new heavy-duty trucks and buses from 2014 (although the NOx standard was recently weakened by Parliament in July 2008). Increasingly, the adoption of equivalent standards in the developing world are being delayed, in large part due to concerns about the availability of the fuels (e.g. ultralow sulfur diesel and urea) necessary for advanced aftertreatment.



Difficulty in setting technology-forcing standards from fuel economy space

With the notable exception of Japan, to date heavy-duty fuel economy has been left largely to market forces, and has not yet been viewed explicitly through the lens of climate change. Experience with regulating heavy-duty emissions suggests that very large reductions are possible when policymakers 1) set targets based upon environmental goals rather than the potential of today's technologies; and 2) commit to technology forcing regulatory requirements. Controlling the climate impact of heavy-duty vehicles may be easier when approached from a GHG perspective than from a fuel economy perspective.

Slow penetration of vehicle standards through "legacy fleets"

Tougher emissions standards take ten years or more to work there way through the HD fleet through vehicle retirement and replacement. Since HD diesel engines are very durable (in the U.S., capable of operating ~1.4 million km or more), and older vehicles are often disproportionately dirty, controlling emission from or accelerating the retirement of legacy fleets will be key to managing air pollution worldwide. Better in-use emission standards,

retrofit programs, and inspection and maintenance programs hold great promise in reducing legacy pollutants.

Lack of strong regulatory controls in countries that import used vehicles from abroad

Not all countries maintain significant domestic automobile industries – many nations in South America, Africa, the former Soviet Union, and the South Pacific rely upon used vehicle imports to meet their mobility needs. Many of those countries currently lack the ability to verify the environmental performance of imported vehicles. More generally, little is known about the environmental implications of the international trade of used trucks and buses, which represents a new kind of cross-boundary pollution of considerable concern to regulators in importing countries.

POLICY FORUMS AND REGULATORY OPPORTUNITIES

The ICCT expects to target the following policy forums during the 2009-2011 time frame:

- Developing countries with major HD vehicle markets, notably China, India, Mexico and Brazil, each of which is expected to deliberate on new vehicle emission standards in the near future. India may also move to regulate heavy-duty vehicles as part of an extended set of standards for the transport sector.
- The California Air Resources Board, which has declared its intention to regulate HD GHG emissions under AB 32, the California Global Warming Solutions Act.
- The United States, where the Environmental Protection Agency and the Department of Transportation have authority to establish new regulations to control GHG emissions or fuel consumption.
- The European Commission, which under proposed legislation would be given the right to regulate CO_2 emissions from heavy-duty trucks and buses.
- China is currently evaluating potential HDV fuel consumption standards.

PROPOSED INITIATIVES

The highest priority over the next several years for the ICCT's activities related to heavy-duty vehicles includes (1) developing a GHG emissions or fuel economy program for heavy-duty vehicles in the United States that can be used as a model for the rest of the world, and (2) in supporting Europe's regulation on NOx and PM emissions and its adoption in other major countries through the use of the ICCT Model Rule.

To support the earliest possible adoption of strict emission standards for new vehicles in the developing world, we will:

- Continue outreach on the ICCT's model rule in developing countries in India and Mexico, developing country-specific analyses and translations where appropriate.
- Prepare a targeted whitepaper summarizing Europe and Japan's experience in building a urea delivery infrastructure, building upon work on the Clean Fuels program on low sulfur diesel fuel. The ICCT will also conduct continuous outreach with policymakers in Asia and Latin America about the challenges faced in distributing urea well in advance of standards requiring NOx aftertreatment.

To provide technical assistance for new GHG emission standards for heavy-duty vehicles in California, the U.S., and the European Union, the ICCT will:

- Finalize SwRI/TIAX modeling study on the technological potential for heavy-duty efficiency improvements, which will make an important contribution to the technical basis for future rulemakings in the U.S. and California. We will then conduct targeted outreach on the study in the 2009/2010 time frame.
- Provide on-going technical assistance to CARB on key design issues for a California-specific GHG emission standard for heavy-duty vehicles (i.e. technical potential, regulated entities, test procedures, particularly for hybrid diesel-electrics, etc.) by building upon the existing "model rule" project.
- Actively coordinate with the European Union on HD GHG emission standards through informal meetings with stakeholders, expert testimony, and detailed comments on regulatory proposals.
- Engage in China's HDV fuel consumption standard development.

To support local policies to clean up legacy fleets worldwide, we will:

- Produce a best-practice document for setting and enforcing in-use emission standards and/or retrofit programs for heavy-duty vehicles, drawing on the experience of select European cities, the Tokyo Metropolitan Government, and the State of California, Hong Kong, and other leading authorities. Using that report as background, we will then work with the Energy Foundation's China Sustainable Energy Program to organize a workshop on retrofits in a major Chinese city.
- Hold an international workshop identifying state of the art practices for heavy-duty inspection and maintenance programs (e.g. Hong Kong's work on loaded-mode testing for in-use vehicles, test procedures to measure particulate emissions in use, remote sensing, etc.) Identify and work with key cities/other stakeholder, in partnership with participants, to pilot the recommendation.

To lay the foundation for an international agreement to restrict the export of dirty used vehicles, the ICCT will:

- Prepare a summary report on the international trade of used heavy-duty vehicles, including the scope of the problem (value and/or number of vehicles), the likely magnitude of emissions involved, and possible measures to minimize pollution from imported vehicles.
- Organize an international workshop on used vehicle exports, with high-level government participation from both exporting nations such as Japan as well as importing countries (e.g. Mexico, Kenya, New Zealand, etc.). A key goal of that workshop will be to identify the proper policy forum for this issue and initiate a targeted campaign to influence that forum.

3.4 FUELS

BACKGROUND AND CONTEXT

One of the most important principles articulated in the Bellagio Memorandum concerns treating vehicles and fuels as a system. Cleaner fuels, especially fuels with lower sulfur and carbon content, are necessary to dramatically reduce pollution from all types of vehicles—from motorcycles to heavy-duty trucks, as well as ocean-going ships and airplanes. Cleaner fuels provide the essential foundation for achieving all other objectives in the ICCT's mission.

With respect to transportation emissions of criteria pollutants, lower sulfur fuels and fuels free of lead, MMT, and other metal additives can help to reduce pollutant emissions from existing vehicles, are a prerequisite for many of the most effective emissions control technologies, and are often required by newer, more efficient engine technologies. While after-treatment control technologies are widely available to reduce pollutant emissions to barely detectable levels, poor fuel quality continues to impede progress toward lowering vehicle emissions in most of the world. Absent cleaner fuels, diesel engines—which offer a cost-effective and readily available way to reduce fuel consumption—can have a disastrous impact on air quality. Moreover, their black carbon emissions can reduce the benefits of improved fuel economy from a climate standpoint. Recently, deteriorating air quality has become a real concern in India, where widespread disparities in fuel taxes and subsidies have prompted a rapid shift toward greater market share for diesel passenger cars. Table 6 shows the net benefits achievable by introducing cleaner fuels *and* vehicles in China.

To make the leap to dramatically more climate-friendly transportation technologies it will be necessary to target the amount of carbon embodied in fuel and introduce alternative fuels with dramatically lower carbon content, such as renewably produced electricity and hydrogen. Improving vehicle efficiency is a cost-effective way to reduce CO_2 emissions in the near-term, but sustaining deep reductions in absolute emissions over the long run will require that we directly tackle fuel switching strategies.

TABLE 6. Health Benefits from Lower Sulfur Fuels in China

Avoided health impacts over the years 2008 to 2030			
Health Outcome	**Improved Vehicles**	**Improved Fuels**	**Total Avoided Incidences**
Total mortality	1.1 million	370000	1.5 million
Chronic bronchitis	2.8 million	930000	3.7 million
Acute bronchitis	79 million	27 million	106 million
Asthma	10 million	3.5 million	14 million
Restricted activity days	740 million	250 million	990 million

Source: Blumberg et al. 2006

HISTORY OF ICCT INVOLVEMENT

The ICCT first distinguished itself with its work to educate policymakers on the need for, and benefits of, reducing sulfur levels in fuels and on the importance of applying the precautionary principle when introducing dangerous metal additives such as MMT. More recently, the ICCT has supported efforts to implement legislation aimed at reducing life-cycle carbon emissions from transportation fuels in California and Europe, and at improving the sustainability of renewable biofuels in Mexico.

Over the past several years, the ICCT has undertaken a number of activities as part of its clean fuels agenda:

- In Mexico, the ICCT has actively supported regulatory intervention to reduce fuel sulfur content. Over a period of several years and working closely with partner organizations such as INE, the Hewlett Foundation, Centro Mario Molina, Centro Mexicano de Derecho Ambiental (CEMDA), and other NGOs, we held workshops, developed cost-benefit and cost-of-delay analyses, and educated key decision-makers.
- In Brazil, the ICCT has worked with federal Environment Ministry and the São Paulo State Secretary, as well as the Hewlett Foundation, to hold a series of workshops on lower sulfur and lower carbon fuels.
- In Colombia, the ICCT supported legislative efforts to reduce fuel sulfur levels. Working closely with the Clinton Climate Initiative, we held a widely attended workshop co-sponsored by the federal ministry of the environment, met with a range of policymakers and allies, and produced a guidance document for legislators and policymakers on the importance of reducing sulfur levels in Bogotá and Colombia as a whole. Sulfur levels have already been reduced from 1,500 parts per million (ppm) to 500 ppm in Bogotá and will be at 50 ppm in 2010.
- In December 2006, the ICCT released a report titled *Costs and Benefits of Reduced Sulfur Fuels in China* and presented results at the second SEPA/EPA workshop in China and at the Better Air Quality workshop in Indonesia. China has agreed to reduce sulfur levels in gasoline to 150 ppm but still has not committed to the necessary reductions in diesel. The Beijing Municipal Environmental Protection Bureau gone further, reducing sulfur levels in both gasoline and diesel to a maximum of 50 ppm.
- In January of 2007, the ICCT drafted a letter to European Commission President Jose Manuel Barroso urging him to support a Low Carbon Fuel Standard for transportation fuels. Sixteen ICCT participants signed this letter. We have also been working with Germany's federal environmental agency (the Umweltbundesamt or UBA) to develop protocols for fuel certification that capture full life-cycle environmental impacts and with California's Air Resources Board to help translate these findings into effective regulations. The ICCT has co-sponsored workshops on low carbon fuels in Germany and California (in the latter case with the Governor's Office and the University of California at Berkeley).
- The ICCT is working with Mexico's INE on legislation to improve the sustainability of renewable fuel production.

- Our MMT status report has been used in India, China, Vietnam, and many other countries in Asia and Latin America to support regulations to reduce or eliminate MMT use in gasoline. It is in the process of being updated with new information. Largely as a result of our efforts, the CAI-Asia Roadmap for Clean Fuels and Vehicles will conclude that "the environmentally responsible approach for Asian countries is to apply the precautionary principle for these metallic additives and to not use them until and unless the scientific and health studies show that they are safe."

TECHNICAL CHALLENGES AND POLICY BARRIERS

Lack of market mechanisms for improving the environmental performance of the petroleum refining industry in the developing world

Governments with state-owned oil companies, such as China, Mexico, and India, tend to subsidize fuel prices. As a result, the costs of cleaning up fuels are difficult to pass on to the consumer and the cost of refinery upgrades come out of tight government budgets (which are lately even more constrained due to high world oil prices). This arrangement means that the decision to improve fuel quality generally rests more solidly in treasury departments than in environmental agencies. Cost-benefit analyses appear to be of limited value due to a lack of trust in the values used to quantify human life and a concern that real government revenues, which could be used for other brick and mortar projects, are traded for less tangible gains in public health. In the end, achieving cleaner fuels appears to be a question of political will and is likely to require powerful champions in the government as well as diverse stakeholder support.

Uncertainty concerning the real life-cycle benefits of biofuels and difficulty in designing and maintaining an international certification program

Low carbon fuel standards provide an important policy framework for dramatically reducing the climate impacts of the transport sector by directly targeting the carbon content of transportation fuels. While the idea of a low carbon fuel standard is straightforward and simple in principle, the technical challenges associated with effectively implementing such a standard are substantial. Given that lifecycle GHG emissions and other climate-related upstream impacts (such as land-use changes associated with biofuels production) vary widely depending on the feedstocks and production processes used, the certification of different fuel producers and products in an international biofuel market would seem to be an enormous challenge. Unfortunately, even greater challenges arise in narrowing present uncertainties concerning the land-use impacts of biofuels production. Numerous critical scientific questions remain unanswered and there is often strong political pressure to arrive at positive assessments of the GHG implications of expanded biofuels use. At the same time, fuels are being bought and sold on a global market. Participation in low carbon markets will require strong certification programs, which track in great detail production methods, feedstocks, and other inputs.

POLICY FORUMS AND REGULATORY OPPORTUNITIES

The ICCT expects to target a number of critical policy forums during the 2009–2011 time frame:

- In Mexico, a number of agencies and stakeholders are working towards the implementation of clean fuels and the sustainable production of renewable fuels. Our primary client is the INE, the research arm of the Ministry of Environment. We are also working with SEMARNAT; PEMEX (the oil industry); CEMDA, CMM, and other NGO groups; and we are trying to make inroads on this issue with the Ministry of Energy and the Treasury Department (Hacienda).
- In the United States, work on low carbon fuel standards is occurring at the federal level (led by U.S. EPA) and in the State of California (key actors include the California Environmental Protection Agency, CARB, and the Governor's office). In the short term, California will have the lead with EPA following.
- The lead agency on low carbon fuels in Europe is the European Commission. The ICCT is also working closely on this issue with Germany's UBA and the Department of Environment, Food and Rural Affairs (DEFRA) in the UK.
- In China, SEPA (MEP) is our principal partner in the effort to improve fuel sulfur content, but they do not have the sole power to develop and implement the necessary regulation. Regulatory development and implementation will ultimately require collaboration across a number of different agencies, including NDRC, the State Council, the Ministry of Finance (MOF) as well as the China Petroleum & Chemical Corporation.
- In Africa, a number of regional intergovernmental bodies are considering adopting regional low sulfur fuel regulations. Other partners in the region include PCFV (the Partnership for Clean Fuels and Vehicles), APINA (the Air Pollution Information Network of Africa), the African Union, and the World Bank, as well as several individual country governments.
- The World Forum for Harmonization of Vehicle Regulations (WP.29) is convened by the UNECE (the United Nations Economic Commission for Europe). While this forum does not currently have a mandate to set fuel regulations, an informal working group on fuel quality is developing a recommendation for fuel quality and is considering reopening the 1998 agreement in order to give the WP. 29 authority to develop global technical standards for fuel quality.

PROPOSED INITIATIVES

Over the next several years, the ICCT will focus its efforts on tracking and promoting the development of low carbon fuel standards in Europe, the UK, and California, and a renewable fuel standard in the United States. We will also continue to promote low sulfur fuels recognizing that greater attention must be paid to developing a strategy for those countries with national energy sectors (e.g., MX, BR, China, India).

To support the adoption of the near-zero low sulfur fuel standards worldwide, the ICCT will:

- Continue and expand outreach to key countries, closely linking these activities to efforts aimed at advancing stricter vehicle emissions standards. Outreach efforts will include tracking the development and implementation of regulations; honing and delivering our message to a greater variety of potential allies, especially in treasury departments and economic ministries; developing additional informational materials, including brochures on the benefits of low sulfur fuels for Africa and elsewhere; and providing technical support to our partners to make better use of, and refine, cost-benefit analyses.
- Highlight the need to treat diesel vehicles and fuels as a system, moving ahead with both cleaner fuels and vehicle standards at the same time. In Mexico, we are working with partners in the city, state, and national government to develop a longer paper, a series of brochures, and a series of workshops to ensure complete understanding of both the policy needs to diesel and the health and climate dangers of dirty diesel.
- Prepare a policy analysis and outreach materials for developing countries on the fuel economy benefits of lower sulfur fuels, based on the European Commission's study *Consultation on the Need to Reduce the Sulphur Content of Petrol and Diesel Fuels Below 50 ppm* (Commission of the European Communities 2000). Sulfur reductions will enable both modest (1–5 percent) fuel economy gains associated with more efficient catalyst operation; they will also open the door to more dramatic gains (15–20 percent improvements) through alternative technologies (diesel and homogenous charge compression ignition) that require sulfur-tolerant after-treatments.
- Participate in the UNECE informal working group on clean fuels.

To support a global move toward lower carbon fuels, the ICCT will:

- Convene an on-going international working group on low carbon fuels to track and forge linkages between the different policy efforts going on around the world to develop implementing regulations for a viable low carbon fuel standard (including especially on-going processes in Europe, the United States, and California).
- Convene a workshop or series of workshops to link policy needs to research efforts in the area of low carbon fuels, likely using California's proposed low carbon fuel standard as an example. The aim would be to develop a widely agreed upon research agenda to answer outstanding questions about the climate impacts of developing renewable fuels and to ensure that carbon reductions associated with the use of these fuels are real and sustained. The ICCT will work with academic partners and policymakers to develop analytic tools to understand what level of carbon reductions could be achieved in the near and long term through expanded reliance on renewable and other lower carbon fuels.
- Complete a report, based upon the input of a working group and/or series of workshops, on innovative policy options (regulatory and fiscal) for restricting the development and marketing of higher carbon fuels and for supporting the leap to game-changing fuels with potentially zero carbon content, such as

electricity and hydrogen. The ICCT will prepare an inventory of high carbon fuel production and use worldwide, including the magnitude of GHG emissions and product flows.

- Summarize effective policies for protecting the environment in nations that are major producers of biofuels. The ICCT will publish a concise paper or brochure highlighting the limitations of volumetric biofuels regulations; finalize and make available our report on sustainability requirements for the production of biofuels (this report was originally developed for Mexico); and look for opportunities to create international linkages in certification programs.
- Participate in international low carbon fuel certification protocol development.

To help eliminate MMT use worldwide, we will:

- Release an updated MMT report, track regulatory developments and sales (if possible), and maintain outreach efforts around the world.

3.5 INTERNATIONAL MARINE

BACKGROUND AND CONTEXT

The already significant air quality impacts from international shipping are expected to grow dramatically over the next 15 years unless action is taken to reduce emissions. In Europe, for example, inventory modeling indicates that emissions from international shipping will exceed emissions from all other mobile sources by 2020. Meanwhile, port facilities worldwide are expanding to accommodate continued growth in the global movement of goods. This creates a window of opportunity to implement emission control strategies that involve infrastructure upgrades. Regional strategies and regulations may be successful in reducing impacts to specific areas, but thus far pressure from individual governments to reduce emissions from international ships has been largely ignored. While numerous technologies exist to control ship emissions, either by lowering fuel sulfur levels and/or by introducing after-treatment devices and engine improvements (e.g., selective catalytic reduction, slide valves, scrubbers), the International Maritime Organization has a record of merely codifying industry practices.

In the absence of international standards, national and local authorities have begun to address pollution from ships. Sweden has successfully implemented market-based measures that provide incentives for the use of lower sulfur fuels and NOx after-treatment. California requires ships to use auxiliary engines operating on lower sulfur fuels within 24 nautical miles of the coast. And the competing ports of Los Angeles and Long Beach have developed a joint clean air action plan that is likely to require cold ironing (i.e., use of shore-based power) for ocean-going vessels while at berth. Some industry members are also taking action to reduce emissions or are joining the call for global fuel standards.

HISTORY OF ICCT INVOLVEMENT

- The ICCT has engaged in a number of activities to promote environmental improvement in the international shipping industry. The ICCT co-sponsored the Clean Ships Conference in February 2007 with the U.S. EPA and the Pacific Merchant Shipping

Association. The conference focused on technologies for reducing emissions from ocean-going vessels. As part of the conference Steering Committee, ICCT staff helped to secure the participation of international speakers, including experts from Sweden and the European Commission.

•In March 2007, the ICCT released a report titled *Air Pollution and Greenhouse Gas Emissions from Ocean-going Ships*, co-authored by Axel Friedrich and Falk Heinen of UBA, and ICCT staff. The report included a review of pollution control measures for ships and related programs throughout the world and focused on the emission-reduction potential, feasibility, costs, and cost-effectiveness of available environmental mitigation measures. It analyzed the legal context for local, regional, and international programs and concluded with a series of policy recommendations.

- Also in March 2007, the ICCT submitted a request to obtain consultative status to the IMO. Consultative status will allow the ICCT to attend IMO meetings and provide official input on policy proposals.
- In October 2007, the ICCT co-sponsored a workshop on the potential for reducing emissions from international marine vessels for IMO delegates from European nations and key representatives from European environment ministries. Workshop partners included the Portuguese presidency of the European Commission, UBA, and the European Federation for transport and Environment.
- Currently, the ICCT is working toward IMO adoption of near-, medium-, and long-term criteria pollutant and fuel economy/GHG standards for ocean-going vessels. Where technically and legally feasible, we are also encouraging nations and major ports throughout the world to address these issues. By applying for consultative status with the IMO, the ICCT is further establishing itself on the international policy scene as the collective voice of leading air quality and transportation regulators.

TECHNICAL CHALLENGES AND POLICY BARRIERS

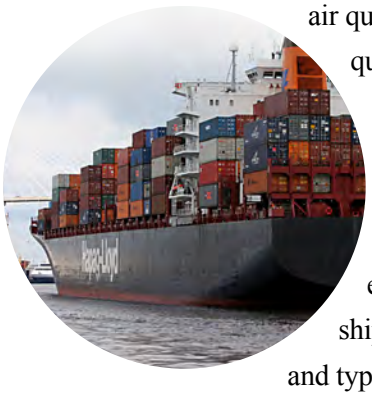
IMO process lacks basic scientific and technical information on environmental issues and solutions

Representatives from member countries at the IMO do not typically have expertise about the science or policy of air pollution or climate change. The IMO secretariat does not develop any of its own analysis. This lack of in-house information and expertise about climate-related policy options and implications at the IMO is likely to cause significant delays in regulatory action, as has happened in the past.

Ability of developing nations to provide sufficient data for an Emission Control Area application to IMO.

To implement certain policies aimed at reducing ship emissions along coastlines and at ports, countries will have to apply for IMO designation of certain areas as “Emission Control Areas” (ECA), which can extend up to 200 nautical miles from the coasts of approved nations or regions. This means quantifying local

air pollution impacts from international shipping, which in turn requires data on ambient air quality, local inventories to quantify the contribution from international ships, atmospheric data and modeling to show the transport of ship emissions, and data on ship traffic (e.g., the number and types of ships coming in and out of port and traveling along coastlines). Developed countries have the data to assemble these applications, but many developing nations will have a difficult time collecting and assimilating the necessary data. For example, a North American ECA application could be held up by lack of data from Mexico.



Common but differentiated responsibilities for reducing CO_2 emissions

Two primary policy options are under discussion within the IMO to address CO_2 emissions from international shipping: (1) a cap and trade program for ship emissions (that could be open to other cap and trade programs) and (2) a fuel tax. In advance of the Marine Environment Protection Committee (MEPC) meeting in October, there are likely to be some additional proposals from Germany and the United States that will add country allocations based on the CO_2 content of imported products and CO_2 emission standards. A significant challenge is crafting a policy that respects the principle of "common but differentiated responsibilities" but that does not place shipping companies from developed nations at an undue disadvantage. Because the IMO is not bound by this principle, it may have greater flexibility in designing an international policy.

POLICY FORUMS AND REGULATORY OPPORTUNITIES

Emissions standards for international ships can potentially be implemented through the IMO, individual countries and regions, and major ports. Most policymakers agree that action at the international (IMO) level is preferred, but often actions at the national level and by major ports are needed to spur IMO intervention. The ICCT's work is primarily focused at the IMO level; we regularly participate in the organization's environmental committees as part of the U.S. delegation to the IMO. Gaining consultative status at the IMO would allow the ICCT to play a more direct role in linking local actors and stakeholders to relevant regulatory deliberations at the international level.

More stringent emission standards for ships

(SOx, NOx, PM) were finalized by the IMO in October 2008. The end result is an 80 percent reduction in NOx emissions from current levels for new ships operating in ECAs by 2016. Fuel sulfur levels within ECAs is limited to 1,000 parts per million (ppm), a significant reduction from the recent global limit of 45,000 ppm. This type of technology-forcing emissions standard (achieving 80 percent NOx reductions will require SCR on new ships) is unprecedented for the IMO.

The IMO has assigned a working group to develop a framework for regulating ship CO_2 emissions in advance of the UN Framework Convention on Climate Change meeting in Copenhagen (COP-15) in December 2009 (the broader set of potential GHG emissions is not being considered at this time). The first meeting of this working group took place in Oslo in June 2008.

PROPOSED INITIATIVES

ICCT activities in this area over the course of the next three years will focus on developing climate change emission standards for international ships and assisting developing nations with ECA applications to control NOx and SOx emissions along their coasts and at ports.

To magnify its voice in the IMO, the ICCT will:

- Continue to pursue its application for consultative status. Our first application was rejected at the Council level by the Chinese delegation for perceived violations of the One China policy. In July of 2008, we received an official letter from the IMO congratulating the organization on "making it through the first stage of review." Receiving a positive vote at the October meeting of the MEPC will require a substantial number of briefings with key country delegations over the next several months. With consultative status, the ICCT will be empowered to speak on the floor of the plenary sessions, actively participate in working groups, and submit policy proposals and technical documents for consideration by the IMO. If our application fails, we will reapply and continue our work as part of the U.S. delegation.

To improve the technical understanding necessary for an international agreement on marine GHG emissions, the ICCT will:

- Collaborate with James Corbett and Jamie Winebrake to input policy-relevant analysis into the IMO process on GHG regulatory options and implications on reductions, competitiveness implications by nation, sector and corporation, and effectiveness of implementation. Professors Corbett and Winebrake are advising the IMO on an update to the organization's original 2000 report on GHG emissions from the shipping industry; both are world-recognized experts in the field.

To help spread ECAs worldwide, the ICCT will:

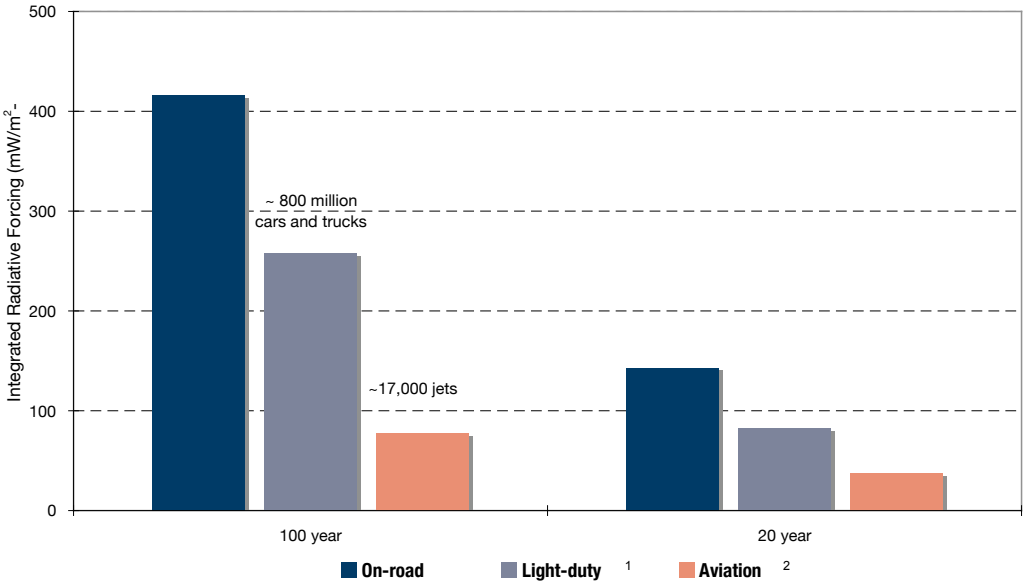
- Work with developing countries to develop ECA applications that can pass muster with the IMO review process. An early example would be providing technical assistance to Mexico in developing an application for a North American ECA.

3.6 COMMERCIAL AVIATION

BACKGROUND AND CONTEXT

Aviation is a large and rapidly growing contributor to global warming and therefore an important area of focus for the ICCT. Due to rapid growth in demand for air travel (annual growth in passenger miles has averaged 4–5 percent in recent years; annual growth in demand for air freight has averaged 6 percent), global CO_2 emissions from aviation are expected to increase 60 percent above 2000 levels by 2020, and may reach five times 2000 levels by mid-century, according to the Intergovernmental Panel on Climate Change (IPCC). Climate impacts from aviation are not limited to CO_2 emissions, however. NOx emissions and contrails formed by

FIGURE 8. Estimated Radiative Forcing by Mode, 2000



[1] Estimated from Fuglestvedt, et.al. (2008) and IPCC (2007).
[2] Does not include probable cirrus cloud impacts.

Source: Fuglestvedt, et.al. (2008).

aircraft at high altitude make a positive contribution to the radiative forcing (heat trapping) properties of the atmosphere. Accounting for these effects (though not for the probable effects of aircraft on cloud formation), the total global warming impact of the aviation sector is estimated to be about 30–45 percent of on-road vehicles (light-duty cars and heavy-duty trucks) worldwide (Figure 8).

Criteria pollutant emissions from aircraft also contribute to local air quality problems. Airports tend to be located in metropolitan areas with other major sources of pollution: approximately three-quarters of the largest airports in the United States, for example, are located in ozone nonattainment areas. New research also suggests that aircraft may be an important source of ultrafine particles in urban areas. Communities near the Los Angeles International Airport experience ambient concentrations of ultra-fine particles that are between three and eight times background levels (Froines, et al. 2008).

TECHNICAL CHALLENGES AND POLICY BARRIERS

Lack of regional and international measures to control air pollution and non-CO_2 climate impacts from the aviation sector

Robust regional and international policies are needed to control the air quality and non-CO_2 climate impacts of aviation. While sharply rising fuel prices (the cost of jet fuel for U.S. carriers has increased more than 300 percent since 2002) are pushing the industry toward more efficient aircraft, market forces do not support—and in some cases actually discourage—efforts to reduce NOx and particulate emissions and releases of water vapor at altitude.

Need for stronger U.S. engagement with air-quality and climate-change related aviation issues

ICAO's environmental council (CAEP) is continuously deliberating on matters related to GHG emissions from aviation, including the suitability of market-based measures, technology goals for aircraft efficiency, and recommended NOx standards. In large part due to the U.S. position, CAEP has made little progress in developing measures to address aviation climate change emissions.

Absence of technical foundation for greater developing country participation in international efforts to reduce aviation emissions

The success of future international agreements to constrain aviation emissions will depend upon the participation of developing countries for at least two reasons. First, the aviation sectors in many of these countries are experiencing high growth rates. Second, unequal application of emissions control requirements will distort competition if some carriers (such as carriers from China, Singapore, and the United Arab Emirates) are allowed to fly the same routes as developed-country carriers but without comparable emission reduction targets. Policymakers from developing countries, however, typically lack sufficient technical capacity to fully engage in the relevant international policy forums. This in turn tends to limit their participation. In addition, better data are needed on emissions specifically from international air freight transport. Dedicated freighters tend to be disproportionately dirty and operated by developing-country carriers.

PROPOSED INITIATIVES

ICCT activities over the next several years will focus on building our technical expertise and policy relationships in order to lay the groundwork for promoting policies on lowering GHG emissions.

To support regional and international measures to control aviation emissions, the ICCT will:

- Participate, beginning September 2008, in efforts by the International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP) to assess the short- and long-term technical potential to reduce NOx, particulate matter, and CO_2 emissions from aircraft. Specifically, the ICCT will provide input on the characterization of aviation emissions (predominately ultrafine particulate matter), recommendations concerning the stringency of pollution control standards for aircraft engines (predominately for NOx emissions); and the long-term potential for emissions reductions through cleaner aircraft technologies and alternative fuels. Participation in CAEP will also help build staff capacity and develop an audience for ICCT outreach.
- Work to influence the development of an upcoming European Commission (EC) proposal for a regional policy to limit aviation NOx emissions through informal meetings with stakeholders, expert testimony, and detailed comments on regulatory proposals. The EC will rely heavily upon CAEP for guidance on the technical potential for NOx reductions when preparing its proposal.

- With U.S. EPA (see below), hold a public workshop in North America to disseminate information about technologies and policies to reduce NOx and particulate emissions, and to minimize contrail and cirrus cloud formation as a result of aircraft operation.

To assist the U.S. EPA in preparing proposals for reducing domestic and international aviation emissions, the ICCT will:

- Work with EPA staff to identify and complete discrete technical tasks aimed at refining the Agency's future proposals for reducing domestic and international aviation emissions.
- Collaborate with EPA on outreach to inform North American policymakers on the non-CO_2 impacts of aviation and to maximize potential participation by developing countries in future international agreements on aviation emissions (see below).

To educate participants and stakeholders in developing countries on the technical basis for commercial aviation regulation and to promote developing-country participation in international efforts to reduce aviation emissions, the ICCT will:

- Draft a summary report, distributed either as a white paper or more broadly as a general ICCT report, outlining key policy issues. Specifically, the report will cover current aviation-emissions inventories, projected growth, technology outlook, and policy options to reduce emissions (e.g. emissions trading, emissions charges, air traffic management, etc.).
- As a longer-term goal, work with EPA to identify developing countries interested in cooperating to support the adoption of market-based instruments (such as emissions trading) to reduce CO_2 emissions from international aviation. An emissions trading system may be adopted under either ICAO or the United Nations in December 2009 or, more likely, in 2013 when the architecture for UNFCCCs third commitment period (2018-2022) is expected to be open for debate.
- Construct an international inventory of the CO_2 and non-CO_2 climate impacts of air freight transport by carrier. The ICCT will use that inventory to produce a report that explores options for mitigating the climate impacts of air freight. Such options might include imposing a levy on international freight to raise funds to recapitalize the aging freighter stock of developing countries. The inventory could also be used to analyze the burden that developing country carriers would assume under an international program to reduce aviation emissions.

4. CORE CAPACITY AND NEW INITIATIVES

The activities described in this section will be used to support the policy initiatives outlined in the previous section. Each regulatory initiative is built upon three pillars of information: (1) rationale for action based on public health and climate change consequences of inaction, and associated benefits of policy action, (2) technological feasibility and cost of achieving necessary emission reductions and in promoting advanced technologies, and (3) policy design and determination of the stringency of the emissions standards. The first three sections of this chapter describe each of these three pillars of information. The last section described a new initiative – called

the Climate Change Roadmap for the Transport Sector – to determine necessary emission reductions in 5 year intervals by region and mode for achieving long-term reductions goals (e.g. 3 Gt by 2030, 80% reduction by 2050).

4.1 CLIMATE AND HEALTH

BACKGROUND AND CONTEXT

Concerns about the adverse health impact of conventional air pollutants and the climate change impacts of greenhouse gas emissions are at the core of ICCT's mission. The first Bellagio principle links public health and climate change, saying that policymakers must design clean vehicle strategies to control conventional and greenhouse gas emissions in parallel. Our work in this area has three goals: (1) to explore relationships between public health and climate change in policymaking; (2) to bridge knowledge gaps in the science and policy of public health and climate change; and (3) to communicate this work internally to each of our program areas and externally to the ICCT participants.

HISTORY OF INVOLVEMENT

A broad range of policy, research and scientific engagement characterize the activities conducted to date under the title of Climate and Health:

- With the leadership of ICCT President Dr. Alan Lloyd, we have played an ongoing advisory role to CARB on AB 32 by assessing opportunities for reducing the state's greenhouse emissions. In additional to ICCT's role in the Economic and Technology Advancement Advisory Committee (see Section 4.4), ICCT worked directly with CARB staff and management on vehicle technology and financial incentive measures.
- In 2007 and 2008, ICCT staff advised the Clinton Climate Initiative on objectives and best practices for the transportation sector. Through this work we had the opportunity to propagate our message to leadership in the forty cities worldwide that are participating in that initiative, at times working directly with them to help meet their climate and air quality goals and to promote the wider dissemination of information on successful clean transport programs.
- Beginning in 2007, we have focused on black carbon as a component of particulate matter, one of the most deadly forms of pollution, and also as the second most important greenhouse emission after carbon dioxide. We have learned why the IPCC failed to adopt a global warming potential (GWP) for black carbon and are working to organize a workshop in the UK to help policymakers better integrate black carbon into climate policy.
- Also starting in 2007, the ICCT has sought to define the co-benefits of specific clean vehicle strategies, defining a series of short, policy-relevant papers focusing on a range of emission sources like light-duty diesels and electric drive vehicles. One example project that leverages our black carbon work analyzed German type approval data to understand the climate and health tradeoffs of light-duty diesel vehicles and to identify a specific policy intervention that captures co-benefits.

TECHNICAL CHALLENGES AND POLICY BARRIERS

Uncertainty about the science of non-CO_2 climate forcing, leading to suboptimal climate strategies

Vehicle emissions like particulate matter, nitrogen oxides, carbon monoxide, volatile organic compounds, and sulfates are dangerous to public health and are strong short-term climate forcers. Ozone is the most important greenhouse emission from transportation after carbon dioxide, while black carbon is the second most important greenhouse emission from all sources. Despite this understanding, there is relatively large uncertainty in the climate forcing of these pollutants. To achieve climate goals cost-effectively while maximizing public health benefits, policymakers need a way to take these emissions into account.

Insufficient understanding of the potential for climate and public health co-benefits, leading to unnecessary tradeoffs in transport policy

Many well-intentioned policy makers are tackling the climate change issue head on, but such good intentions can be so narrowly focused that they make unnecessary tradeoffs between climate and health. Tighter CO_2 emission standards on vehicle fleets tend to increase populations of diesel vehicles, but this becomes dangerous when these vehicles have weak emission standards for NOx and particulate matter, that latter which is known to increase rates of premature mortality and chronic disease.

Insufficient access to centralized, standardized, and policy-relevant technical data

The data necessary to define the public health and climate impacts of vehicle emissions can at times be resource and time-intensive for local policymakers to access and to summarize.

POLICY FORUMS

The public health and climate change program interacts directly and indirectly with science and policy forums. Direct action occurs with organizations like the Intergovernmental Panel on Climate Change, or in forums we create like the upcoming workshop we have scheduled on black carbon in the UK. Indirect policy action is work that feeds into each of our program areas. For example, the aviation program area has a specific goal of engaging in direct policy action at ICAO, an international policy forum on aviation, to address the non-CO_2 climate impact of aircraft.

PROPOSED INITIATIVES

To help incorporate the climate impact of non-CO_2 forcers in international and national climate strategies, the ICCT will:

- Identify the appropriate metric for comparing black carbon to carbon dioxide, quantify its radiative forcing by time horizon and geography, establish its relationship to co-pollutants, and adopt a recommendation for ICCT participants and the IPCC to use in their work.
- Establish a workable recommendation for policymakers to incorporate ozone and other non-carbon vehicle emissions climate forcing agents into emission reduction strategies.
- Directly engage the IPCC on non-CO_2 climate forcers by serving as a technical resource to negotiators during the upcoming series of meetings to set a new global agreement on greenhouse emissions. Our science and policy

expertise will provide valuable information on specific strategies and limitations to emission reductions in the transportation sector.

To support California's efforts to develop and implement a comprehensive climate strategy under AB 32, we will:

- Continue to serve as a resource for regulators and other stakeholders on vehicle technologies, and will explore low and zero-carbon fueling options for plug-in hybrids and other electric-drive vehicles.
- Continue to provide technical advise to regulators and help coordinate the efforts of NGOs on financial incentives such as pay as you drive insurance, congestion charging, and the impacts of a potential cap & trade system that covers the transportation sector.

To educate policymakers about the potential for co-benefits in transportation, the ICCT will:

- Produce a series of short, policy-relevant papers on the co-benefits of reducing non-CO_2 climate forcers on the basis of both total carbon equivalent emissions and public health impacts. The papers will address scenarios such as dieselization, electrification, biofuels, and institutional reform, and will target our participants and inform the work of each of our program areas.
- Build a centralized resource of transportation-relevant, policy-specific health and climate science and data that will target the policy activities of our participants and provide opportunities for developing in-house expertise.
- Partner with the Health Effects Institute (HEI) and with the WHO to summarize technical data on public health and air quality regulations, respectively. This data will be useful for making international comparisons, measuring progress, and identifying jurisdictions ripe for leapfrogging. Particular attention will be paid to tracking key emerging issues such as ultrafine particles (as researched by health scientists), and cirrus, ozone and black carbon forcing (currently investigated by climate scientists).

4.2 POLICY TRACKING

This project will summarize new laws and regulations from major jurisdictions around the world on transportation and air pollution, create useful comparisons, and communicate these results on a regular basis to ICCT Participants and relevant experts and policymakers around the world. An example of the type of information we would collect and disseminate is illustrated in Figure 9.

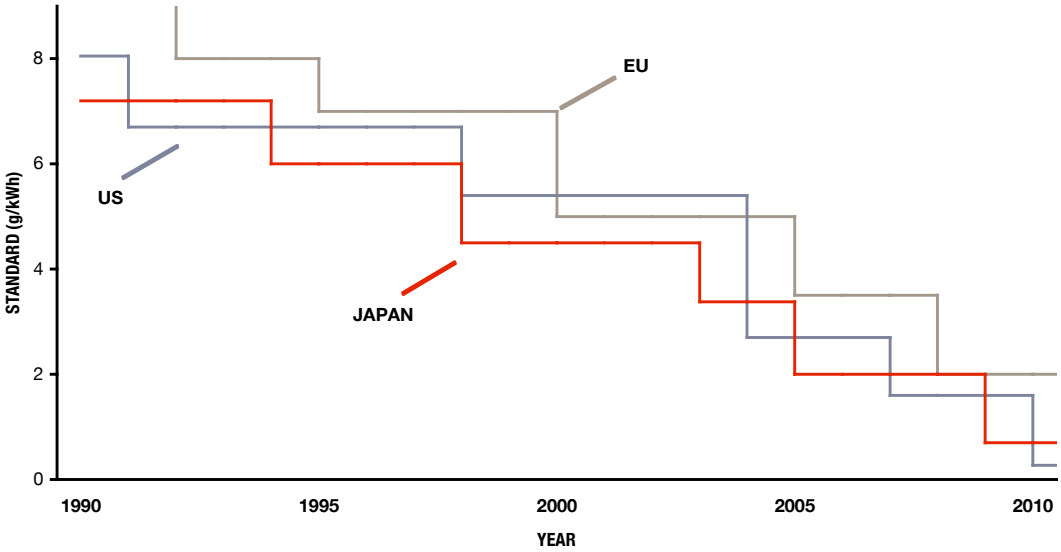
The information would be collected and updated by mode and region. It would be available on our website to the general public.

4.3 ADVANCED TECHNOLOGIES AND POLICY INNOVATION

BACKGROUND AND CONTEXT

Technology plays a central role in advancing a clean transportation agenda. The ICCT sees itself as performing two distinct roles in promoting advanced transportation technologies. The first is to ensure that regulators and policymakers are

FIGURE 9. Average NOx Emission Standards for Heavy-Duty Diesel Trucks in the European Union, Japan, and the United States, 1990-2010



Note: The stringency of an emission standard is influenced by the applicable type approval test cycle. As different test cycles are used in Europe, Japan, and United States, there are limits to the accuracy of a simple comparison of numerical emission values.
Source: Walsh et al. 2007.

accurately informed about the current state of transportation technology. A basic understanding of technology—both in terms of what the best currently available technologies can achieve and in terms of expected opportunities for further improvement—is usually essential to inform the development of new standards and policies. The second cross-cutting need is to promote innovation aimed at next-generation technologies, including technologies that represent a major leapfrogging opportunity or that open up a new and promising but heretofore unexplored technology pathway. Such revolutionary or breakthrough technology advances are needed to provide long-term air-quality and climate change solutions.

Promoting advanced transportation technologies thus represents an important focus for the ICCT that cross-cuts all program areas. On the one hand, regulatory requirements and policies must be updated on an ongoing basis to reflect the latest technology improvements. At the same time, policymakers must recognize that incremental improvements, while critical for moderating the impact of growth in global transportation demand over the next several decades, are unlikely, by themselves, to produce large reductions in total emissions given the scale of expected growth. Thus it will also be important to continue creating new drivers for innovation. Recent IEA forecasts, for example, point to a 30 percent increase in global energy demand for transportation by 2030— even taking into account current policies to promote efficiency improvements. In countries like China and India, in particular, the latent demand for personal-vehicle travel that will be unleashed by rising

income levels for large segments of the population can be expected to overwhelm even relatively aggressive improvements in vehicle performance and per-kilometer (or per-mile) emissions.

HISTORY OF INVOLVEMENT

To date, the bulk of the ICCT's direct involvement on advanced technologies and policy innovation has been through the Economic and Technology Advancement Advisory Committee (ETAAC) panel, chaired by ICCT President Dr. Alan Lloyd. ICCT staff played a leading role in delivering a broad and well-focused report on low and zero carbon technology development, and opportunities for environmental and economic benefits. The draft AB 32 scoping plan prepared by CARB reflected a large number of the ETAAC recommendations, and prominently highlighted ETAAC's support for a number of them. ETAAC's review of the draft plan, before it is adopted at the end of 2008, will further highlight additional opportunities for low and zero carbon vehicles and vehicle energy sources.

TECHNICAL CHALLENGES AND POLICY BARRIERS

Lack of accessible technology databases for policymakers

It is often difficult for policy-makers to keep track of what technologies are currently available, when emerging technologies will become available, how much the technologies will cost, and how effective different technology combinations will be. The information needed to answer these questions is widely scattered and much of it is produced by manufacturers and suppliers who are promoting their own products produce much of this information. A high level of expertise is also needed to sort through all the data and claims to produce useable information and there are few public sources for this type of expertise. The National Academy of Sciences produced a reasonably comprehensive study of existing and near-term technologies for improving automobile fuel economy in early 2002, although it targeted only the U.S. auto market. This study is still widely used, due to the lack of any other source of public information. Some consulting firms track technology benefits and costs on an ongoing basis, but typically they produce reports only when paid and the reports are usually not comprehensive. Further, most of the existing information on transportation technologies is targeted to OECD countries—very little information exists to help developing countries.

Policies targeting emissions only do not adequately stimulate technological innovation

Policies aimed at curbing emissions—whether through a market-based approach (emissions taxes or cap-and-trade programs) or technology or performance-based standards— are often insufficient at stimulating major technology advances *beyond* what is available today (or likely to be available in the near term). Market-based programs, for example, may not generate the financial incentives needed to justify the large R&D investments that would open the door

to truly game-changing technological advances, while more traditional standards typically codify current best practice based on already available technologies. In the worst case, some forms of regulation can have the unintended effect of "locking in" technology pathways that might cause opportunities for more dramatic improvement to be missed. In other words, these kinds of policies may be needed to establish a floor, but additional policies may be needed to raise the ceiling.

Failure to address financial, regulatory, or infrastructure barriers to wide-scale deployment hamper public investments in new technology

Many governments, recognizing the importance of technology innovation and the potential economic (as well as environmental) benefits it provides, have responded by adopting specific policies to promote next-generation technologies, including direct public spending on basic and applied research, public-private consortia or partnerships, and competitively-awarded grants or subsidies. Too often, public investments in new technology fail to yield hoped-for results because of a lack of concurrent efforts to address financial, regulatory, or infrastructure barriers to wider-scale deployment. Greater attention also needs to be paid to the crucial transition from basic R&D to successful demonstration and deployment, and to ensuring long-term R&D funding for new technologies as well.

PROPOSED INITIATIVES

To help track and assess clean transportation technologies for both developed and emerging markets, the ICCT will:

- Build an advanced transportation technology database, with existing technologies tracked by penetration rates and assessed for cost and effectiveness on different types of vehicles. Emerging technologies would be carefully followed and assessed for likely effectiveness, cost, lead-time, and market acceptance. Data sources would include technical journals, conference presentations, and purchased technical summaries.
- Create an industry advisory board and collaborate with individual companies such as Corning, Johnson Matthey, Bosch and relevant industry groups (such as the MECA, the Manufacturer of Emission Controls Association) to gather data and verify existing reports.
- Generate annual or biannual synthesis reports, published on its website, on the state of advanced transportation technologies with highlights of recent technological progress.
- Build a targeted webpage that would provide information about advanced transportation technologies in an easily searchable way.

To promote ongoing technological advances, including major leapfrogging opportunities, we will:

- Establish a new advisory panel of international experts on advanced transportation technologies and to augment its staff capabilities in this area by hiring two to three additional individuals with specific related expertise. The advisory panel would have 10–15 members, some of them drawn from existing Council participants and others

representing new constituencies in the public sector, industry, and academia.

- Through that group, identify leading scientists, engineers, and institutions working on technology innovation in countries with ICCT participants, along with key agencies and individuals involved in setting technology policy.
- In cooperation with the advisory panel, compile information about the policies in place or proposed in different countries or regions and their potential to accommodate, and ideally promote, advanced and breakthrough technologies. To inform these efforts, the advisory panel—working with ICCT staff—will hold workshops, consult with innovation leaders and experts, and undertake targeted technology assessments. We will look specifically at opportunities for implementing effective technology policies in key developing markets, on the one hand, while also exploring prospects for leveraging greater success through multi-lateral coordination and cooperation at the international level.
- Collect and disseminate information about best practices in technology policy, assess advanced technology options and identify promising areas for breakthrough improvements (i.e. that is, areas where large gains can be achieved through game-changing innovations), and identify and address critical barriers (e.g. infrastructure, financing, etc.) to the deployment of advanced technologies.

4.4 CLIMATE CHANGE ROADMAP FOR THE TRANSPORT SECTOR

BACKGROUND AND CONTEXT

The purpose of this project is to develop a climate change roadmap for the transportation sector that would achieve an 80% emissions reduction by 2050. The project would essentially work backwards from this target to determine necessary emission reductions by region and transportation sector. The project results will allow for a detailed breakdown of required (and specific) regional and national actions so that specific policy actions and their timing can be revealed and tracked. This effort will also be useful to industry in planning its investments in green technologies, marketing plans, and etc.

Evaluated interventions (controls) will include at least three types of policies: (1) efficiency, GHG, and emissions standards for all modes of transportation, (2) policies to address activity in specific modes (e.g., reducing distances traveled in private cars), and (3) reducing the carbon intensity of transport fuels. Close attention will be paid to both the cost effectiveness and time required for full implementation of policies.

This project will build off of a number of existing studies, including the IPCC 4th Assessment, the IEA World Energy Outlook and related transport projections, the Environmentally Sustainable Transport (EST) project by OECD, work on decarbonizing transport by the International Transport Forum (ITF, formerly the European Conference of Ministers of Transport), scenarios developed by the World Business Council on Sustainable Development (WBCSD), and national strategy development in places such as

the UK, Germany, Sweden, Netherlands. All these initiatives are valuable resources but they are just the start of a broad effort towards a sustainable global transport system. They can (and should) be used as input into strategy building but none is sufficiently robust to provide the specific metrics envisioned for this project -- which will allow for detailed regional and national monitoring of compliance with a specific 80% emissions reduction goal.

PROPOSED INITIATIVES

To lay out a clear, global transportation roadmap consistent with the goal to avoiding the worst climate disturbances, the ICCT will:

- Establish an overarching advisory group consisting of key individuals from government, industry, academia, NGOs, etc. This group will review and consolidate the recommendations developed by technical workgroups targeting greenhouse gas emission reductions in each transportation sector.
- Establish technical workgroups for each transportation sector: on-road vehicles (i.e. light- and heavy-duty vehicles and two and three-wheelers), marine transport, and aviation. These groups will be responsible for developing control scenarios for their respective sectors.
- Develop or refine an appropriate and sufficiently precise emissions accounting model for emissions impact analysis. Initially, the IEA transportation model will be evaluated for use.
- Develop initial baseline scenarios designed to reflect the most likely emissions levels given current and expected (in the absence of further unplanned intervention) control and growth conditions for each transport sector.
- Develop initial control scenarios for each transport sector that consider efficiency, GHG, and emissions standards, fuel substitution, and behavioral policies designed to include all practically feasible and cost effective measures (based on current or highly likely technological status, with cost effectiveness identified) that can be implemented with minimal market disruption. The timing of implementation and associated emission reductions will be identified, and the specific level of reductions that should be achieved by specific countries determined.
- Based on the model results for the complying control scenario (i.e., the scenario that meets the 80% reduction target), develop a series of metrics for benchmarking, including a detailed list of controls and expected cost effectiveness, emission targets by year, sector, region, and (to the extent possible) individual countries. These metrics can then be used by individual regions or countries to evaluate their respective progress toward attaining a sustainable global transportation system.

Where appropriate, metrics will be displayed in tabular format by mode. Types of metrics that could be included are the following: (1) Emission Targets by Country (Tg CO_2e), (2) Efficiency Targets (g CO_2e/km), (3) Activity Targets (Billion km per year), and (4) Fuel Carbon Content Targets (g CO_2/MJ).

5. COMMUNICATIONS

Effective outreach to key stakeholders and communication of our research and analysis is necessary in order for the ICCT to be effective. We must translate complex scientific findings into compelling and policy-ready results. With both the key constituents and our audience spread throughout the globe, the ICCT faces a greater and more urgent challenge in this regard than most organizations of its size. In the coming years, we expect to put a great deal more resources into a comprehensive program of communications in order to increase the effectiveness of all of our work. We will strive to improve both internal communications—within and among staff, the Council, and our board—and external communications—primarily directed at a select group of policy-makers and policy-shapers worldwide.

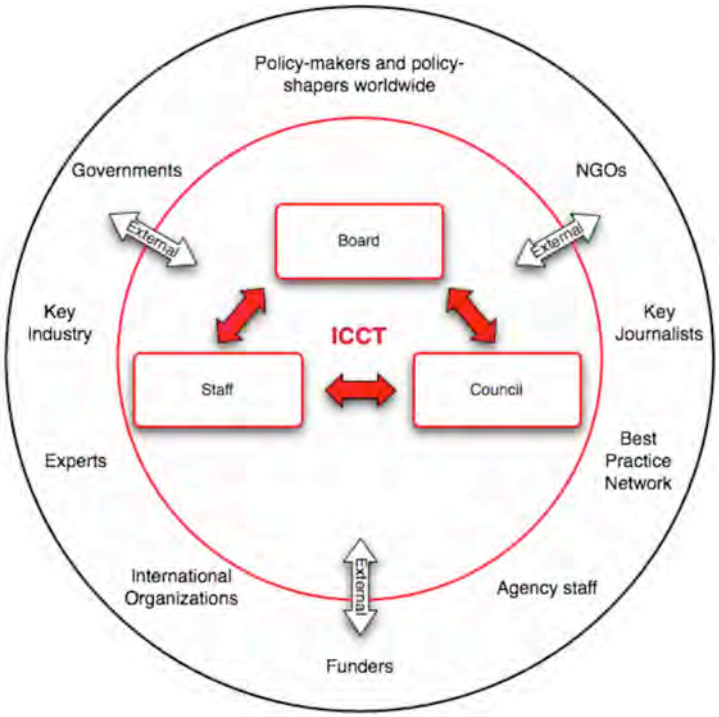
Our communications strategy will draw upon participants and an expanded network of experts and policy-makers as some of the most effective emissaries in communicating our work and multiplying its impact. Over the next several years, we will strive to become known among air quality and transportation emissions regulators and policymakers around the world as the definitive source for information, analysis and best practices. At the same time, we expect that the auto and oil industries look to the ICCT for a vision of what's to come.

The ICCT is concerned with strengthening our communications efforts at three primary levels:

- ***Internal:*** In addition to the staff and board, this includes the Council. Clear channels of communication between staff, board and participants is critical to our overall effectiveness. The Council is at the same time the core of the organization, a key audience, and a compelling messenger.
- ***External:*** This includes the ICCT's key audience, the perhaps 2,000–3,000 policy-makers and policy-shapers who matter in this world. Key constituents include our partner organizations (governments, NGOs, funders, etc), the other government agencies that we may not work with as closely, international regulatory agencies, leading industry players, major journalists, experts and academics. Some of these partners may also become effective messengers for our work.
- ***Targeted:*** In order to meet project goals and to influence policy efforts, we will often need more targeted outreach efforts and media strategies. This may include face-to-face meetings with key regulators, press briefings and releases, workshops, or letters to decision-makers.

As demonstrated in Figure 10, the external audience the ICCT must focus its communications efforts on is a fairly select and finite group of people. While wider media campaigns may be necessary for some of our targeted outreach strategies, in general we expect to focus our efforts on that select group of policy-makers that matters. This will mean expanding our network and reach beyond the Council. We will focus our initial efforts on identifying and developing channels of information to the select few decision-makers that are likely to innovators and influencers in the countries which we work and will further expand the network from there.

FIGURE 10. Targets of Expanded ICCT Communications



In order to effectively communicate our work to the key audiences listed above, we will need to do the following:

1. ***Hire a Communications Director*** *to help us make outreach and communications as much of a priority as effective analysis and strong technical work.*

Adding a Communications Director will help the ICCT to develop better communications tools. But in order to have any impact with our key audience, the communications director must be well-integrated into the rest of the staff and Council to ensure these tools are used in a potent and compelling manner.

The Communications Director will:

- *Develop an ICCT Communications Strategy* – The first step will be to survey the Council and other key policy-makers that are part of our intended audience to determine what kind of information to communicate and what the most effective medium for that delivery.
- Facilitate communications with the Council – This includes both peer-to-peer interaction and communication between ICCT staff and participants. Possible tools include email updates or newsletters, web-based seminars, steering committee and strategy calls, a plan for regular check-in with each participant, and frequently updated press kits, talking points, and presentation materials.
- Improve communications tools – An enhanced website, including RSS feed, potential blogs or local pages, and improved information tools on policies worldwide (developed in conjunction with the policy tracking project) will help dramatically to improve our external communications. Other potential tools include a regular newsletter

(likely web or email based), presentation and report templates, working database of top experts and information, an annual report, fact sheets and backgrounders, and ICCT marketing materials.

- Promote better targeted outreach and media strategies – Working with program staff, the communications director will help project leads to develop an outreach and media strategy, work with media resources to arrange press briefings and releases, suggest ways to distill the message and improve summary documents, and help to highlight the local and regional application of global reports. In addition, the Communications Director should work to develop and maintain working relationships with the key journalists covering the ICCT issues at the five to ten most influential publications.

2. ***Continue to support and build*** *upon our network of close relationships with key policy-makers through effective meetings and workshops.*

Even in a carbon-constrained world, face-to-face meetings continue to be an important component of our outreach efforts. Our small, focused Council meetings on an 18-month to two-year schedule help to make connections, identify shared problems, crystallize solutions, and forge alliances that will help maintain efforts in the months in between. More information about our meetings can be found on page 62.

3. ***Strengthen our targeted outreach*** *efforts around individual reports and specific analysis.*

Each report or analysis that ICCT completes is just the starting point of our work. Without tailored and targeted outreach efforts, the message will not have the impact needed to actually influence policy. A complete outreach strategy for a project will include analysis of the key audiences and messengers, the kinds of arguments that will hold sway, and the channels of communication that will be necessary.

In most cases, major reports are developed in collaboration with a select team of ICCT participants that contribute to, and eventually endorse, the report and its recommendations. Review from other experts in our expanded network ensures that participants are not overburdened with review responsibilities, provides an additional layer of professionalism and reliability to our reputation, and demonstrates a conscientious and thorough approach. In addition, influential reviewers can become some of the most potent spokespeople for our work.

At the same time, each major report should be accompanied by short summaries, tailored to the audience and region. This could be in the form of presentations, written summaries, or accompanying brochures. These simple summaries will make our work more policy-ready in individual countries and clarify common misconceptions. Translations are critical, as are brief, demonstrative illustrations. Table 8, on page 63, offers examples of our recent completed reports and those expected in the coming year.

6. ORGANIZATIONAL STRUCTURE

The ICCT is governed by a Board of Directors composed of funders, participants, and leaders of partner organizations. In 2007 the Board was expanded in order to bring new perspective to the strategy and direction of the organization's work. The Board is currently in the process of formalizing their activities and plans to hold three face-to-face meetings each year. The Board is responsible for identification and appointment of Council participants and oversees the President and Executive Director of the ICCT.

At the core of the ICCT are the experts and leading policy-makers that form the Council, an integral part of our identity that is one of the keys to our success. This group of unique, powerful, global leaders lends authority to all that we do and sets a high bar for impartiality and technical rigor in our work. While each person participates as an individual on the Council, in practice ICCT staff works closely with participants' organizations as partner agencies, including government agencies, NGOs, and funding partners. In addition, the Council helps to set strategy and identify priorities; supplies a more complete and on-the-ground understanding of the implications and complexities of the issues that we address; reviews and takes part in the work, including reports and workshops; and helps to identify and take advantage of policy opportunities around the world.

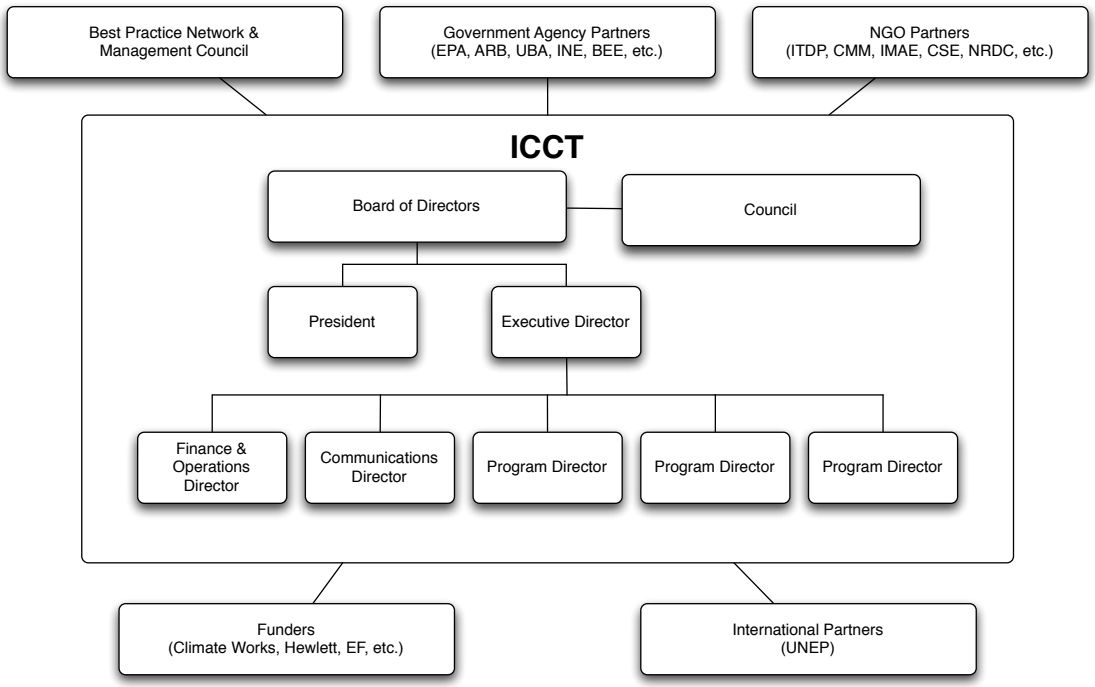
6.1 ORGANIZATIONAL CHART

As part of the strategic planning process, senior staff (including the Executive Director, President, and current Research Director and Senior Scientist), with the assistance and input of the Chairman of the Board of Directors, have engaged in an organization design planning process. The primary goals of that process were to:

- Create a scalable organization that can comfortably grow to a staff of forty;
- Increase management and organization accountability;
- Enable efficient production of high-quality, policy-relevant work and quick and effective responses to participants;
- Provide clearly defined roles, responsibilities, and authority;
- Facilitate a team approach, enabling work across sectors, programs, and geographies;
- Foster a strong network of participants, with effective communication and project integration between staff and the Council;
- Create standardized work processes, including program and project management, that will lead to greater efficiencies and staff satisfaction; and
- Provide opportunities for growth and development of ICCT staff.

The organizational planning process resulted in maintaining the President and Executive Director positions, with more clearly defined roles and responsibilities, and adding five new management positions (Figure 11). The President and Executive Director of the ICCT report directly to

FIGURE 11. ICCT Management Structure within the Constellation of Partner Organizations



the Board of Directors. The President is largely the ambassador of the ICCT to the outside world, while the Executive Director is responsible for development, strategy, board communications, and overseeing managing directors. Directly reporting to the Executive Director are:

- Director of Finance and Operations – Manages human resources, finance, and IT functions within the ICCT. Provides monthly financial updates to the Board.
- Director of Communications – Provides effective communication tools for the organization including newsletter/updates to participants and partners; an improved website and web-based tools; annual reports, press kits, and marketing tools; and, in consultation with program and project leads, input on project-based outreach and media strategies.
- Director of Programs – Manage programs and oversees program leads. One program director will oversee Passenger Vehicles (including motorcycles), Technology Innovation and Fuels; another, Heavy-duty Vehicles, Marine, and Aviation; and the third, Climate and Health, Climate Change Roadmap, and Policy Tracking.

Each of the programs will have a program lead to manage the associated projects. Staff will work in integrated teams, mostly overlapping between multiple programs. The cross-cutting programs, such as Technology Innovation, Policy Tracking, and Climate Change Roadmap, will have to work closely with the sector-based programs and vice-versa. Program staff will be assigned to one program for hiring and supervision, under the guidance of the three Program directors.

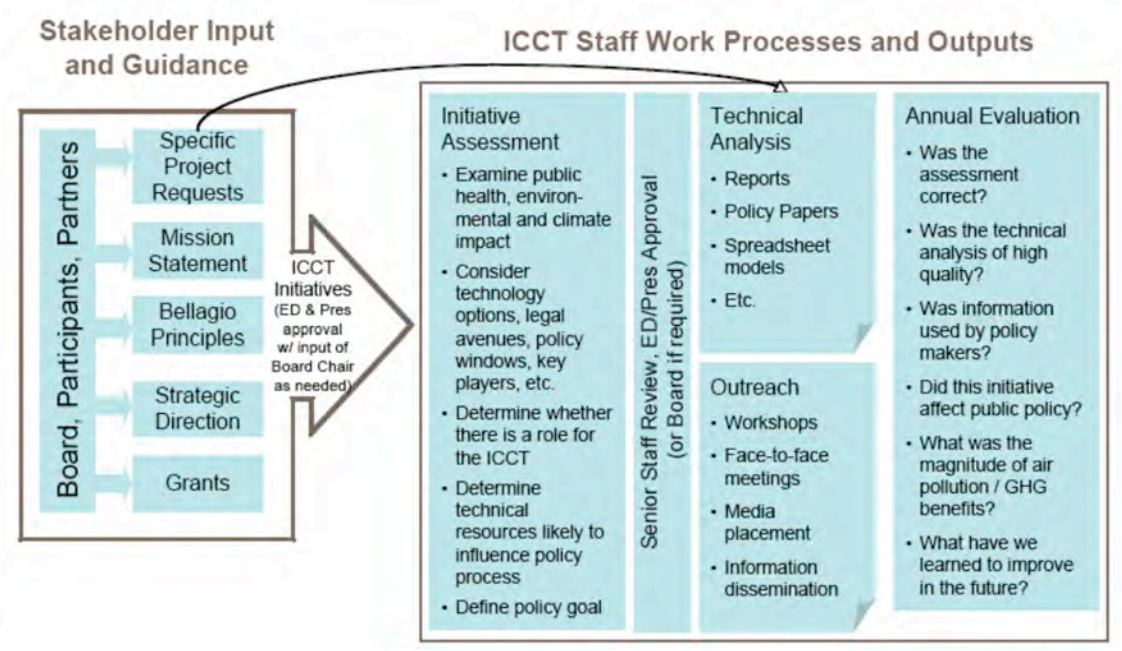
Regional or country leadership is an additional role and lens through which to view ICCT work. The country or region lead may also be a program lead or program staff and the ICCT work within that country or region may span multiple programs. The ICCT staff country/ program leads will be responsible for maintaining effective working relationships and knowledge of on-the-ground conditions in the country or region. This role will be essential for identifying and creating opportunities for ICCT to make important contributions to emission reduction strategies.

The geographic distribution of the Council, staff, and project-based work presents a serious challenge to an organization of this size. The Council spans the globe. Staff currently works out of two primary offices, in Washington D.C. and San Francisco, California. We expect to open offices in other countries with active projects and partners. The staff would likely be housed in the offices of active allies, including government, NGO or funding partners. In order to take advantage existing opportunities, to strengthen our partnerships, and manage active projects, our first priorities for opening offices and adding in-country staff are likely to be Europe, India and Mexico. As we grow staff expertise and leadership at the regional level, we expect to expand opportunities in China and Brazil.

6.2 INSTITUTIONAL ROLES AND RESPONSIBILITIES

The Board of Directors, Council, and Partners all play an important role in helping the ICCT to shape initiatives and projects. Figure 12 presents a flowchart showing how input and guidance from ICCT stakeholders lead to resource allocation decisions that in turn flow through to organizational outputs.

FIGURE 12. The ICCT "Wiring Diagram"



Proposals for major initiatives are assessed on the basis of multiple criteria, including the magnitude of the public health and environmental benefits achievable through the initiative; technological, legal, and policy opportunities and barriers; existence of a role for ICCT; and anticipated demands on organizational resources. This assessment will help with prioritization and will be a key step in project planning, which will involve a complete team of ICCT staff, including the program and project leads, program or core capacity directors, the communications director, the executive director and the president. Project management will include annual evaluation to ensure that projects are on track and to learn from past successes and failures, allowing the ICCT to hone its effectiveness over time. In order to streamline the process and ensure efficiency in dealing with urgency of requests for assistance from participants and other partners, decisions involving short-term, low-level commitments of ICCT resources will be fast-tracked and made by program leads in real-time.

6.3 MONITORING AND EVALUATION

Building an effective organization is a fundamentally bottom-up process that relies heavily on evaluating the performance of individual projects. We use the following types of questions when evaluating the performance of those projects:

1. What are the measurable environmental impacts (emission reductions, reduced health impacts, etc.)?
2. Have we influenced policy internationally, nationally, or locally? Has that impact been direct (i.e. writing or contributing to discrete regulations) or indirect (i.e. creating new policy opportunities)?
3. Have our interventions been timely? Have there been "spillover" effects attributable to our actions, and have we helped prevent long-term developments in the wrong direction (negative "lock-in")?
4. Have we used resources efficiently? Did we meet important deadlines both inside and outside of the organization? Did we meet project goals with the expected level of resources, or did we need to shift resources from competing projects?
5. Have we furthered the ICCT's mission by creating further opportunities and clear steps forward, both within and without? Have we fostered interdependence and provided resources and precedents for others to work from?
6. Have we disseminated knowledge effectively through precedent-setting policies, best practice models, or changing perceptions in the public eye?
7. Are we creating "added value"? Are we achieving "brand" recognition by becoming a trusted resource for organizations, governments, and important officials on specific issues? Are others picking up on our best practice models and precedents in their own work?

The ICCT will input much of the data developed in our internal effectiveness evaluation into the recently launched ClimateWorks Critical Path Narrative and Tool. The Critical Path package

will allow the ICCT to communicate its strategy and expected outcomes to ClimateWorks and its network partners using common terminology and baseline inventories. The logic model will summarize how each initiative is linked to specific tactics that will be evaluated annually according to quantifiable metrics of success or indicators. The expected value analysis will provide a probability weighted estimate of carbon dioxide (CO_2) equivalent tons addressed by each initiative. In addition to a valuable evaluation tool Critical Path package can be useful in identifying high priority initiatives. We expect that the Critical Path package will become an important component of ICCT strategic planning and resource prioritization process in the coming year.

7. PRIORITY INITIATIVES

This section describes the ICCT's priority initiatives identified for the three-year period of 2009 to 2011. These initiatives derive from the resource allocation criteria described in section 2 and specific projects and initiatives described in section 3 and 4.

7.1 REGULATORY PRIORITIES

This section explains our priorities by type of policy initiative. In its simplest terms, our highest priority for climate change work is to propagate and strengthen fuel economy / GHG and conventional emission standards in the top ten ICCT countries and regions and low carbon fuel standards in the Europe, California, the United Kingdom, and in the United States (renewable fuel standards). Priorities that tend to blend air pollution and climate change benefits include regulatory efforts to strengthen emission standards that control black carbon and ozone (both greenhouse gases not currently included in the Kyoto "basket"). The bulleted list of regulatory policies contains our highest priorities for the next several years.

- ***Fuel Economy / Greenhouse Gas Emission Standards for On-road Vehicles***. Establish and strengthen fuel economy or greenhouse gas emission standards (we would prefer the latter) in all the major countries in which we work. For passenger vehicles in 2009, our highest priority is in the United States (including California), India and Mexico. For heavy-duty vehicles, our priority is the United States (including California again) where there is a mandate in federal legislation to develop new fuel economy standards for medium and heavy-duty vehicles. Developing a world-class regulatory policy for heavy-trucks in the United States will lay the groundwork for spreading the policy to other nations around the world.
- ***Low Carbon Fuel Standards***. Support the ongoing regulatory processes underway on low carbon fuel standards in California, Europe, the United Kingdom. The United States is also relevant within this context because the US EPA is drafting a Renewable Fuel Standard that includes lifecycle analysis similar to the methodologies used in the Low Carbon Fuel Standards. Low carbon fuels are essential if the transport sector is to do more than stabilize its emissions over time. The challenge lies in preserving these excellent policy initiatives while there is great uncertainty about the lifecycle GHG emission benefits of the current suite of biofuels options.

- ***Technology-Neutral Standards for Diesel Passenger Cars***. European weak emission standards (NOx and PM) for passenger diesels unnecessarily trade public health for climate change benefits. Other countries – notably India and Mexico – are seeing a sharp rise in passenger diesels that will lead to adverse public health consequences because they follow European standards. This project is working with Mexico and India to establish stricter standards for diesel cars and light trucks.
- ***Greenhouse Gas Emission Standards for International Marine.*** The ICCT is participating in the International Maritime Organization's working group charged with recommending greenhouse gas emission standards in advance of the COP-15 meeting in Copenhagen in December 2009. We have partnered with maritime experts to provide us with technical assistance and policy analysis.
- ***Climate Change Roadmap***. To support our efforts to underscore the urgency of establishing and strengthening climate change policies for vehicles and fuels, the ICCT is embarking on a multi-year project to develop a timeline for regulatory policies, performance targets (e.g., 75 mpg passenger fleet by 2050 in the United States) and technological milestones by mode and region.
- ***World-Class Heavy-Duty Vehicle Emission Standards.*** The ICCT developed a model rule for controlling NOx and PM emissions from heavy-duty trucks and buses. Continued work with other nations to tailor our findings to receptive nations is expected to lead to accelerated reductions in black carbon and ozone.
- ***Fast Action Initiative on Black Carbon.*** ClimateWorks is embarking on a multi-sectoral initiative to produce immediate reductions in black carbon emissions on an international scale. The ICCT is applying its scientific and technical expertise to lead the strategy for the transportation sector.

7.2 MEETINGS AND WORKSHOPS

At the ICCT, outreach to our participants and experts around the world are carried out through relatively small, focused meetings. We have held five meetings of the ICCT Participants since the first meeting in Bellagio in 2001. Our current schedule is to hold a meeting every 18 months. Given additional funding, we are planning to add regional meetings in the off years to allow us to focus on more geographic, and substantively-specific topics with subsets of our ICCT participants (and likely regional experts as well).

TABLE 7. Schedule of ICCT Meetings (2007 - 2011)

YEAR	PARTICIPANT MEETINGS	REGIONAL PARTICIPANT MEETINGS	BOARD MEETINGS	COMPLETED / PLANNED WORKSHOPS
2007	Hong Kong	--	1	5
2008	--	--	1 – 2	2
2009	Europe	--	3	6
2010	--	Latin America/TBD	3	8
2011	TBD	--	3	10

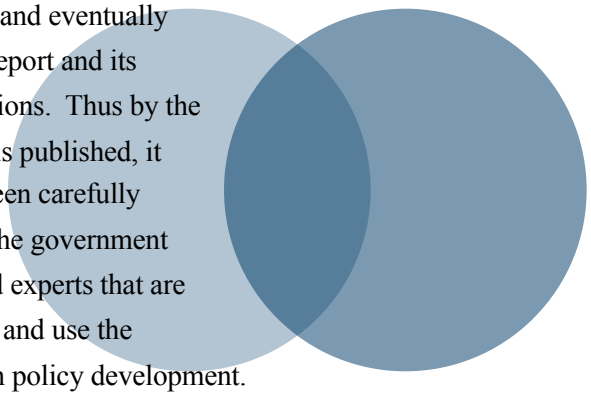
In addition to ICCT Participant meetings, the ICCT tends to organize meetings – often in collaboration with other countries – on specific technical topics (e.g., international marine in Brussels, heavy-duty vehicle fuel economy technologies in San Diego, Mexico fuel economy standards in Mexico City, etc). We expect to increase the number of these highly effective

workshops in the future. We find these meeting invaluable in building friendships and knowledge that serves as a springboard of policy development. Table 7 provides a schedule of expected ICCT meetings for the next three years.

We are privileged to have an active Board of Directors and a highly engaged and experienced chairman. In the past, the Board has provided the ICCT with regular guidance and oversight on monthly and now quarterly conference calls. Meetings were held annually. As the ICCT has grown, the Board recognizes that it will need to hold several in-person meetings each year.

7.3 MAJOR REPORTS

For planning purposes, it is useful to identify major research initiatives and new reports that are expected over the course of 2009, and to provide a sense of the number and types of reports that have been published previously (Table 8). As mentioned, most of the major reports are developed in collaboration with a select team of ICCT Participants that contribute to, and eventually endorse, the report and its recommendations. Thus by the time a report is published, it has already been carefully reviewed by the government regulators and experts that are likely to need and use the information in policy development.



Major reports are only one way that the ICCT works to bring about policy change. There is a great deal of analysis that is done for government agencies that is never published, and in some cases, it is this analysis that is as effective as our published reports.

TABLE 8. Major Reports Published and Proposed from 2007 to 2009

YEAR	MAJOR REPORTS (COMPLETED AND PLANNED)
2007	• Air Pollution and Greenhouse Gas Emissions from Ocean-going Ships • Passenger Vehicle Greenhouse Gas and Fuel Economy Standards: A Global Update • A Model Regulatory Program for Reduction Exhaust and Evaporative Emissions From Heavy-duty Vehicles and Engines • Increasing Vehicle Fuel Economy Without Sacrificing Safety
2008	• Best Practices for Motorcycle Emissions Control Programs (expected Fall) • MMT: A Science and Policy Review (expected Fall)
2009	• Fiscal Policies to Promote Fuel Efficiency in Passenger Vehicles: A Global Review • A Heavy-duty Model Regulatory Program for India / Brazil • Regulatory Design Options for Heavy Duty Vehicle Greenhouse Gas Emission Standards • Series of Paper that Examine the Co-benefits of Different Technologies and Fuel Scenarios (multi-year effort) • Air Pollution and Greenhouse Gas Emissions from Commercial Aviation

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APPENDIX A - ICCT STAFF BIOS

SENIOR STAFF

Dr. Alan C. Lloyd

President

Alan C. Lloyd is the President of the International Council on Clean Transportation. He served as the Secretary of the California Environmental Protection Agency from 2004 through February 2006 and as the Chairman of the California Air Resources Board from 1999 to 2004. Prior to joining CARB, Dr. Lloyd was the Executive Director of the Energy and Environmental Engineering Center for the Desert Research Institute at the University and Community College System of Nevada, Reno, and the chief scientist at the South Coast Air Quality Management District from 1988 to 1996. Dr. Lloyd's work focuses on the viable future of advanced technology and renewable fuels, with attention to urban air quality issues and global climate change. A proponent of alternate fuels, electric drive and fuel cell vehicles eventually leading to a hydrogen economy, Dr. Lloyd was the 2003 Chairman of the California Fuel Cell Partnership and is a co-founder of the California Stationary Fuel Cell collaborative. He earned both his B.S. in Chemistry and Ph.D. in Gas Kinetics at the University College of Wales, Aberystwyth, U.K.

Mr. Drew Kodjak

Executive Director

Drew Kodjak is Executive Director of the ICCT. Prior to joining the ICCT, Mr. Kodjak served as Program Director for the National Commission on Energy Policy (NCEP), a bipartisan 16-member Commission of US energy experts that released a highly influential report, Ending the Energy Stalemate, in December 2004. Mr. Kodjak has also served as Attorney-Advisor to the U.S. Environmental Protection Agency's Office of Transportation and Air Quality in Ann Arbor, MI. While at EPA, Mr. Kodjak contributed to regulatory development and drafting efforts for several key rulemakings including adoption of new emission controls on heavy-duty diesel trucks, mobile source air toxics and recreational vehicles. Mr. Kodjak is a graduate of New York University and Boston University Law School where he graduated with honors in 1991. Mr. Kodjak is a member of the Minnesota, New Jersey, and District of Columbia Court of Appeals Bar Associations.

Ms. Katherine Blumberg

Program Director

Katherine Blumberg is the Research Director for the ICCT. Ms. Blumberg has worked on clean fuels and clean vehicles, effective public transportation, enlightened fiscal policies, retrofit strategies, and fuel efficiency in the United States, Mexico, Brazil and China. Ms. Blumberg holds an M.S. in Energy and Resources and an M.S. in Engineering, with a focus on Air Quality, both from the University of California, Berkeley.

Ms. Fanta Kamakaté

Program Director

Fanta Kamakaté is a Senior Scientist with the ICCT. Her current projects include benchmarking the fuel efficiency of freight transportation by heavy-duty vehicle across several OECD nations and developing the ICCT's Clean Ports and Ships initiative. Ms. Kamakaté has extensive experience analyzing both the technical viability and potential for implementation of a wide range of mobile source emission control strategies. Ms. Kamakaté holds an M.S. in Energy and Resources with a focus on air quality from the University of California, Berkeley and a B.S. in Civil and Environmental Engineering from Stanford University.

STAFF

Dr. Anup P. Bandivadekar

Senior Policy Analyst

Anup Bandivadekar is working with the ICCT's passenger vehicle program and focusing on reducing greenhouse gas emissions from passenger vehicles in India. Previously, he was a postdoctoral fellow in the Sloan Automotive Laboratory at the Massachusetts Institute of technology (MIT), where he evaluated vehicle and fuel technologies that can significantly reduce greenhouse gas emissions and petroleum consumption from the U.S. light-duty fleet over the next thirty years. He holds a Bachelor of Engineering degree from University of Mumbai and a Master of Science Degree from Michigan Technological University in the field of Mechanical Engineering as well as a Master of Science in Technology and Policy and a Ph.D. in Engineering Systems from MIT.

Ms. Freda Fung

Senior Policy Analyst

Freda Fung joined the ICCT in October 2008. Her work focuses on reducing greenhouse gas emissions and other air pollution from transportation sector in China. She is also currently involved in advancing low carbon fuel policy in the United States. Prior to joining the ICCT, Freda was an automotive analyst at Environmental Defense Fund, where she conducted research on vehicle and fuel policies to reduce impacts of automotive use on climate change. Before that, she worked with Tellus Institute, a non-profit research and consulting group in Boston, where she engaged in research on market-based supply chain management practices to minimize chemical use and waste in the automotive and aerospace sectors. She also worked as a consultant in Hong Kong based environmental consulting firm. Freda received a Masters degree in Environmental Management and Policy from Lund University in Sweden and a Masters degree in Economics from the Chinese University in Hong Kong.

Ms. Hui He

Policy Analyst

Hui He is a policy analyst with the ICCT since 2007. Her work has focused on passenger vehicle fuel economy providing both analytic and policy development support. Ms. He has a Bachelor in Law and Economics from Peking University and a Master's of Public Affairs from the University of Texas at Austin.

Ms. Mary Johnson

Director of Operations & Finance

Mary heads up the Operations and Finance arena with the ICCT. Her work is focused on ensuring reliable financial, HR performance, process structure and growth for the organization. She has had over 15 years experience with non-profit and for-profit organizations. Mary holds a Bachelor of Science degree from the University of Minnesota in the areas of Political Science, Rhetoric and Historic Preservation of Buildings.

Ms. Yulee Kim

Executive Assistant / Office Manager

Yulee Kim joined the International Council on Clean Transportation as an Administrative Assistant to Alan Lloyd in July 2006. Her responsibilities have expanded to include managing San Francisco office operations and special projects for the ICCT. Prior to joining the ICCT, Ms. Kim has managed programs in the field of human resources in the technology industry. She has a B.S. in International Business Administration focusing on developing countries from San Francisco State University.

Mr. Ray Minjares

Policy Analyst

As policy analyst at ICCT Ray Minjares focuses on the intersection of public health and transportation. Previously he has worked as a policy analyst in Washington, DC focusing on national clean vehicle policies. There he directed the National Clean Bus Project for the Environmental and Energy Study Institute and coordinated its strategic outreach during reauthorization of TEA-21. Later he moved to the American Cancer Society to support the implementation of its strategic management plan. In 2005 he accepted a fellowship in the masters in health program at UC Berkeley where he pursued research on the built environment, agriculture and health policy. Mr. Minjares holds a Masters in Public Health degree with an emphasis on Health Policy and Management. He is also a graduate of the University of California, Los Angeles with a B.A. in Environmental Studies and International Development Studies.

Mr. Ed Pike

Staff Scientist

Ed Pike, P.E., joined the International Council on Clean Transportation (ICCT) in Fall 2007. His work at the ICCT currently focuses on climate change and California's Economic and Technology Advancement Advisory Committee. He worked at the US EPA's Pacific Southwest Region for 15 years prior to joining the ICCT. His experience at US EPA included reviewing and issuing Clean Air Act permits for industries ranging from electricity generation to petroleum production and refining. He has also contributed to a number of local and national rule-makings. His career has also included rotations at the Bay Area Air Quality Management District, and in the US EPA Pacific Southwest Region's Office of the Regional Administrator. He has a B.S. in Civil Engineering and a B.A. in Political Science from Stanford University.

Dr. Daniel Rutherford

Staff Scientist

Daniel Rutherford is a Staff Scientist with the ICCT. His current work focuses on public policies to control emissions from new and in-use heavy-duty vehicles, to improve passenger vehicle fuel economy, and to reduce greenhouse gas emissions from the aviation sector. Prior to joining the ICCT, Mr. Rutherford completed a dissertation assessing the Tokyo Metropolitan Government's diesel emissions policy, which established the world's largest market for clean diesel technologies when implemented in 2003. He holds a B.A. in Chemistry from the University of Minnesota at Morris and a M.S. and Ph.D. in Environmental Engineering and Science from Stanford University.

Mr. Alvaro F. Vasquez

Operations

Alvaro Vasquez joined the International Council on Clean Transportation as Program Administrator in November 2005. He speaks fluent German, Spanish, English, and Portuguese with a working knowledge of Latin. Mr. Vasquez graduated with bachelor degrees in History and International Relations in 2003. He recently graduated with his master's degree in International Economic Policy in Latin America and the Middle East at the American University in Washington, DC.

Washington DC
1225 Eye Street NW, Suite 900
Washington, District of Columbia 20005
USA
+1 (202) 534-1600

San Francisco
One Post Street, Suite 2700
San Francisco, California 94104
USA
+1 (415) 399-9019

www.theicct.org

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