

DRAFT PROPOSAL

Evaluation of Transition Paths to Electric Drive Vehicles

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Check if applicable:

Animal subjects _____

Human subjects _____

Evaluation of Transition Paths to Electric Drive Vehicles

ICCT Response to CARB Research Solicitation

Advanced Clean Cars

TABLE OF CONTENTS

ABSTRACT.....	3
INTRODUCTION	4
OBJECTIVES.....	6
TECHNICAL PLAN.....	7
Description of techniques and research methods to be employed:	7
Discussion of major tasks and how they'll be performed.....	10
Task 1: Enhance the usefulness of the existing model.	10
Task 2: Conduct formal peer review and modify model as appropriate.	13
Task 3: Compile, evaluate and incorporate the impact of existing global incentives.	13
Task 4: Identify, evaluate and incorporate the potential impact of innovative incentives.....	14
Task 5: Identify vehicle characteristics that indicate progress towards electrification, and build into the model the capacity to track new car market trends based on those characteristics	15
Task 6: Prepare final report	16
Project and Data Management Plan	16
Project and Data Management Associated with the present proposal.....	18
References	19

ABSTRACT

This proposal describes how the International Council on Clean Transportation (ICCT) proposes to be responsive to the California Air Resources Board's solicitation for draft research proposals in the Advanced Clean Cars scope of work, specifically in the research areas of New Car Market Trends, Technology Impacts on Consumer Welfare, Valuation of Co-Benefits, and Innovative Approaches to Transform the New Vehicle Market.

In the introduction, The ICCT details how its approach leverages recent and ongoing modeling and research to address knowledge gaps regarding the factors that drive customer preferences and the relative impact of such factors on EV deployment. ICCT explains how the resulting analyses would help policymakers better target incentive and other strategies and thus would support ARB's efforts to achieve the goals laid out in the Governor's Executive Order B-16-2012, and would better position the ARB to respond to consumer demand issues likely to be raised in the course of the upcoming midterm review of the recently adopted passenger vehicle GHG standards for model years 2017-2025.

In the objectives section, ICCT describes 4 specific objectives and their benefit to ARB: (1) Enhance the usefulness of the existing modeling tool by better characterizing the influence of various policies and barriers, (2) Evaluate existing incentive policies in place around the world to determine their impact, "monetize" that impact for purposes of reflecting policies in the model, test their resulting effect on deployment, and estimate the resulting costs and benefits, (3) Identify innovative incentive policies not currently in use, and similarly reflect them in the model, test their effect and quantify their impacts and, (4) Identify innovative approaches to characterize progress towards fleet electrification, build them into the model, and use the model to characterize the existing fleet and extrapolate future progress.

The technical plan lays out a clear path to achieve these objectives including descriptions of 6 proposed tasks and how they will be performed. Broadly, ICCT's technical plan includes both qualitative and quantitative research. The quantitative portions of the work will make use of the Light-duty Alternative Vehicles and Energy Transitions (LAVE-Trans) model. The six proposed tasks are: (1) Enhance the usefulness of the existing model, (2) Conduct peer review and modify model as appropriate, (3) Compile, evaluate and incorporate existing incentives, (4) Identify, evaluate and incorporate innovative incentives, (5) Identify vehicle characteristics, build into model and (6) Prepare final report.

As detailed in the project schedule, ICCT proposes a timeframe of 30 months for completion, beginning Q3 of 2013 with the final 6 months for ARB and RSC review of the draft final report and delivery of a revised final report and data files to the ARB. In the resume section, as well as in the references to publications section of the technical plan and throughout the narrative, ICCT proves that it's proposed project team, lead by principle investigator John German, are experienced experts and well qualified to lead this project. Finally, in the cost proposal ICCT provides an estimated budget broken down by task of \$224,384 with a request to ARB for \$201,946 and the remainder to be cost-shared with existing ICCT funds.

INTRODUCTION

This proposal from the International Council on Clean Transportation (ICCT) responds to the Air Resources Board (ARB) research solicitation on “Support for Advanced Clean Cars”, specifically the research areas of New Car Market Trends, Technology Impacts on Consumer Welfare, Valuation of Co-Benefits, and Innovative Approaches to Transform the New Vehicle Market. The ICCT’s approach leverages recent and ongoing modeling and research to address knowledge gaps regarding the factors that drive customer preferences and the relative impact of such factors on electric vehicle (EV) deployment. The resulting analyses would help policymakers better target incentive and other strategies and thus would support ARB’s efforts to achieve the goals laid out in the Governor’s Executive Order B-16-2012¹, and would better position the ARB to respond to consumer demand issues likely to be raised in the course of the upcoming midterm review of the recently adopted passenger vehicle greenhouse gas (GHG) standards for model years 2017-2025.

The ICCT is well-positioned to address this scope of work. The ICCT has undertaken a number of projects to better understand the potential for electric drive to help meet long term emission reduction goals, and how best to encourage a transition to electric drive while at the same time maximizing reductions from conventional and hybrid vehicles. This work has included a series of reports² on electric vehicle technology status and related policies, recommendations to the ARB and the United State Environmental Protection Agency (USEPA) on the treatment of EVs in passenger vehicle GHG standards, and a report, recommendations and sponsorship of international workshops on how to calculate upstream emissions from EVs.

Most recently, the ICCT has sponsored the development of a new modeling tool, which calculates the costs and benefits of a transition to electric drive passenger vehicles in California under various technology and policy scenarios. This model, a “national” version of which is being used by the National Research Council’s Committee on Transitions to Alternative Vehicles and Fuels as it prepares its forthcoming report, provides a state-of-the-art capability to quantitatively assess the impact of vehicle performance, cost, the prevalence of early adopters, infrastructure availability and other factors on vehicle deployment rates. The model provides a structured framework for integrating knowledge and assumptions about interaction of regional, national and global policies on zero emission vehicle deployment, rather than attempting to forecast the future. In particular, the modeled scenarios provide insight into the relative effectiveness of various strategies and the timescale over which these policy incentives would be required.

¹ <http://gov.ca.gov/news.php?id=17472>

² Vehicle Electrification Policy Study, Task 1 Report: Technology Status, International Council on Clean Transportation, February 2011, Vehicle Electrification Policy Study, Task 2 Report: Metrics, International Council on Clean Transportation, February 2011, Vehicle Electrification Policy Study, Task 4 Report: Complementary Policies, International Council on Clean Transportation, February 2011

The ICCT work has already produced a number of insights regarding California's electric vehicle policy which are feeding into ongoing discussions regarding AB 118 reauthorization, the importance of hydrogen infrastructure, possible uses of AB 32 auction revenues, the relative prospects of various electric drivetrains, and other issues. Such findings include:

- The benefits of a transition to electric drive appear to be an order of magnitude greater than the costs over the modeled transition period between now and 2050. The significant long term payoff appears to justify early investment in support of increased electric drive vehicle deployment.
- Simply "internalizing the externalities" of internal combustion engine (ICE) deployment does not appear to be sufficient to achieve a successful transition to electric drive. It will be necessary to provide additional subsidies, but such subsidies appear to be justified by the benefits created.
- Analyses of the benefits of vehicle policies typically focus on the impact of physical changes, e.g. reduced pollution and reduced oil consumption. An additional category of benefits recognized by economics³ but not typically applied to energy policy is "network external" benefits, which stem from early adopters reducing costs for subsequent purchasers through economies of scale, increased learning, and increased familiarity with the technology. The value of such benefits, which are large in this instance, have been extensively studied in the development of personal computer operating systems and cell phones.
- California's Zero Emission Vehicle mandate is an important driver for the transition, but what happens outside of California (in Section 177 states, the rest of the US, and globally) has a tremendous impact on the likelihood of success. In the absence of policies supportive of electric drive in other jurisdictions, significant California sales are not achieved until after 2030 for battery electric vehicles (BEVs) and after 2040 for fuel cell electric vehicles (FCEVs). Action at either the federal or global level results in an earlier and larger transition.
- In general terms, it appears that FCEVs can achieve higher deployment levels than can BEVs. Most modeling scenarios result in a mix of powertrains, but consistently a larger share goes to FCEVs. This is primarily because FCEVs, assuming that there is adequate availability of hydrogen fuel, do not face the range and recharge time limitations of BEVs. Plug-in hybrid electric vehicles (PHEVs) are a transitional technology and do not achieve ongoing high deployment levels due to their cost penalty vis a vis the other options.
- Vehicle deployment is non-linear; there appear to be "tipping points" after which it accelerates rapidly when a combination of underlying factors drive the cost of alternative powertrains to parity with ICEs. Conversely, a promising early trajectory can collapse if the underlying factors do not support sustained growth. These underlying factors include

³ Farrell, J. and P. Klemperer, 2007. "Coordination and Lock-in: Competition with Switching Costs and Network Effects", *Handbook of Industrial Organization, Volume 3*, M. Armstrong and R. Porter, eds., Elsevier

vehicle cost, the payback period desired by consumers for investments in fuel efficiency, consumers' valuation of range and recharge time limitations, fuel availability, the number of early adopters vs. mainstream customers, and the diversity of models available.

- The tipping points can be influenced by policy, but the timing of policy intervention is important. The ideal policy will adapt in response to market development, and a coordinated approach across regions will help avoid stranded investments.

The ICCT work has also identified areas where additional research, leading to and coupled with refinement of the model, would be fruitful. At present the model does not differentiate between California and Section 117 states, for example, even though the policy landscape varies greatly. In addition it would be very helpful to better understand how to monetize and incorporate in the model the impact of non-financial incentives (e.g. HOV lane access, parking privileges) and disincentives (e.g. difficulty of infrastructure installation, risk aversion). The research and model improvements proposed in this submittal will allow researchers and policymakers to assess in a more detailed fashion how changes in the location, target and timing of incentives affect projected vehicle deployment.

OBJECTIVES.

The objectives of this research are to:

- (1) Enhance the usefulness of the existing modeling tool by better characterizing the influence of various policies and barriers.
- (2) Evaluate existing incentive policies in place around the world to determine their impact, "monetize" that impact for purposes of reflecting policies in the model, test their resulting effect on deployment, and estimate the resulting costs and benefits.
- (3) Identify innovative incentive policies not currently in use, and similarly reflect them in the model, test their effect and quantify their impacts.
- (4) Identify innovative approaches to characterize progress towards fleet electrification, build them into the model, and use the model to characterize the existing fleet and extrapolate future progress.

The deliverables from this research will be a series of briefing papers outlining the results of each task and quantifying the impact of the various approaches on vehicle deployment and the composition of the vehicle fleet, as well as on consumer and societal welfare. Upon completion of the project, the results will be summarized and published in a peer-reviewed journal. When evaluating changes in consumer welfare due to fuel economy standards, the model will also use the "shift of reference point" concept in order to address concerns raised by OMB and others.

The results of the project will benefit ARB in several ways. A rigorous review of existing international policies to see what is working and not working will help ARB identify the most promising approaches for California to employ. Research on innovative approaches will help

address consumer issues such as risk aversion that we know are important but are not well targeted by existing strategies. Incorporation of this information into the model, with the ability to define and quantitatively test a broad range of incentive strategies, will help ARB justify requests for AB 118 and auction revenue funds and more effectively target the funds received. A quantitative estimate of the impact of complementary policies, or the lack thereof, in Section 177 states will help build the case for policymakers in those states to provide support that in turn will enhance electrification prospects in California. Improved availability and targeting of incentives will improve the odds of successful deployment and thus support ARB's efforts to achieve the goals laid out in the Governor's Executive Order, and better position the ARB to respond to consumer demand issues likely to be raised in the course of the upcoming midterm review of the recently adopted passenger vehicle greenhouse gas (GHG) standards.

TECHNICAL PLAN

Description of techniques and research methods to be employed:

This project involves both qualitative and quantitative research. The qualitative components (compilation of existing incentives, identification of innovative incentives, evaluation of effectiveness, monetization of impact, identification and evaluation of vehicle characteristics) will involve desk research by ICCT staff and contractors and interviews with external experts from governmental institutions (in US, EU, Japan and China), policy research organizations (Transport and Environment in the EU, China Sustainable Energy Program), and academic institutions (UC Davis, Tsinghua University). This work will draw in large part on ICCT's existing international network of staff and deep knowledge of conditions in major automotive markets worldwide. For example, the ICCT has co-sponsored workshops in China with the Ministry of Industry and Information Technology (MIIT) on New Energy Vehicle policy issues, in the EU with the EU Commission, has organized an international workshop on financing hydrogen infrastructure held in Toronto, and will be participating in upcoming hydrogen infrastructure policy discussions in Japan.

The ICCT will also draw upon the results of ARB's recently funded research project entitled "New Car Buyers' Valuation of Zero-Emission Vehicles". This research, being conducted by the University of California, Davis, will collect survey and interview data on the vehicle purchasing process and influencing factors on new light-duty vehicle buyers in California and Section 177 states, with a particular focus on the barriers and motivations for near- and pure ZEVs. The results of this work will directly shed light on the valuation of various factors by innovators and early adopters. The research results are scheduled to be available in time to feed into the relevant ICCT tasks.

The quantitative portions of the work (improvements to the model, model runs) will make use of the Light-duty Alternative Vehicles and Energy Transitions (LAVE-Trans) model⁴. The LAVE-Trans model represents consumers' choices among vehicle technologies, the effects of scale, learning and technological change on the costs and performance of vehicles, and the supply of energy for vehicles. Consumers' choices are estimated using a nested multinomial logit model. There is a great deal of uncertainty about the best values for many of the parameters that determine consumers' choices and firms' decisions, as well as technological factors. The approach pioneered by Donndenlinger and Cook⁵ and adapted to vehicle choice modeling by Greene⁶ of deriving key choice model parameter from basic assumptions is applied here. In the face of great uncertainty this method has the advantage of insuring at least the plausibility of key estimates as well as providing a direct link between assumptions and model behavior.

The LAVE-Trans model is an Excel spreadsheet model with 27 worksheets. Figure 1 illustrates the relationships between the major components of the model. The areas where exogenous inputs enter the model are shown as blue boxes. A relatively large amount of exogenous information is required to carry out a model run. Baseline projections of vehicle sales and energy prices are required to 2050. Technical attributes of advanced technology vehicles, including fuel consumption per km, on-board energy storage and retail price equivalent at full scale and learning, must be specified for current and certain future years. Parameters that determine consumers' willingness to pay for vehicles and their attributes must also be provided. The model translates these into coefficients for the vehicle choice model. The technology cost curves employed as inputs to the model were developed by ICCT vehicle technology experts, who prepared new cost and efficiency estimates that incorporate the impact of continuously more stringent emission and fuel economy standards.

For this analysis the model was calibrated to the 2011 Annual Energy Outlook Reference Case projection⁷. Given a starting sales projection, the Vehicle Choice model first estimates any changes to consumers' vehicle purchase decisions, then estimates the shares of ICE, HEV, PHEV, BEV and FCV technologies for passenger cars and light trucks for both Innovator/Early-adopter and Majority market segments. Sales are passed to the Vehicle Stock worksheet, which retires vehicles as they age and keeps track of the number of

⁴ Greene, D.L., C. Liu and S. Park, 2012. "Light-duty Alternative Vehicle Energy Transitions (LAVE-Trans) Model: Working Documentation and User's Guide", Center for Transportation Analysis, Oak Ridge National Laboratory, Oak Ridge, Tennessee, August.

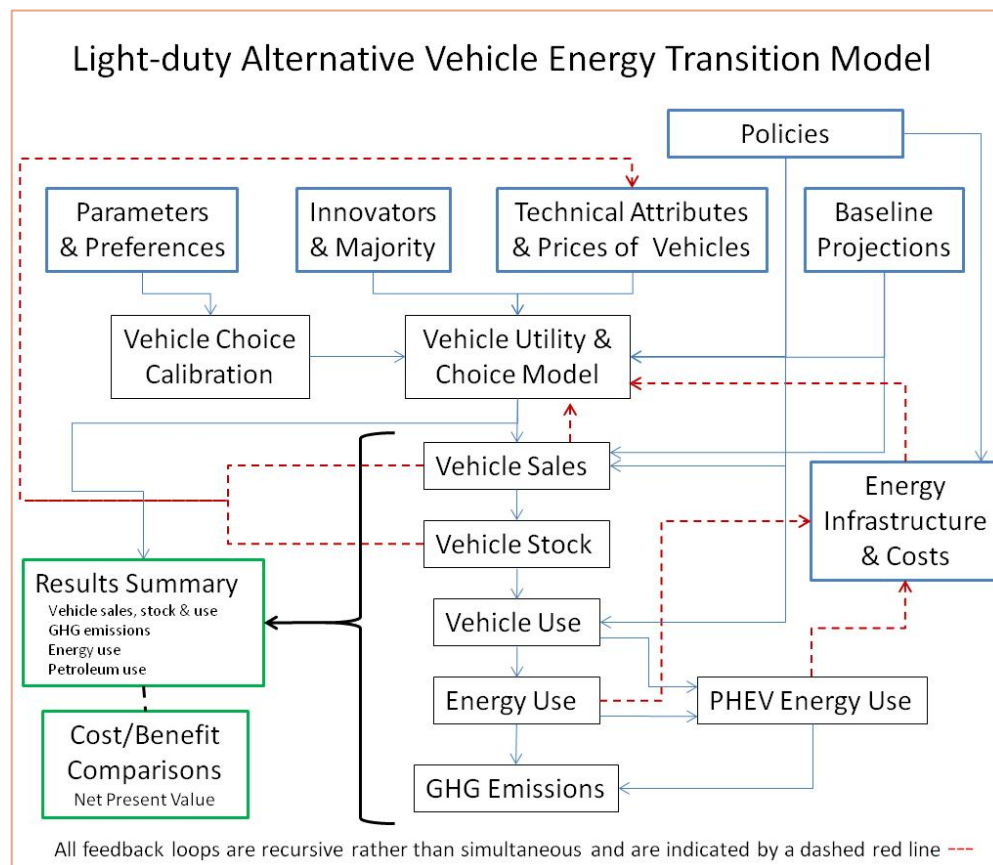
⁵ Donndenlinger, J.A. and H.E. Cook, 1997. "Methods for Analyzing the Value of Automobiles", SAE Technical Paper 970762, Society of Automotive Engineers, Warrendale, PA.

⁶ Greene, D.L., 2001. TAFV Alternative Fuels and Vehicles Choice Model Documentation, ORNL/TM-2001/134, Oak Ridge National Laboratory, Oak Ridge, TN.

⁷ Energy Information Administration (EIA), 2011. Annual Energy Outlook 2011, DOE/EIA-0383(2011), U.S. Department of Energy, Washington, D.C.

vehicles of each technology type by model year, for every forecast year⁸. Vehicle kilometers by age and vehicle type depend on fuel prices and energy efficiency and are calculated in the Vehicle Use worksheet. In the Energy Use worksheet energy use is calculated for all but PHEVs by multiplying vehicle kilometers by number of vehicles and by energy consumption per kilometer. PHEV use of electricity and gasoline depends on specified utility factors and is calculated in a separate worksheet. Well-to-wheel greenhouse gas, NO_x, HC, and PM10 emissions factors are applied in other worksheets to calculate total emissions.

Figure 1
Diagrammatic Representation of the LAVE-Trans Model



The effects of policies are estimated by comparing a Policy Case to a Base Case. The two cases are based on identical assumptions about technological progress and market conditions so that the difference reflects the impacts of the transition policies. The LAVE model produces five cost and benefit measures:

1. Net subsidy to vehicles and fuels

⁸ National Highway Traffic Safety Administration (NHTSA), 2006. Vehicle Survivability and Travel Mileage Schedules, Technical Report DOT HS 809 952, National Center for Statistics and Analysis, U.S. Department of Transportation, Washington, D.C.

2. Value of changes in GHG emissions
3. Value of changes in oil consumption
4. Value of changes in NO_x, HC, and PM10
5. Net change in consumers' surplus

Two versions of the LAVE-Trans model, one representing California and the Section 177 states⁹ and another representing the rest of the U.S., were linked together for this study. Each was approximately calibrated to the 2011 Annual Energy Outlook based on the Census Regions to which each state belonged. The linkage between the two regions is recursive. Sales of vehicles and other outputs for California and the Section 177 states in year *t* are passed to the rest of U.S. model where they affect year *t*+1. Outputs of year *t*+1 in the U.S. model affect year *t*+1 in the California model.

Discussion of major tasks and how they'll be performed.

Task 1: Enhance the usefulness of the existing model.

1.1. Improve the characterization of Section 177 state incentive policies

At present the model does not differentiate between California and Section 177 states, even though complementary policies differ greatly across the jurisdictions. For example California offers a \$2,500 purchase rebate, New Jersey offers only a sales tax exemption, and New York and Connecticut have no consumer-oriented financial incentives. The mix of other incentives also varies, again with California providing the most comprehensive approach. Thus the model will tend to overestimate consumer demand in Section 177 states. This has been identified by automakers as an issue deserving further attention. ICCT will determine the incentives currently in place, develop a sales-weighted single measure to cover all Section 177 states (it is not feasible to have state-by-state variation) and reflect that updated measure in the model.

1.2. Review and to the extent possible improve the characterization of non-financial incentives and barriers

The model explicitly and quantitatively incorporates consumer response to factors such as vehicle range, availability of home, public and fast charging infrastructure, model availability, and innovative technology. While calibration of such factors is difficult due to limited availability of data on consumer reaction, the model allows researchers to better understand their relative importance and interaction. ICCT will undertake additional research on the

⁹ The Section 177 states are those that have adopted the California vehicle standards (CT, ME, MA, RI, VT, NJ, NY, PA, DE, MD, AZ, NM, OR and WA.)

valuation of such non-financial incentives and barriers (e.g. loss aversion) and incorporate any identified improvements into the model, as well as conducting sensitivity analyses on the relative impact of the various incentives and barriers.

1.3. Expand the technology development path scenarios

The model uses "expected" and "optimistic" technology cost curves based on estimates prepared by ICCT vehicle technology experts. These cost curves posit dramatic increases in vehicle efficiency (nearly 4X for conventional hybrid vehicles with internal combustion engines in the "expected" case) due to aggressive downweighting and reduced vehicle load. ICCT will define and review with ARB technical staff a "pessimistic" case and examine its impact on the scenario results.

On the other hand, there is evidence that the "expected" and "optimistic" scenarios currently incorporated may not actually be all that optimistic beyond 2030. ICCT is planning to publish two papers by summer 2013 that will build upon the NRC Committee study on 2050 Light-Duty Transitions that will be published in March 2013.¹⁰ The first ICCT paper will update the efficiency assessment of all vehicle types (ICE, hybrids, BEVs, and FCVs) after 2030. The second paper will conduct updated and more detailed analyses and sensitivity tests on the cost of BEVs and FCVs compared to conventional vehicles. If this work documents a need for changes to the "expected" and/or "optimistic" scenarios, ICCT will revise the technology inputs accordingly and examine the impact on the scenario results.

1.4. Update existing scenario model runs using the updated model.

Using the modifications incorporated in subtasks 1.1 through 1.3 ICCT will perform additional model runs based on the scenarios used in the modeling work to date, as well as expanding the scenarios with additional sensitivity cases.

¹⁰ Transitions to Alternative Vehicle and Fuels, National Research Council Committee, publication expected March 2013. John German, the ICCT principle investigator for this proposal, was the head of the vehicle subcommittee for this report and guided development of future vehicle technology and cost estimates through 2050, including both conventional vehicles and battery-electric and fuel cell vehicles.

Table 1 shows the existing scenarios.

Table 1: Scenarios Used in Modeling Work to Date

Cases	CA + S177 States' Policies	Rest of US Policies (with 3-year lag)	Rest of World Sales (Exogenous)	Vehicle Technology
1	Infrastructure + Vehicle Subsidy	NO	NO	Expected
2	Infrastructure + Subsidy	Infrastructure + Subsidy	NO	Expected
3	Infrastructure + Subsidy	NO	Introducing Rest of World Sales	Expected
4	Subsidy Only	Subsidy Only	NO	Expected
5	Infrastructure + Subsidy	NO	NO	Optimistic
6	Infrastructure + Subsidy	Infrastructure + Subsidy	NO	Optimistic

Stakeholders have also noted a desire to better understand the impact of governmental as opposed to internal manufacturer subsidies. Questions include the impact of internal manufacturer subsidies on prices for other vehicles, and the ability for an "all subsidy" approach (i.e. no ZEV regulation) to achieve the same outcomes. These issues will be addressed as part of the additional model runs.

1.5. Conduct additional stakeholder outreach and obtain feedback

ICCT has held organized briefings for a variety of stakeholders including state agencies, NGOs and the automobile sector¹¹, along with a number of other meetings. At these

¹¹ Participants in the briefings have included Aniss Bahreinian (CEC), Max Baumhefner (NRDC), Analisa Bevan (ARB), Robert Bienenfeld (Honda), Tom Cackette (ARB), Belinda Chen (ARB), Joshua Cunningham (ARB), Brian Dahlin (NHTSA), Catherine Dunwoody (CA Fuel Cell Partnership), Anthony Eggert (UC Davis), David Friedman (UCS), Gloria Helfand (USEPA), Dean Kato (consultant for Toyota), Simon Mui (NRDC), Joan Ogden (UC Davis), Tim Olson (CEC), Jacob Ward (DOE), Malachi Weng-Gutierrez (CEC), John Whitefoot (NHTSA)

discussions the ICCT obtained input on the model itself as well as on key assumptions, findings and conclusions. This stakeholder input process has helped to improve the model's representation of the California regulatory and policy environment, and to identify important policy questions that the model can usefully address. Throughout the conduct of the proposed work ICCT will continue to solicit feedback from a wide range of interested parties. This ongoing scrutiny will be supplemented by a formal peer review of the model, as described in Task 2.

1.6 Prepare summary report

The Task 1 report will present the results of model runs conducted using the existing scenarios (used in work to date) but with the updated version of the model, and discuss the impact of the changes. The presentation of results will include discussion of the net present value of any investment in incentives, taking into account the value of co-benefits including the value of greenhouse gas reduction, petroleum reduction, and other co-benefits such as "network externality" benefits from early adopters reducing costs for subsequent purchasers through economies of scale, learning, and increased familiarity with the technology.

Task 2. Conduct formal peer review and modify model as appropriate.

2.1. Conduct formal peer review

The National Research Council's Committee on Transitions to Alternative Vehicles and Fuels has used a national version of the model for a forthcoming report, and experts from that group have reviewed the methodology. Nevertheless it would be helpful to have a more formal peer review to ensure that the work has sufficient credibility to be used in future proceedings. In addition to the stakeholder review and comment process outlined above, ICCT will arrange for a formal peer review of the base model in consultation with CARB staff. The peer review comments and ICCT responses will be submitted to ARB in memo form.

2.2. Modify model as appropriate

Prior to undertaking the remaining analyses ICCT will identify and incorporate any additional changes to the model that are appropriate in light of the peer review findings.

Task 3: Compile, evaluate and incorporate the impact of existing global incentives.

3.1. Compile and evaluate existing international policies and practices

Over the past several years ICCT has conducted several studies of existing international incentives, including a review of fiscal policies to encourage motor vehicle greenhouse gas reduction and a compilation of lessons learned from international practices. An organization

affiliated with ICCT is currently conducting a survey of Chinese incentive policies. Using its international partners ICCT will review existing policies and identify those that have the greatest impact on vehicle sales. To the extent possible ICCT will incorporate the results of the ARB's recently funded study of "New Car Buyers' Valuation of Zero-Emission Vehicles", which is collecting survey data on the factors that influence consumer purchasing decisions on near- and zero emission vehicles.

3.2. Monetize the impact of preferred policies, incorporate results into the model, and run updated scenario analyses.

Using the best available information ICCT will monetize the impact on consumer purchase behavior of the identified incentives (i.e. express the impact of the incentive in terms of an equivalent dollar as value perceived by vehicle purchasers) and incorporate their use into the model. ICCT then will update the scenarios to be considered, as needed, and perform additional model runs.

3.3. Prepare summary report.

The Task 3 report will present the results of new analyses conducted with the updated version of the model, and discuss the impact of the changes. The report will highlight any improved strategies that come to light, and will present the range of results (net present value, co-benefits, etc.) outlined for the Task 1 report.

Task 4: Identify, evaluate and incorporate the potential impact of innovative incentives

4.1. Identify and evaluate potential innovative incentives

ICCT will identify a range of candidate innovative incentives. Possible areas of investigation include:

- Incentives that address consumer risk aversion, such as free loaner vehicles, arrangements with insurance companies such as AAA for roadside assistance for stranded vehicles, guaranteed resale value or similar measures
- BEV incentives focused only on early adopters and fleets
- FCEV incentives targeted towards the mass market
- Incentives that take advantage of potential linkage between BEV charging and utilities, and between hydrogen storage and use of excess renewable energy
- Incentives based on vehicle performance characteristics other than range or battery capacity (e.g. electric miles travelled or recharge time)

Using the best available information ICCT will evaluate the effectiveness of the potential incentives. This will involve consideration of the factors that are important to consumers and how well the potential incentives address those factors. Sensitivity analysis conducted with the LAVE-Trans model has ranked the importance of the factors incorporated into the model.

Additional information on consumer preferences will be obtained from the UCD survey work and other relevant external research.

4.2. Monetize the impact of preferred incentives, incorporate results into the model, and run updated scenario analyses.

ICCT will monetize the impact of the incentives on consumer purchase behavior, and incorporate their use into the model. ICCT then will update the scenarios to be considered, as needed, and perform additional model runs.

4.3. Prepare summary report.

The Task 4 report will present the results of new analyses conducted with the updated version of the model, and discuss the impact of the changes. The report will highlight any improved strategies that come to light, and will present the range of results (net present value, co-benefits, etc.) outlined for the Task 1 report.

Task 5. Identify vehicle characteristics that indicate progress towards electrification, and build into the model the capacity to track new car market trends based on those characteristics

5.1. Identify possible additional metrics and evaluate all metrics.

The California Zero Emission Vehicle program requires manufacturers to build specified numbers of zero and near-zero emission vehicles, with vehicles awarded varying credit based on their electric range. The Board has directed staff to identify alternative metrics that better account for the variety of approaches being employed by manufacturers (e.g. charge-sustaining vs. charge-depleting operation, limp-home capability). ICCT will identify metrics that can meaningfully characterize progress towards electrification of the vehicle fleet. As appropriate the metrics will be consistent with and linked to incentives identified in the previous tasks. Possible areas of investigation include:

- Projected lifetime or annual electric miles travelled for a vehicle platform
- Installed battery capacity
- Charge-sustaining vs. charge-depleting operation
- Recharge time

As part of this task ICCT will use to the extent possible the findings of ARB's recently funded research proposal entitled Advanced Plug-in Electric Vehicle Travel and Charging Behavior.

5.2. Incorporate alternative metrics into the model, and prepare projections of market trends

ICCT will build into the model the capacity to track new car market trends based on the identified metrics. This aspect is directly responsive to the New Car Market Trends

component of the ARB research solicitation, which asks for "approaches and methods that allow for ongoing characterization of the existing new vehicle fleet as well as some ability to extrapolate, forecast or project future trends".

5.3. Prepare summary report

The Task 5 report will characterize the existing fleet based on the identified metrics and project fleet composition throughout the study period using those metrics.

Task 6. Prepare final report

6.1 Prepare draft report

The Task 6 draft report will compile results from the previous task reports and describe the results of the entire project. The draft will be provided to ARB staff for their review six months prior to the expiration of the contract.

6.2 Prepare final report

Two months after the receipt of any comments provided by ARB staff and/or the Research Screening Committee, the ICCT will prepare a final report taking into account and responding to comments received and suitable for publication.

Project and Data Management Plan

ICCT follows an internally designed project management process. A project team consists of a project manager (PM), a lead author/principal investigator (PI), and supporting staff and consultants. The lead author/principal investigator is the person primarily responsible for the day-to-day project activities including the analysis and drafting of the report. The project manager will be responsible for establishing and meeting project milestones, ensuring adequate resources are deployed (staff and discretionary), and arbitrating the review process. The Program Manager tracks each project tasks and subtasks in a project tracker worksheet. When delays are anticipated in tasks that are on the critical path, plans are made to reschedule less important tasks. The Chief Program Officer on a biweekly basis oversees the progress of critical sponsored projects to ensure timely completion of projects.

Principle investigator and project manager are both tasked with communicating with the project sponsor on a regular basis via email, meetings, telephone calls, and online as well as in person presentations. The Project Manager will be available at all times to discuss all aspects of the project to ensure that the project sponsors' expectations and requirements are being matched and met by the project team.

Project teams are assisted by a Program Administrative Strategy & Support Team (PASS Team). The mission of the PASS Team is to improve organizational efficiency, set administrative strategic direction and enhance overall organizational support wherever it is needed. Members of the PASS team overlap with the ICCT operations and finance team, which provides monthly updates on staff costs and overheads by program initiative, associated travel, meeting and consultant costs. The Program Directors along with the Chief Program Officer closely monitor the expense of each initiative and track it against the program and/or project plan progress.

ICCT continually invests in training its staff and actively promotes a cooperative, supportive, flexible, and team-oriented work environment. Our technical team is diverse with background in engineering and science, economics, law, and finance with practical experience in on-road and off-road transportation technology, costs analysis, life cycle analysis, and policy development. While ICCT is organized in programmatic areas and regions, the organization structure actively encourages formation of multidisciplinary teams that cut across program and regional boundaries. ICCT staff are seldom assigned to just one project at a time, which allows for greater flexibility in allocating different staff time to different projects as necessary.

While the Chief Program Office and the Executive Director are responsible for ensuring quality of ICCT work products in general, the quality of a given project is a responsibility of the PI and PM. Since handling and processing large amount of data is critical to ICCT's overall work products, the project team is tasked with conducting accuracy checks for data gathered either in-house or from a third party source. All data gathered for the purpose of a specific project is stored in a separate project specific folder with multiple mirrors (a server in each of ICCT offices, and a secure web location). The PI guides the team to ensure that data analysis and reporting follows standard procedures, and that technical reviews of work products are conducted before submission to the client. ICCT's Roadmap Modeling team is responsible for review and calibration of any models that project energy use and emission inventories.

All major projects identify potential and committed internal project reviewers. The review time for all reviewers and compensation for external reviewers is included in the project budget, where applicable. In certain cases, the program manager and principle investigator may invite several outside experts to constitute an external advisory committee, which is briefed on a regular basis during the project execution. The goal of these internal and external reviews is to ensure that the ICCT documents are technical accurate, well written, and supported with data and analysis.

Once the team begins work on the first draft of the manuscript, the project manager, with input from the lead author and the communication director, establishes a timeline from draft to publication.

Project and Data Management Associated with the present proposal

The principle investigator for the proposed research is Mr. John German, a Senior Fellow at the ICCT, who has previously worked with Honda Motor Company, the U.S. Environmental Protection Agency, and Chrysler. Dr. Anup Bandivadekar, who is the passenger vehicle program director will act as the project manager. Dr. Alan Lloyd, President of the ICCT, will provide ICCT senior management and strategic input. Additional members of the project team include Chuck Shulock, former Assistant Executive Officer at ARB, Dr. David Greene and his research associate Sangsoo Park at Oak Ridge National Laboratory, and Dr. Peter Mock, Dan Rutherford, Hui He, and Kate Blumberg at ICCT. The expected roles are summarized briefly in Table 1, and detailed resume for team members are included in a following section.

Table 2. Project management structure

	Name, Title	Primary roles
Principle Investigator*	John German, Senior Fellow	Technology assessments, report writing
Program Manager*	Anup Bandivadekar, Ph.D., Program Director	Engineering analysis, projections analysis, oversight of overall work plan
Project Oversight*	Dr. Alan Lloyd, President	Senior management and strategic input
Researcher*	Chuck Shulock, Contractor	Development of technical, policy, analytical methodology; report writing
Researcher*	David Greene, Ph.D., Contractor	Model development
Researcher*	Dr. Sangsoo Park, Contractor	Model development
Researcher	Peter Mock, Ph.D., Program Director	Europe incentives and policies
Researcher	Hui He, Researcher	China incentives and policies
Researcher	Dan Rutherford, Program Lead	Japan incentives and policies
Researcher	Kate Blumberg, Program Director	Other country incentives and policies

* Key project staff

The project organization structure is designed to efficiently and deliberately move through the various stages of the project. The plan to guarantee such progress is to have an internal project deadline system that precedes the ARB deliverable deadline system by a full month for every task and subtask. The ICCT can uphold this aggressive timeline because the

researchers' extremely high familiarity with the data and methods required greatly streamlines the initiation of the project. The ICCT will establish fine-detailed sub-tasks that create higher certainty about the project work earlier in the process, and will confirm the resulting timeline with ARB staff.

The LAVE-TRANS model is set up to use assumptions from publicly available and widely used data sources. The model has been calibrated against the 2011 Annual Energy Outlook, and will be re-calibrated using the 2013 Annual Energy Outlook at the beginning of this project. Key assumptions with respect to vehicle efficiency and costs will be documented and published in a peer reviewed National Research Council report, available March 2013. Information gathered on existing and proposed international incentives will be cross checked against the Electric Vehicle Initiative (EVI) data. In addition, a formal peer review of the model has been incorporated in the project proposal, and peer reviewer selection will be done in consultation with CARB staff to ensure thorough vetting of the model. The program manager and/or principle investigator will be available at all times to answer any questions that CARB staff may have about the data sets being used to develop, verify and run the model.

References

Annual Energy Outlook 2011, Energy Information Administration (EIA), 2011. DOE/EIA-0383 (2011), U.S. Department of Energy, Washington, D.C.

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Analyzing the Transition to Electric Drive in California, David L. Greene, Sangsoo Park, The Howard H. Baker, Jr. Center for Public Policy, The University of Tennessee, forthcoming

Calculating Electric Drive Vehicle Greenhouse Gas Emissions, International Council on Clean Transportation, 2012

Consumer Vehicle Choice Model Documentation, Greene D. L. and C.Z. Liu, EPA-420-B-12-052, Office of Transportation and Air Quality, U.S. Environmental Protection Agency, available at <http://www.epa.gov/otaq/climate/documents/420b12052.pdf>, 2012.

Coordination and Lock-in: Competition with Switching Costs and Network Effects", Farrell, J. and P. Klemperer, Handbook of Industrial Organization, Volume 3, M. Armstrong and R. Porter, eds., Elsevier, 2007

Fiscal Policies for Passenger Vehicle CO2 Emissions, and Implications for China, International Council on Clean Transportation, October 2011

Light-duty Alternative Vehicle Energy Transitions (LAVE-Trans) Model: Working Documentation and User's Guide, Greene, D.L., C. Liu and S. Park, 2012. Center for Transportation Analysis, Oak Ridge National Laboratory, Oak Ridge, Tennessee, August.

Methods for Analyzing the Value of Automobiles, Donndenlinger, J.A. and H.E. Cook, 1997. SAE Technical Paper 970762, Society of Automotive Engineers, Warrendale, PA.

Predicting Individual On-road Fuel Economy Using Simple Consumer and Vehicle Attributes, Z. Lin and D.L. Greene, SAE Technical Paper Series No. 11SDP-0014, Society of Automotive Engineers, Warrendale, PA, April 12, 2011.

Review and Comparative Analysis of Fiscal Policies, International Council on Clean Transportation, February 2011

TAFV Alternative Fuels and Vehicles Choice Model Documentation, Greene, D.L., 2001. ORNL/TM-2001/134, Oak Ridge National Laboratory, Oak Ridge, TN.

Technical Basis and Suggested Policy Framework for Sustained Focus on Vehicle Electrification, International Council on Clean Transportation, submitted for journal review

Transitions to Alternative Vehicle and Fuels, National Research Council Committee report, publication expected March 2013.

Vehicle Electrification Policy Study, Task 1 Report: Technology Status, International Council on Clean Transportation, February 2011

Vehicle Electrification Policy Study, Task 2 Report: Metrics, International Council on Clean Transportation, February 2011

Vehicle Electrification Policy Study, Task 4 Report: Complementary Policies, International Council on Clean Transportation, February 2011

Vehicle Survivability and Travel Mileage Schedules, National Highway Traffic Safety Administration (NHTSA), 2006. Technical Report DOT HS 809 952, National Center for Statistics and Analysis, U.S. Department of Transportation, Washington, D.C.

PROJECT SCHEDULE

		2013		2014				2015				2016	
		Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Task													
1. Enhance usefulness of existing model													
	1.1 Improved characterization of 177 states												
	1.2 Characterization of non-financial incentives and barriers												
	1.3 Technology development path scenarios												
	1.4 Model runs												
	1.5 Stakeholder outreach and feedback												
	1.6 Summary report												
2. Conduct peer review and modify model as appropriate													
	2.1 Formal peer review												
	2.1 Modify model												
3. Compile, evaluate and incorporate existing incentives													
	3.1 Compile and evaluate												
	3.2 Monetize impact, incorporate into model, run scenarios												
	3.3 Summary report												
4. Identify, evaluate and incorporate innovative incentives													
	4.1 Identify and evaluate												
	4.2 Monetize impact, incorporate into model, run scenarios												
	4.3 Summary report												
5. Identify vehicle characteristics, build into model													
	5.1 Identify and evaluate possible metrics												
	5.2 Incorporate into model, prepare projections												
	5.3 Summary report												
6. Prepare final report													
	6.1 Draft Final Report												
	6.2 Final Report after receiving ARB feedback												
7.1 Preparation of a peer reviewed journal publication draft													
7.2 Submission of journal paper													
Quarterly progress reports		X	X	X	X	X	X	X	X	X			
Meetings with ARB staff		X		X		X		X	X		X		

John M. German

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PROFESSIONAL EMPLOYMENT

January 2009 to present	SENIOR FELLOW, INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION <ul style="list-style-type: none">• Primary responsibility for technology innovation and U.S. policy development.• Managing project to track technology costs and benefits worldwide.
February 1998 to January 2009	MANAGER, ENVIRONMENTAL AND ENERGY ANALYSIS, PRODUCT REGULATORY OFFICE, AMERICAN HONDA MOTOR CORPORATION <ul style="list-style-type: none">• Provide policy and technical analyses on vehicle-related emissions and energy issues.• Liaison between Honda R&D, both in the U.S. and Japan, and external organizations, including government agencies, environmental groups, other manufacturers, academia, and state representatives.• Primary Honda representative on fuel economy and global warming issues, including testifying before Congress, writing testimony, writing responses to CAFE rulemaking, and making presentations.
October, 1986 to January, 1998	SENIOR TECHNICAL ADVISOR, U.S. EPA OFFICE OF MOBILE SOURCES. Supervised up to 8 employees, managed development of regulations and guidance, and served as technical consultant on a wide variety of issues. <ul style="list-style-type: none">• Technical manager for study on Tier II emission standards for cars and light trucks.• Designed and managed extensive research project evaluating in-use driving behavior and its impact on emissions in support of revisions to the Federal Test Procedure. Created and managed extensive usage of teams across organizational boundaries.• Managed the development of the Nonroad Engine and Vehicle Emission Study.• Managed rulemaking for Cold Temperature Carbon Monoxide Standards.• Worked with transportation planners to help create and develop a computer simulation model for vehicle emissions.• EPA senior technical advisor on greenhouse gas and fuel economy issues, including CAFE alternatives, in-use fuel economy factors, and advanced technology. Active member of EPA global warming team and an inter-agency modeling team.• Created and managed rulemaking assessing LDT CAFE test procedure adjustments.• Developed policy guidance for driver-selectable devices, coastdown procedures, dynamometer power absorption settings, and model year definition and duration.
May, 1985 to Sept., 1986	TEAM LEADER, U.S. EPA OFFICE OF MOBILE SOURCES. Supervised 3 employees and managed manufacturer motor vehicle emissions compliance program. <ul style="list-style-type: none">• Wrote guidance on numerous certification procedure issues.
December, 1981 to May, 1985	ENGINEERING SUPERVISOR, CHRYSLER POWERTRAIN. Supervised 6 engineers, supported product planning, and developed strategies to optimize vehicle fuel economy and to ensure compliance with all fuel economy requirements. <ul style="list-style-type: none">• Chrysler's principal technical advisor on fuel economy and methods to improve CAFE• Provided technical analyses and written responses to proposed regulations.• Represented Chrysler on fuel economy matters with EPA and NHTSA.• Provided CAFE projections and analyzed CAFE impacts of future product changes.• Team leader of a project to implement Shift Indicator Lights.
November, 1976 to December, 1981	ENGINEER, CHRYSLER POWERTRAIN. Designed and implemented, from scratch, Chrysler's system to comply with extensive EPA fuel economy regulations issued in 1975. Also coordinated fuel economy testing, served as liaison with EPA, helped write responses to proposed regulations, and worked on special projects.

AWARDS and ADVISORY COMMITTEES

2010-11	NATIONAL RESEARCH COUNCIL – Committee on Transitions to Alternative Vehicles and Fuels
2008	NATIONAL RESEARCH COUNCIL – Committee for a Study of Potential Energy Savings and Greenhouse Gass Reductions from Transportation
2006	SAE ENGINEERING MEETINGS OUTSTANDING ORAL PRESENTATION AWARD , for “It’s a High-MPG Vehicle Issue, Not a Hybrid Issue”, SAE Government/Industry Mtg.
2004	BARRY McNUTT AWARD FOR EXCELLENCE IN AUTOMOTIVE POLICY ANALYSIS 1 st recipient of annual award from the SAE
2002-2003	ADVISORY BOARD , Advanced Power Technology Alliance, Center for Automotive Research, Ann Arbor, MI
2002-2003 2001-2002	SAE INDUSTRIAL LECTURESHIP PROGRAM , to promote interaction between practicing engineers and faculty and students via campus visits
1995	SILVER MEDAL , U.S. EPA for strategies to reduce air pollution from nonroad engines
1994	EPA SCIENCE ACHIEVEMENT AWARD in Air Quality. Only person in EPA’s Office of Mobile Sources ever to receive this award.
1993	OUTSTANDING TECHNICAL COMMUNICATION in the 1992-93 Society for Technical Communication of Southeastern Michigan Technical Publications Competition, for "Nonroad Engine and Vehicle Emission Study"
1992	BRONZE MEDAL , U.S. EPA for the "Nonroad Engine and Vehicle Emission Study"
1991	BRONZE MEDAL , U.S. EPA for the Cold Temperature Carbon Monoxide Rulemaking

LEADERSHIP TRAINING

2000	Honda Leader’s Program – Center for Creative Leadership
1997	Modeling and Computer Simulation of Internal Combustion Engine--U. of Mich. course
1996-7	Excellence in Government Fellows Program--Council for Excellence in Government
1995	Diversity Workshops - University of Michigan
1993	Total Quality Management
1992	Looking Glass Workshop: Leadership in Multilevel Organizations – Creative Leadership
1991	Use of Consultative Methods - EPA Institute
1990	Work Group Leadership - Conservation Foundation
1989	Regulation Development in EPA - EPA
1988	Planning Effective Meetings - EPA
1987	Zenger-Miller Supervision program on Behavior Modeling - EPA
1985	Personnel Management for Managers and Supervisors - OPM
1984	Interaction Management - Chrysler Institute
1982	Organizational Leadership and Productivity - Mansare Corp.
1982	Leadership Effectiveness Training - Chrysler Institute
1981	Supervisory Skills Training - Chrysler Institute

EDUCATION

1980-1984	University of Michigan. Completed 34 hours towards M.B.A. GPA: 7.9 (A=8.0)
1970-1975	University of Michigan, B.S., Physics (minor in Math). Honors: National Merit Finalist, Honors Program, Dean's List Activities: U. of Michigan Marching Band and Concert Band

PUBLICATIONS

D. Meszler, J. German, P. Mock, and A. Bandivadekar, "EU cost curve development methodology", November 2012, published by ICCT. <http://www.theicct.org/eu-cost-curve-development-methodology>

D. Meszler, J. German, P. Mock, A. Bandivadekar, "Initial processing of Ricardo vehicle simulation modeling CO2 data", July 2012, published by ICCT. <http://www.theicct.org/initial-processing-ricardo-vehicle-simulation-modeling-co2-data>

F. Posada Sanchez, A. Bandivadekar, and J. German, Estimated Cost of Emission Reduction Technologies for Light-Duty Vehicles, published by ICCT, June 2012. <http://theicct.org/estimated-cost-emission-reduction-technologies-ldvs>

P. Mock, J. German, A. Bandivadekar, and I. Riemersma, "Discrepancies between type-approval and real-world fuel consumption and CO2 values in 2001-2011 European passenger cars", published by ICCT, April 2012. <http://www.theicct.org/fuel-consumption-discrepancies>

D. Kodjak, A. Bandivadekar, J. German, and N. Lutsey, "The regulatory engine: How smart policy drives vehicle innovation", published by ICCT, January 2011. <http://www.theicct.org/regulatory-engine>

John German, Hybrid Powered Vehicles, SAE Technology Profile T-119, 2nd edition, book published by Society of Automotive Engineers, Warrendale, Pa., 2011.

J. German and N. Lutsey, "Size or Mass? The Technical Rationale for Selecting Size as an Attribute for Vehicle Efficiency Standards", July 2010, published by ICCT. <http://www.theicct.org/2010/08/size-or-mass/>

J. German and D. Meszler, "Best Practices for Feebate Program Design and Implementation", April 2010, published by ICCT. <http://www.theicct.org/2010/04/feebate-best-practices/>

John German, "Leadtime, Customers, and Technology: Technology Opportunities and Limits on the Rate of Deployment". Reducing Climate Impacts in the Transportation Sector. D. Sperling and J. Cannon, Springer Press, 2008.

D. Greene, J. German, and M. Delucchi, "Fuel Economy: The Case for Market Failure". Reducing Climate Impacts in the Transportation Sector. D. Sperling and J. Cannon, Springer Press, 2008.

J. German, "Reducing Vehicle Emissions Through Cap and Trade Schemes". Driving Climate Change: Cutting Carbon from Transportation. D. Sperling and J. Cannon, Elsevier & Academic Press, 2006.

Hybrid Gaseoline-Electric Vehicle Development, edited by John German, SAE PT-117, 2005.

John German, "Hybrid Electric Vehicles", *Encyclopedia of Energy*, Elsevier & Academic Press, 2004

John German, Hybrid Powered Vehicles, SAE Technology Profile T-119, book published by Society of Automotive Engineers, Warrendale, Pa., 2003.

John German, "Hybrid Vehicles Go to Market", TR News #213, March-April 2001.

John German, "VMT and Emission Implications of Growth in Light Truck Sales", Air and Waste Management Association Emission Inventory Conference proceedings, Oct. 1997.

J. Alson, J. German, K. Gold, R. Larson, and M. Wolcott, "Transportation Energy Demand Models: Why They Underestimate Greenhouse Gas Emissions", Climate Change Analysis Workshop Proceedings, June 6-7, 1996.

John German, "Off-Cycle Emission and Fuel Efficiency Considerations", Asilomar conference on Transportation and Energy, 1995.

John German, "Observations Concerning Current Motor Vehicle Emissions", SAE 950812, Feb. 1995.

J. Koupal and J. German, "Real-Time Simulation of Vehicle Emissions Using VEMISS", CRC On-Road Vehicle Emissions Workshop, April 1995.

S. Sheppard, J. Fieber, J. Cohen, and J. German, "Cold Start Motor Vehicle Emissions Model", Air and Waste Management Association, Cincinnati, 1994.

P. Enns, J. German, and J. Markey, "EPA's Survey of In-Use Driving Patterns: Implications for Mobile Source Emission Inventories", AWMA/CARB Specialty Conference on Emission Inventory, Pasadena, CA, October, 1993.

Anup P. Bandivadekar
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Phone: 202-534-1607 (work) Fax: 202-204-2303, E-mail: anup@theicct.org

Education

February 2008 **Ph.D. in Engineering Systems (Technology, Management and Policy Track)**

Research Assistant: Sloan Automotive Laboratory, **Massachusetts Institute of Technology (MIT)**

Thesis: Evaluating the Impact of Advanced Vehicle Technologies in U.S. Light-Duty Vehicle Fleet

Advisors: Prof. John Heywood, Prof. John Holdren (Harvard), Prof. Henry Jacoby, Prof. David Marks

June 2004 **Master of Science (SM) in Technology and Policy**

Research Assistant: Sloan Automotive Laboratory, MIT, GPA 5.0/5.0

Thesis: Combinations of Policy Measures with a High Potential for Reducing Fuel Consumption of the U.S. Light-Duty Vehicle Fleet (Technology and Policy Program Best Thesis Award for Year 2003-2004)

December 2001 **Master of Science (MS) in Mechanical Engineering**

Graduate Research Assistant: Department of ME-EM, GPA 3.91/4.0

Michigan Technological University (MTU)

Thesis: Development of a Model for Material Flows and Economic Exchanges within the U.S. Automotive Life Cycle Chain.

November 1998 **Bachelor of Engineering (BE) in Mechanical Engineering**

K. J. Somaiya College of Engineering (KJSCOE), **University of Mumbai**

First Rank in College and *Fifth Rank* in the University. 74% (Equivalent to a GPA of 3.90-4.00 in college)

Work Experience

08/12 – till date **Passenger Vehicle Program Director: International Council on Clean Transportation (ICCT)**

07/09 – 07/12 **Passenger Vehicle Program Lead: International Council on Clean Transportation (ICCT)**

Managing the passenger vehicle program consisting of eight researchers focused on reducing air pollution and greenhouse gas emissions from passenger vehicles in the top ten vehicle markets of the world. Spreading the best practices in technology and policy design across different regions by providing advice to key regulators and policymakers in these markets.

04/08 – 06/09 **Policy Analyst: International Council on Clean Transportation (ICCT)**

Providing technical analysis and policy support for improving energy efficiency within the transportation sector. The primary focus of the work was on technical analysis and policy development related to new fuel economy and/or greenhouse gas emission norms for passenger vehicles, motorcycles, and commercial trucks in U.S., EU, India, China, and Mexico.

01/08 – 04/08 **Postdoctoral Associate: MIT Energy Initiative (MITEI)**

Writing research papers and reports based on the doctoral work in the area of technology and policy alternatives to reduce petroleum use and greenhouse gas emissions.

02/08 – 04/08 **Consultant: National Research Council (NRC) Committee on “America’s Energy Future”**

Survey and review of the relevant literature on automotive fuel efficiency technology and on automotive fuels, Obtaining, analyzing, and preparing summaries of the relevant data, preparing a written report of the analyses.

- 06/03-08/03 **Visiting Research Scholar:** Judge Institute of Management Studies, **University of Cambridge**.
Designed and partially developed a graduate level subject in System Dynamics for the Technology Policy Master of Philosophy program as well as the MBA program.
- 01/02 - 07/02 **Research Associate:** Department of ME-EM: **MTU**
Conducted research in the area of Environmentally Responsible Design and Manufacturing, wrote research proposals, reviewed research papers.
- 10/98 - 07/99 **Trainee Engineer-Mechanical: Uhde India Ltd.**, Mumbai, India
Designed and analyzed heat exchangers, pressure vessels, process columns and storage tanks. Reviewed and checked vendor drawings, Prepared design specifications.
- 07/98 - 09/98 **Graduate Trainee Engineer:** TELCO Ltd. (now **TATA Motors**), Pune, India
Quality Assurance Division: Statistical Process Control in TATA 207 Assembly Shop. Initiated process capability study and worked with the line workers and supervisors to improve the process.

List of Publications by Type¹

Book-Chapters:

- Cheah L., C. Evans, **A. Bandivadekar** and J. Heywood, “*Factor of Two: Halving the Fuel Consumption of New U.S. Automobiles by 2035*,” in Sperling D. and J. Cannon (Editors), Reducing Climate Impacts in the Transportation Sector, Springer, 2008, pp. 49-72.
- **Bandivadekar A.**, and J. Heywood, “Coordinated Policy Measures for Reducing the Fuel Consumption of the U.S. Light-Duty Vehicle Fleet,” in Sperling D. and J. Cannon (Editors), Driving Climate Change: Cutting Carbon from Transportation, Elsevier, 2006, pp. 41-72.

Ph.D. Thesis:

Evaluating the Impact of Advanced Vehicle Technologies in U.S. Light-Duty Vehicle Fleet, Thesis (Ph. D.)--Massachusetts Institute of Technology, Engineering Systems Division, Technology, Management, and Policy Program, 2008, 182 pages. <http://dspace.mit.edu/handle/1721.1/43856>

Journal Articles:

- Kromer M., **A. Bandivadekar**, C. Evans, “Long-Term Greenhouse Gas Emission and Petroleum Reduction Goals: Evolutionary Pathways for the Light-Duty Vehicle Sector,” Energy, Volume 35, Issue 1, January 2010, pp. 387-397.
- Evans C., L. Cheah, **A. Bandivadekar**, J. Heywood, “Getting More Miles per Gallon,” Issues in Science and Technology, Vol. XXV, No. 2, Winter 2009, pp. 71-80.
- Cheah L., **A. Bandivadekar**, K. Bodek, and J. Heywood, “The Trade-Off between Automobile Performance, Weight, and Fuel Consumption” SAE International Journal of Fuels and Lubricants, April 2009, Vol. 1 No. 1, pp. 771-777.
- **Bandivadekar A.**, L. Cheah, C. Evans, T. Groode, J. Heywood, E. Kasseris, M. Kromer, and M. Weiss, “Reducing the Fuel Use and Greenhouse Gas Emissions of the U.S. Vehicle Fleet,” Energy Policy Vol. 36, Issue 7, July 2008, Pages 2754-2760.
- **Bandivadekar A.**, V. Kumar, K. Gunter, and J. Sutherland, “A Model for Material Flows and Economic Exchanges Within the U.S. Automotive Life Cycle Chain,” Journal of Manufacturing Systems, Vol. 23, No. 1, 2004, pp. 22-29.

¹ Note that the list does not include paper abstracts or conference poster presentations.

Peer Reviewed Conference Papers:

- **Bandivadekar A.**, V. V. Kumar, K. Gunter, and J. Sutherland, “A model for material flows and economic exchanges within the U.S. automotive life cycle chain,” Transactions of the North American Manufacturing Research Institute of SME, 2004, Vol. 32, pp. 303-310.
- **Bandivadekar A.**, K. Gunter, and J. Sutherland, “A Model for Material Flows and Economic Exchanges Within the U.S. Automotive Life Cycle Chain and its Sensitivity to Systemic Changes,” Proceedings of the 9th CIRP Life Cycle Engineering Seminar, Erlangen, Germany, April 2002, pp. 181-189.

MIT Technical Reports

- **Bandivadekar, A.**, K. Bodek, L. Cheah, C. Evans, T. Groode, J. Heywood, E. Kasseris, M. Kromer, M. Weiss, *On the Road in 2035: Reducing Transportation's Petroleum Consumption and GHG Emissions*, MIT Laboratory for Energy and the Environment (LFEE) Report 2008-05 RP, July 2008, <http://web.mit.edu/sloan-auto-lab/research/beforeh2/otr2035/index.html>, 173 pages.
- Cheah L., C. Evans, **A. Bandivadekar** and J. Heywood, *Factor of Two: Halving the Fuel Consumption of New U.S. Automobiles by 2035*, MIT Laboratory for Energy and the Environmental (LFEE) Report, LFEE 2007-04 RP, October 2007 http://web.mit.edu/sloan-auto-lab/research/beforeh2/files/cheah_factorTwo.pdf 51 pages
- **Bandivadekar, A.** and J.B. Heywood, “Coordinated Policy Measures for Reducing the Fuel Consumption of the U.S. Light-Duty Vehicle Fleet,” Massachusetts Institute of Technology, Laboratory for Energy and the Environment Report LFEE 2004-001, 76 pp.

Other Peer-reviewed Reports:

- Hui H., and **A. Bandivadekar**, *A Review and Comparative Analysis of Fiscal Policies Associated with New Passenger Vehicle CO₂ emissions*, International Council on Clean Transportation, January 2011.
- Posada F., **A. Bandivadekar**, and J. German, *Estimated Cost of Emission Reduction Technologies for Light-Duty Vehicles*, International Council on Clean Transportation, June 2011.

Conference Paper (not peer reviewed)

- Garg S., **A. Bandivadekar**, and D. Kodjak, Fuel economy standards for passenger vehicles: A need for energy security, presented at Petrotech 2009, Paper ID-870, 7 pages. January 2009, New Delhi.
- Posada F., F. Kamakate, and **A. Bandivadekar**, Sustainable Management of Two and Three Wheelers in Asia, presented at 6th Annual Environmentally Sustainable Transport (EST) Forum, 15 pages, December 2011.
- Bansal G., F. Posada, A. Baral and **A. Bandivadekar**, Costs and Benefits of Cleaner Fuels and Vehicles in India, presented at 10th International Oil and Gas Conference Petrotech-2012, New Delhi, October 2012.

Opinion Pieces:

J. Heywood, **A. Bandivadekar**, and C. Evans, “Market can Fuel Energy Solutions,” Boston Globe, May 23, 2007.

Masters Theses:

- Combinations of Policy Measures with a High Potential for Reducing Fuel Consumption of the U.S. Light-Duty Vehicle Fleet, Thesis (S.M.)--Massachusetts Institute of Technology, Engineering Systems Division, Technology and Policy Program, 2004, 82 pages. <http://dspace.mit.edu/handle/1721.1/17911>
- Development of a Model for Material Flows and Economic Exchanges within the U.S. Automotive Life Cycle Chain, Thesis (M.S.)--Michigan Technological University, Department of Mechanical Engineering and Engineering Mechanics, 2002.

Invited Presentations/lectures (2006 onwards)

- **PTT Public Company Ltd., Thailand**, “Assessment of Future Vehicle and Fuel Technologies, and Their Potential Impact” March 24th 2006
- **MIT 1.020** (Ecology II: Engineering for Sustainability) class lecture, “Energy Sources and Efficiency in Transportation: Potential for Moving to Hydrogen as a Fuel” May 9th 2006
- **MIT LFEE-AGS** short course on *Energy and Climate: Towards Sustainable Systems*, “Oil, Hybrids, Fuel Cells, Ethanol ... and all that Jazz” June 13th 2006
- **Network of Educators in Science and Technology (NEST)**, “U.S. Light-Duty Vehicle Energy and Greenhouse Gas Challenge” June 30th 2006
- **Spouses and Partners at MIT (SPMIT)**, “Oil, Cars and Our Kids” October 4th 2006
- Lifelong Learning Program at **Regis College**, “Oil, Cars and Our Kids” November 27th 2006
- **MIT Sustainable Energy Lecture**, “Transportation Energy Challenge” January 23rd 2007
- **MIT 1.020** (Ecology II: Engineering for Sustainability) class lecture, “Transportation Energy Challenge” March 7th 2007
- **Energy Forum and Expo, Grand Junction, Colorado**, “Transportation Energy Challenges and Opportunities”, February 22nd, 2008
- **World Bank, Washington D.C.** “Vehicle Technology and the Carbon Intensity of Transport”, June 17th, 2008
- **Center for Strategic and International Studies (CSIS), Washington D.C.**, “Transportation Energy Challenge”, June 8th 2009, http://csis.org/files/attachments/090608_energy_agenda_bios.pdf
- **Center for Clean Air Policy (CCAP), Washington D.C.** “Plug-in Hybrid Vehicles and Light-Duty Vehicle Fuel Use/GHG Emissions”, June 23rd, 2009
- **Organization for Economic Cooperation and Development (OECD)** Workshop and Policy Dialogue on Technical Barriers to Trade: Promoting Good Practices in Support of Open Markets, **Paris, France**, “Controlling CO₂ Emissions from Automobiles”, 5th October 2009, http://www.oecd.org/document/22/0,3343,en_2649_36251006_43320662_1_1_1_1,00.html
- **Global Fuel Economy Initiative (GFEI) India Symposium** on Fuel Economy, **New Delhi, India**, “Review of Fuel Economy/Greenhouse Gas Standards Worldwide”, 25th November 2009, http://www.globalfueleconomy.org/Documents/Updates/2-Anup-Bandivadekar_nov2509.pdf
- **U.S. Department of State, Washington D.C.**, Washington Energy Seminar, “Transportation Technologies and their Impact,” February 4, 2010.
- **Global Fuel Economy Initiative (GFEI) Central and Eastern Europe** Program Launch, Cleaner, More Efficient Vehicles: Reducing Emissions in Central and Eastern Europe, **Budapest, Hungary**. “An overview of the global approach to fuel economy”, 5th May 2010, <http://www.globalfueleconomy.org/Documents/Updates/Budapest-2010/Anup-Bandivadekar-budapest-2010.pdf>
- **CMS Environment**, Media Workshop on Fuel Efficiency, **Hyderabad, India**, “Understanding Fuel Efficiency: The Current Worldwide Scenario”, 12th August 2010, <http://www.cmsindia.org/Anup.pdf>
- **Global Fuel Economy Initiative (GFEI)** workshop on Improving Fuel Economy in **Australia**, “Fuel Economy Standards, Learning from International Experience and Evidence” <http://www.globalfueleconomy.org/updates/Documents/Master-Presentation-Melbourne.pdf>, March 2011
- **Latin America Environmentally Sustainable Transport Forum, Bogota, Columbia**, “Improving Vehicle and Fuel Efficiency” <http://www.uncrdlac.org/fts/Presentaciones%20Jueves%2023/FTS%202011%20-%20Anup%20Bandivadekar.pdf>, June 2011
- **Endicott House Symposium** on “Opportunities for Technology and Policy Innovation in Energy and Environment” presentation title “How Smart Regulations Drive Vehicle Innovation”, Dedham, MA, http://www.nescaum.org/documents/opportunities-for-technology-and-policy-innovation-in-energy-and-environment/2-bandivadekar-endicott_17aug11_v0.pdf, August 2011

- **Center for Science and Environment, New Delhi**, "Global Trends in Reducing Vehicular Emissions" September 2011.

Selected Activities/Awards

- 2004 Technology and Policy Program (TPP) Leadership Award for setting up incoming student mentorship program as well as co-developing the first TPP careers brochure.
- Martin Family Society of Fellows for Sustainability (2004-2005).
- Reviewer for Journal of Industrial Ecology (2007, 2008)
- Reviewer for Energy Policy (2009, 2010)
- Reviewer of Energy (2010)
- Reviewer of Climate Policy (2010, 2011)
- Reviewer of International Journal of Powertrains (2013)
- Founding member of the MIT Energy Club (2004-2005); Member of executive committee (2006-2007); Organized a panel on “Unconventional Oil: Enhancing Energy Security in a Carbon Constrained World” at the 2007 MIT Energy Conference
- Volunteer with Association for India’s Development (AID) from 2004 – 2007; Responsibilities included reviewing development project proposals, and making site visits for project review.
- Presenter for *The Climate Project*; Raising awareness about global climate change in the community.



Europass Curriculum Vitae



Personal information

First name(s) / Surname(s)

Alan Lloyd

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18124 Wedge Parkway, Suite 535, Reno, NV USA

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E-mail

alloyd@theicct.org

Nationality

UK

Gender

male

Work experience

Dates

2006- present

Occupation or position held

President

Main activities and responsibilities

Lead ICCT's strategy and projects to reach its mission to dramatically improve the environmental performance and efficiency of cars, trucks, buses, and transportation systems in order to protect and improve human health, the environment, and quality of life. Focus on advanced technologies, particularly electric drive and fuel cell vehicles.

Name and address of employer

International Council on Clean Transportation (Washington, DC USA)

Type of business or sector

Non-profit organization

Dates

2005- 2006

Occupation or position held

Secretary of the California Environmental Protection Agency

Main activities and responsibilities

Oversaw a budget of \$1.5 billion and 4,500 employees throughout California. As Secretary, Dr. Lloyd lead the Governor's Climate Action Team to develop a plan to implement the Governor's aggressive Executive Order to reduce greenhouse gas emissions in California to 80% of 1990 levels. He chaired the California Greenhouse Gas Registry, was a member of the Oceans Protection Council, chaired the Environmental Justice Agency Working Group and was a co-chair of the Goods Movement Action Plan requested by Governor Schwarzenegger. Dr. Lloyd led the California delegation in Montreal and developed a Memorandum of Understanding in collaboration with Professor José Goldemberg to share experiences in reducing greenhouse gases in the states of São Paulo, Brazil, and California, United States.

Name and address of employer

California Environmental Protection Agency (California, USA)

Type of business or sector

US government agency

Dates

1994- 2004

Occupation or position held

Chairman, Air Resources Board

Main activities and responsibilities	Oversaw a \$150 million budget and a staff of nearly 1,000 employees located in northern and southern California. Gave many presentations to national and international audiences, focusing on the viable future of advanced technology and renewable fuels, with attention to the urban air quality challenges faced by California and to the impact on global climate change. Was a major proponent of alternate fuels, electric drive and fuel cell vehicles to lead to a hydrogen economy.
Name and address of employer	Air Resources Board, California Environmental Protection Agency (California, USA)
Type of business or sector	US government agency
Dates	1996- 1999
Occupation or position held	Executive Director
Main activities and responsibilities	The Director is a professional collaborator with and mentor for the Center faculty providing leadership for research and academic programs. Research involved alternate fuels, renewable energy and advanced technologies.
Name and address of employer	Energy and Environmental Engineering Center (EEEC), Desert Research Institute (Nevada, USA)
Type of business or sector	Research institute
Dates	1988- 1995
Occupation or position held	Chief Scientist
Main activities and responsibilities	In charge of the Technology Advancement office. Advised Executive Management on applications of technical and scientific research and development to improve air quality; formulated research development proposals which advance technology, and provided scientific input to the Executive Officer for public policies including technology which affects the Los Angeles Basin.
Name and address of employer	South Coast Air Quality Management District (Diamond Bar, California USA)
Type of business or sector	State government
Dates	1984- 1988
Occupation or position held	General Manager
Main activities and responsibilities	Responsible for the management of all financial, technical and personnel aspects of the California office of ENSR (over 100 staff). This included signing off on all grants and contracts, final reports, personnel acquisitions and evaluations. Set strategic direction for new business of the California office. Responsible for the overall financial performance of the office. As Senior Scientist, also intimately involved with all aspects of atmospheric chemistry, including acid deposition, oxidant formation, toxic air contaminants, and global climate change.
Name and address of employer	ENSR (formerly ERT, Westlake), (California USA)
Type of business or sector	Private company

Education and training

Title of qualification awarded	Ph.D. Gas Kinetics
Name and type of organisation providing education and training	University College of Wales, Aberystwyth
Title of qualification awarded	Bachelor of Science, Chemistry
Name and type of organisation providing education and training	University College of Wales, Aberystwyth

Academic Honors	Pembrokeshire County Scholarship for University Study; Office for Scientific and Technical Information Research Fellow, Department of Chemistry, University of Leeds, England; Visiting Scientist, National Bureau of Standards, Washington, DC
Personal skills and competences	
Mother tongue(s)	English
Additional information	<u>Professional Award Related to Hydrogen</u> National Hydrogen Association Lifetime Honorary Membership. US Fuel Cell Council Pathfinder Award Canadian Hydrogen Association, medal of Recognition for Outstanding Services for the Advancement of Hydrogen Energy and Hydrogen Economy in North America. List of Publications available upon request

CHARLES M. SHULOCK

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QUALIFICATIONS

Proven track record managing highly visible, complex and controversial environmental programs. More than thirty years of experience using budget, legislative, administrative and regulatory processes to achieve program results. Broad-based knowledge of environmental, motor vehicle and greenhouse gas laws, programs and policies. Good working relationships with key officials from government, business and environmental organizations. Excellent written and verbal communication skills. Extensive public speaking experience.

EDUCATION

- | | |
|------|---|
| 1978 | University of California, Berkeley
Master of Public Policy |
| 1975 | Georgetown University
Bachelor of Arts, Honors English |

EXPERIENCE

- | | |
|--------------|---|
| 2009-to date | Environmental and Climate Policy Consultant
Self-employed consultant. Projects include reports on vehicle electrification policy, development of recommendations on electric vehicle aspects of California and Federal passenger vehicle greenhouse gas regulations, and support for modeling work regarding the transition to electric drive in California, all for the International Council on Clean Transportation (ICCT); evaluation of possible uses of AB 32 auction revenues, for the Energy Foundation; and participation on a study team assessing the status of New Energy Vehicle deployment and policy in China, for the World Bank. |
| 2007-2009 | Assistant Executive Officer
California Air Resources Board (ARB)
Member of ARB executive management team and ARB lead for climate change issues. Established and directed the Office of Climate Change, responsible for implementing the Global Warming Solutions Act of 2006 (AB 32). Managed development of the AB 32 Scoping Plan, laying out first-in-the-nation recommendations to achieve significant greenhouse gas reductions. Prepared budget requests, identified needed expertise, set up organizational structure, |

recruited and hired staff, defined workflow, tasks and timing, worked closely with wide range of stakeholders, and conducted extensive public participation process. Represented California at the multi-state Western Climate Initiative.

- 1998-2007 **Program Manager for Motor Vehicle Greenhouse Gas Reduction;
Vehicle Program Specialist
California Air Resources Board**
Project leader for successful implementation of AB 1493, which directed the ARB to adopt regulations to reduce greenhouse gas emissions from motor vehicles. Leader of the ARB staff teams that prepared the 2001 and 2003 amendments to the California Zero Emission Vehicle regulation. Identified needed work products, managed rulemakings, worked extensively with multiple stakeholders, and helped defend adopted regulations against automaker litigation. Assisted in the adoption of similar regulations by other states and nations.
- 1994-1997 **Chief Deputy Director
California Office of Environmental Health Hazard Assessment**
Planned, organized and directed the activities of the Office, which provides objective scientific information to policymakers regarding health risks posed by hazardous materials in the environment. Assigned tasks to staff, provided policy guidance, and monitored work progress through to timely completion. Represented the office in interactions with the administration, the legislature, and interest groups.
- 1991-1994 **Assistant Secretary
California Environmental Protection Agency (Cal/EPA)**
Senior advisor to Cabinet-level Secretary for Environmental Protection. Established and supervised internal budget, contract and administrative functions, and reviewed budgets for all Cal/EPA organizations. Served as Agency liaison to the air quality, health science and pesticide regulatory programs. Reviewed, edited and approved mandated reports. Represented the Agency on advisory groups at the state and national levels. Managed the development of the first Cal/EPA strategic plan.
- 1984-1991 **Assistant to the Secretary for Policy Development
California Environmental Affairs Agency (predecessor to Cal/EPA)**
Senior staff to the Secretary for Environmental Affairs. Managed internal Agency budget, contract and other administrative functions. Provided Agency oversight of Air Resources Board, Water Resources Control Board and Integrated Waste Management Board budgets. Lead staff for development and implementation of Governor's Reorganization Plan Number 1 of 1991, which created Cal/EPA.

1978-1983 **Program Analyst**
Legislative Analyst's Office, California Legislature
Advised the legislature on fiscal aspects of California's air quality, solid waste management, pesticide, and toxic substances control programs. Analyzed budget requests and legislation, presented and defended recommendations before legislative committees, and responded to requests for information.

AWARDS AND RECOGNITION

2004 ARB Lifetime Achievement Award
2004 ARB Gold Superior Accomplishment Award
2002 ARB Gold Superior Accomplishment Award

DAVID L. GREENE

Home: 212 Way Station Trail • Farragut, Tennessee 37922 • (865) 966-0891

Work: Oak Ridge National Laboratory • National Transportation Research Center • 2360 Cherahala Boulevard • Knoxville, Tennessee 37932 • (865) 946-1310

PERSONAL

Born: November 18, 1949, New York, New York

Married, two children

EDUCATION

THE JOHNS HOPKINS UNIVERSITY

Ph.D., Geography and Environmental Engineering, 1973–78

UNIVERSITY OF OREGON

M.A., 1972–73

COLUMBIA UNIVERSITY

B.A., 1967–71

EMPLOYMENT

UNIVERSITY OF TENNESSEE, KNOXVILLE

2010–PRESENT

*1/2010–Present Senior Fellow, Howard H. Baker, Jr. Center for Public Policy
Research Professor, Department of Economics*

INSTITUTE FOR TRANSPORTATION STUDIES, UNIVERSITY OF CALIFORNIA, DAVIS

2008–2009

9/2008–6/2009 Visiting Research Faculty

OAK RIDGE NATIONAL LABORATORY (ORNL)

1977–PRESENT

*1999–Present Corporate Fellow, Oak Ridge National Laboratory
1989–1999 Senior Research Staff Member II and Manager of Energy Policy Research
Programs, Center for Transportation Analysis
1988–1989 Senior Research Analyst, Office of Policy Integration, U.S. Department of
Energy (On assignment from ORNL)
1987–1988 Head, Transportation Research Section
1984–1987 Senior Research Staff Member I
1982–1984 Research Staff Member
1980–1982 Leader, Transportation Energy Group
1977–1980 Research Associate*

AWARDS AND HONORS

2012 Roy W. Crum Award for Distinguished Achievement, Transportation Research Board of the National Research Council

2011 DOE Vehicle Technologies Program R&D Award, U.S. Department of Energy

2011 Edward L. Ullman Award, Association of American Geographers

2009 Alliance to Save Energy, Energy Efficiency Hall of Fame

2008 Science Communicator Award, UT-Battelle

Recognition by the Intergovernmental Panel on Climate Change for Contributions to the Award of the 2008 Nobel Peace Prize to the IPCC

2007 Department of Energy Hydrogen Program R&D Award (with P.N. Leiby)

Barry D. McNutt Award for Excellence in Automotive Policy Analysis, Society of Automotive Engineers, 2007
 Member Emeritus, Transportation Research Board Committee on Alternative Fuels, 2006
 Barry D. McNutt Award for best paper of 2004, Energy Committee, Transportation Research Board
 Lifetime National Associate of the National Academies, 2002
 UT-Battelle Award for Excellence in Science and Technology, 2001
 Oak Ridge National Laboratory Significant Event Award, 2001
 Corporate Fellow of Oak Ridge National Laboratory, 1999
 Outstanding Paper of 1999, *The Energy Journal*, International Association for Energy Economics
 Lockheed-Martin Significant Event Award, 1999
 Member Emeritus, Transportation Research Board Committee on Transportation Energy, 1998
 Lockheed-Martin Significant Event Award, 1996
 Distinguished Service Certificate, Transportation Research Board, 1993
 ORNL Special Achievement Award, 1991
 Distinguished Service Certificate, Transportation Research Board, 1989
 Energy Specialty Group Paper Award, Association of American Geographers, 1986
 ORNL Special Recognition Award, Oak Ridge National Laboratory, 1986
 Technical Achievement Award, Martin Marietta Energy Systems, 1985
 Pyke Johnson Award, Transportation Research Board, 1984

PROFESSIONAL ACTIVITIES

- Board of Directors, American Council for an Energy Efficiency Economy
- Board of Advisors, Institute for Transportation Studies, University of California, Davis
- Editorial Advisory Board, *Transportation Research Part D*, 1996–present
- Editorial Board Member, *Energy Policy*, 2001–present
- Editorial Board Member, *Journal of Transportation and Statistics*, 2001–2006, 2011–present
- Editorial Board Member, *Transportation Quarterly*, 1999–2005
- Editor-in-Chief, *Journal of Transportation and Statistics*, 1997–2000
- Editorial Board Member, Macmillan Encyclopedia of Energy, 1998–2001
- Editorial Advisory Board, *Transportation Research A*, 1986–1997
- National Research Council
 - Transportation Research Board Standing Committees:
 - Committee on Transportation and Sustainability, Member, 2006–present
 - Committee on Energy, A1F01, Chairman 1983–1986, 1986–1990; Member, 1993–1998; Member Emeritus, 1999–present
 - Subcommittee on Forecasting Transportation Energy Demand, A1F01(2), Chairman, 1982–1983
 - Section F, Energy and Environmental Concerns, Chairman, 1990–1992
 - Committee on Alternative Fuels, A1F05, Member, 1993–2006, Member Emeritus, 2006–present
 - Task Force on Freight Transportation Data, A1B51, Secretary, 1989–1996
 - Committee on Transportation Information Systems and Data Requirements, Member, 1983–1986, 1986–1989
 - Ad Hoc Committees:
 - Committee on Assessment of Technologies for Improving Fuel Economy of Light-Duty Vehicles – Phase 2, 2012–2015
 - Special Task Force on Climate Change and Energy, 4/15/2012–4/14/2015
 - Committee on Transitions to Alternative Vehicles and Fuels, 2011–2012
 - Special Task Force on Energy and Climate Change, 2008–2009
 - Committee on the Assessment of Fuel Economy Technologies for Light-Duty Vehicles, 2007–2010
 - Planning Group for Workshop on Issues Related to Peaking of Global Oil Production, 2005
 - Committee on State Practices in Setting Mobile Source Emissions Standards, 2004–2006
 - Chair, Committee for the Symposium on Introducing Sustainability into Surface Transportation Planning, 2003–2004
 - Panel on Combating Global Warming through Sustainable Surface Transportation Policy, TCRP Project Panel H-21A, 2002–2005
 - Committee on Effectiveness and Impacts of Corporate Average Fuel Economy (CAFE)

- Standards, 2001
- Committee for the Study of the Impacts of Highway Capacity Improvements on Air Quality and Energy Consumption, 1993–1994
- Committee on Fuel Economy of Automobiles and Light Trucks, Energy Engineering Board, Commission on Engineering and Technical Systems, 1991–1992
- Committee for the Study of High-Speed Surface Transportation in the United States, 1990
- Planning Group on Strategic Issues in Domestic Freight Transportation, 1990
- Steering Committee for Conference on Transportation, Urban Form, and the Environment, 1990
- National Cooperative Highway Research Program, Panel on “Evaluating Alternative Methods of Highway Finance,” 1991–1992
- Intergovernmental Panel on Climate Change
 - Lead Author, Working Group III, Fourth Assessment Report, 2007
 - Lead Author, Working Group III, Third Assessment, 2001
 - Lead Author, Working Group III, Aviation and the Global Atmosphere, 1999
 - Principal Lead Author, Working Group II, Second Assessment Report, 1995
- Association of American Geographers
 - Board of Directors, Transportation Specialty Group, 1989–1991
 - Secretary-Treasurer, Transportation Geography Specialty Group, 1980–1982
 - Editor, *Transportation Geography Newsletter*, 1980–1982
- Society of Automotive Engineers, member, 1985–present
- International Association for Energy Economics, member
- Consulting
 - International Council for Clean Transportation, 2011
 - International Transport Forum, 2007
 - Addx Corporation, 2007
 - United Nations Framework Convention on Climate Change, 2007
 - Securing America’s Future Energy, 2007
 - Center for Clean Air Policy, 2007
 - Pollution Probe Canada, 2006–2007
 - The Energy Foundation China Project, 2005—present
 - The Pew Center on Global Climate Change, 2004—present
 - Eno Transportation Foundation, 1991–1996
 - Transportation Research Board, 1996–1997

BOOKS

and D.W. Jones and Mark Delucchi, eds., *The Full Costs and Benefits of Transportation*, Springer-Verlag, Heidelberg, 1997.

Transportation and Energy, Eno Foundation for Transportation, Lansdowne, Virginia, 1996.

and D. J. Santini, eds., *Transportation and Global Climate Change*, American Council for an Energy Efficient Economy, Washington, DC, 1993.

ARTICLES IN PROFESSIONAL JOURNALS

Z. Lin, J. Dong, C. Liu and D.L. Greene, “Estimation of Energy Use by Plug-in Hybrid Electric Vehicles: Validating Gamma Distribution for Representing Random Daily Driving Distance”, *Transportation Research Record*, No. 2287, pp. 37-43, Transportation Research Board, Washington, D.C.

G. Upreti, D.L. Greene, K.G. Duleep and R. Sawhney, “Fuel cells for non-automotive uses: Status and prospects”, *International Journal of Hydrogen Energy*, volume 37, issue 8, pp. 6339-6348, 2012.

“Rebound 2007: Analysis of National Light-Duty Vehicle Travel Statistics”, *Energy Policy*, vol. 41, pp. 14-28, 2012.

C. Liu, E.C. Cooke, D.L. Greene and D.S. Bunch, "Feebates and Fuel Economy and Emissions Standards: Impacts on Fuel Use in Light-Duty Vehicles and Greenhouse Gas Emissions," *Transportation Research Record* No. 2252, pp. 23-30, Journal of the Transportation Research Board, Washington, D.C., 2011.

Z. Lin and D.L. Greene, "Assessing Energy Impact of Plug-in Hybrid Electric Vehicles: Significance of Daily Distance Variation over Time and Among Drivers", *Transportation Research Record* No. 2252, pp. 99-106, Journal of the Transportation Research Board, Washington, D.C., 2011.

Z. Lin and D.L. Greene, "Promoting the Market for Plug-in Hybrid and Battery Electric Vehicles: The Role of Recharge Availability," *Transportation Research Record* No. 2252, pp. 49-58, Journal of the Transportation Research Board, Washington, DC, 2011.

"What's Greener than a VMT Tax? The Case for an Indexed Energy User Fee to Finance U.S. Surface Transportation," *Transportation Research D-Environment*, vol. 16, pp. 451-458, 2011.

"Uncertainty, Loss Aversion and Markets for Energy Efficiency", *Energy Economics*, vol. 33, pp. 608-616, 2011.

Z. Lin and D.L. Greene, *Predicting Individual On-road Fuel Economy Using Simple Consumer and Vehicle Attributes*, SAE Technical Paper Series No. 11SDP-0014, Society of Automotive Engineers, Warrendale, PA, April 12, 2011.

and P.R. Boudreaux, D.J. Dean, W. Fulkerson, A.L. Gaddis, R.L. Graham, R.L. Graves, J.L. Hopson, P. Hughes, M.V. Lapsa, T.E. Mason, R.F. Standaert, T.J. Wilbanks and A. Zucker, "The Importance of Advancing Technology to America's Energy Goals," *Energy Policy*, vol. 38, no. 8, pp. 3886-3890, March 2010.

Rubin, J., P.N. Leiby and D.L. Greene, "Tradable Fuel Economy Credits: Competition and Oligopoly," *Journal of Environmental Economics and Management*, vol. 58, no. 3, pp. 315-328, 2009.

"Measuring Energy Security: Can the United States Achieve Oil Independence?" *Energy Policy*, 2010, Vol. 38, No. 4, pp. 1614-1621.

"Feebates, Footprints and Highway Safety," *Transportation Research Part D*, vol. 14, pp. 375-384, 2009.

"Vehicles and E85 Stations Needed to Achieve to Achieve Ethanol Goals," *Transportation Research Record* No. 2058, pp. 172-178.

and P.N. Leiby, P.D. Patterson, S.E. Plotkin and M. Sing, "Oil Independence: Achievable National Goal or Empty Slogan?" *Transportation Research Record*, No. 2017, pp. 47-53, Washington, DC, 2007.

and J.L. Hopson, R. Goeltz and J. Li, "Analysis of In-Use Fuel Economy Shortfall Based on Voluntarily Reported Mile-per-Gallon Estimates," *Transportation Research Record*, No. 1983, pp. 99-105, 2007.

Leiby, P.N., D.L. Greene, D. Bowman and E. Tworek, "Systems Analysis of Hydrogen Transition with HyTrans," *Transportation Research Record*, No. 1983, pp. 129-139, 2007.

and J.L. Hopson and J. Li, "Have We Run Out of Oil Yet? Oil Peaking Analysis from an Optimist's Perspective," *Energy Policy*, vol. 34, pp. 515-531, 2006.

S. Ahmad and D.L. Greene, "The Effect of Fuel Economy on Automobile Safety: A Reexamination," *Transportation Research Record* No. 1941, pp. 1-7, Washington, DC, January 2005.

and J.L. Hopson and J. Li, "Running Out of and Into Oil: Analyzing Global Depletion and Transition Through 2050," *Transportation Research Record* 1880, pp. 1-9, Transportation Research Board, Washington, DC, 2005.

and P.D. Patterson, M. Singh and J. Li, “Feebates, Rebates and Gas-Guzzler Taxes: A Study of Incentives for Increased Fuel Economy,” *Energy Policy*, vol. 33, no. 6, pp. 721-827, 2005.

Sheffield, J., et al., “Energy Options for the Future,” *Journal of Fusion Energy*, vol. 23, no. 2, pp. 63-109, 2004.

and J. Hopson, “An Analysis of Alternative Forms of Automotive Fuel Economy Standards for the United States,” *Transportation Research Record No. 1842*, pp. 20-28, Transportation Research Board, Washington, DC, 2003.

H.L. Hwang, S.M. Chin and D.L. Greene, “In, Out, Within and Through: Geography of Truck Freight in the Lower 48,” *Transportation Research Record*, no. 1768, pp. 18-25, Transportation Research Board, Washington, DC, 2001.

and S.E. Plotkin, “Energy Futures for the U.S. Transportation Sector,” *Energy Policy*, vol. 29, no. 14, pp. 1255-1270, 2001.

and N. Tishchishyna, “The Costs of Oil Dependence: A 2000 Update,” *Transportation Quarterly*, vol. 55, no. 3, pp. 11-32, 2001.

H.L. Hwang, D.L. Greene, S.M. Chin, J. Hopson and A.A. Gibson, “Real-time Indicators of VKT and Congestion: One Year of Experience,” *Transportation Research Record*, no. 1719, pp. 209-214, Transportation Research Board, Washington, DC, 2000.

and J.M. DeCicco, “Engineering-Economic Analyses of Automotive Fuel Economy Potential in the United States,” *Annual Review of Energy and the Environment*, vol. 25, pp. 477-536, 2000.

L.A. Greening, D.L. Greene and C. Difiglio, “Energy Efficiency and Consumption—The Rebound Effect—A Survey,” *Energy Policy*, vol. 28, pp. 389-401, 2000.

R.N. Schock, W. Fulkerson, M.L. Brown, R.L. San Martin, D.L. Greene and J. Edmonds, “How Much Is Energy R&D Worth as Insurance?” *Annual Review of Energy and the Environment*, vol. 24, pp. 487-512, Annual Review, Palo Alto, California, 1999.

S.M. Chin, D.L. Greene, J. Hopson, H.L. Hwang and B. Thompson, “Towards Real-Time Indices of U.S. Vehicle Travel and Traffic Congestion,” *Transportation Research Record*, no. 1660, pp. 132-139, National Academy Press, Washington, DC, 1999.

and J. Kahn and R. Gibson, “Fuel Economy Rebound Effect for U.S. Household Vehicles,” *The Energy Journal*, vol. 20, no. 3, pp. 1-31, 1999.

“Survey Evidence on the Importance of Fuel Availability to Choice of Alternative Fuels and Vehicles,” *Energy Studies Review*, vol. 8, no. 3, pp. 215-231, 1998.

“Why CAFE Worked,” *Energy Policy*, vol. 26, no. 8, pp. 595-614, 1998.

and Donald W. Jones and Paul N. Leiby, “The Outlook for U.S. Oil Dependence,” *Energy Policy*, vol. 26, no. 1, pp. 55-69, 1998.

and Michael Wegener, “Sustainable Transport,” in *Journal of Transport Geography*, vol. 5, no. 3, pp. 177-190, 1997.

Steven E. Plotkin and David Greene, “Prospects for Improving the Fuel Economy of Light-Duty Vehicles,” *Energy Policy*, vol. 25, no. 14-15, pp. 1179-1188, 1997.

“Economic Scarcity: Monopoly, Not Geology, Threatens Global Supply,” *Harvard International Review*, vol. XIX, no. 3, Summer, 1997.

“Environmental Impacts,” *Journal of Transport Geography*, vol. 5, no. 1, pp. 28–29, 1997.

“Energy for Transportation,” *Journal of Transport Geography*, vol. 5, no. 1, pp. 30–32, 1997.

and Y. Fan, “Transportation Energy Intensity Trends, 1972–1992,” *Transportation Research Record*, no. 1475, pp. 10–19, Energy and Environment, Transportation Research Board, Washington, DC, 1995.

M.A. Deluchi, D.L. Greene and Quanlu Wang, “Motor Vehicle Fuel Economy: The Forgotten Hydrocarbon Control Strategy?” *Transportation Research A*, vol. 28A, no. 3, pp. 223–244, 1994.

“Transportation and Energy,” *Transportation Quarterly*, vol. 48, no. 1, pp. 91–101, Winter, 1994.

and K.G. Duleep, “Costs and Benefits of Automotive Fuel Economy Improvement,” *Transportation Research*, vol. 27A, no. 3, pp. 217–236, May, 1993.

“Transportation and Energy: The Global Environmental Challenge,” *Transportation Research*, vol. 27A, no. 3, pp. 163–166, May, 1993.

“Energy Efficiency Improvement Potential of Commercial Aircraft,” *Annual Review of Energy and Environment*, vol. 17, pp. 537–573, 1992.

“Vehicle Use and Fuel Economy: How Big is the Rebound Effect?” *The Energy Journal*, vol. 13, no. 1, pp. 117–143, April 1992.

“A Note on OPEC Market Power and Oil Prices,” *Energy Economics*, vol. 13, no. 2, pp. 123–129, April 1991.

“The Cost of Short-Run Pricing Strategies to Increase Corporate Average Fuel Economy,” *Economic Inquiry*, vol. XXIX, no. 1, pp. 101–114, January 1991.

“Fuel Choice for Multifuel Vehicles,” *Contemporary Policy Issues*, vol. VIII, no. 4, pp. 118–137, October 1990.

“CAFE or PRICE? An Analysis of the Effects of Federal Fuel Economy Regulations and Gasoline Price on New Car MPG, 1978–89,” *The Energy Journal*, vol. 11, no. 3, pp. 37–57, September 1990.

“Technology and Fuel Efficiency,” *Forum for Applied Research and Public Policy*, vol. 5, no. 1, pp. 23–29, University of Tennessee, Spring 1990.

Carmen Difiglio, K.G. Duleep and D.L. Greene, “Cost Effectiveness of Future Fuel Economy Improvements,” *The Energy Journal*, vol. 11, no. 1, 1990.

“Short-Term Options for Controlling CO₂ Emissions of Light-Duty Vehicles,” *SAE Technical Paper Series 901111*, Society of Automotive Engineers, 1990.

“Motor Fuel Choice: An Econometric Analysis,” *Transportation Research A*, vol. 23A, no. 3, pp. 243–253, 1989.

“Fuel Choice for Dual-Fuel Vehicles: An Analysis of the Canadian Natural Gas Vehicles Survey,” *SAE Technical Paper Series 892067*, Society of Automotive Engineers, Warrendale, Pennsylvania, 1989.

J.J. Erickson, D.L. Greene and A.J. Sabadell, “An Analysis of Transportation Energy Conservation Projects in Developing Countries,” *Transportation*, vol. 15, no. 3, pp. 163–189, 1988.

and J.T. Liu, “Automotive Fuel Economy Improvements and Consumers’ Surplus,” *Transportation Research A*, vol. 22A, no. 3, pp. 203–218, 1988.

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M.A. Deluchi, Q. Wang and D.L. Greene, *Motor Vehicle Fuel Economy: The Forgotten Hydrocarbon Control Strategy?* ORNL-6715, Oak Ridge National Laboratory, Oak Ridge, Tennessee, July 1992.

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Q. Wang, D.L. Greene and M.A. Deluchi, “Effects of Increasing Fuel Economy on Gasoline Vehicle HC Emissions,” *Proceedings of the 84th Annual Meeting and Exhibition, Air and Waste Management Association*, Vancouver, BC, Canada, June 16–21, 1991.

“Coverage and Quality Problems with Existing Data Resources for Freight Transportation,” *Proceedings of the Special Conference on Freight Transportation Data: The Changing Federal Role Since Deregulation*, Transportation Research Circular, No. 367, Transportation Research Board, Washington, DC, 1990.

and M. Singh, *First Interim Report on the Interagency Commission on Alternative Motor Fuels*, Office of Energy Demand Policy, Office of Policy, Planning and Analysis, U.S. Department of Energy, Washington, DC, September 30, 1990.

“Commercial Aircraft Fuel Efficiency Potential Through 2010,” *Proceedings 1990 Intersociety Energy Conversion Engineering Conference*, Reno, Nevada, published by the American Institute of Chemical Engineers, August 12–17, 1990.

Energy Efficiency Improvement Potential of Commercial Aircraft to 2010, ORNL-6622, Oak Ridge National Laboratory, Oak Ridge, Tennessee, June 1990.

and Anju Rathi, *Alternative Motor Fuel Use Model: Model Theory and Design, and User’s Guide*, ORNL/TM-11448, Oak Ridge National Laboratory, Oak Ridge, Tennessee, April 1990.

with Donald Igo, "Energy Dependence," Chapter 3 in *National Strategic Transportation Study*, U.S. Department of Transportation, Washington, DC, 1989.

"A Context for Estimating Economic and Energy Security Benefits," Technical Report Two, *Assessment of Costs and Benefits of Flexible and Alternative Fuel Use in the U.S. Transportation Sector*, DOE/PE-0091, Office of Policy, Planning and Analysis, U.S. Department of Energy, Washington, DC, September 1989.

and J.C. Liang, *Modeling Operating Weight and Axle Weight Distributions for Highway Vehicles*, ORNL-6437, Oak Ridge National Laboratory, Oak Ridge, Tennessee, July 1988.

et al., "Research Priorities in Transportation and Energy," *Transportation Research Circular*, no. 323, Transportation Research Board, Washington, DC, September 1987.

Simulating the Market for Automotive Fuel Efficiency: The SHRSIM Model, ORNL/TM-10074, Oak Ridge National Laboratory, Oak Ridge, Tennessee, February 1987.

and M.C. Holcomb, *Off-Highway Use of Gasoline in the United States*, U.S. Department of Transportation, Federal Highway Administration, Office of Highway Information Management, Washington, DC, July 1986.

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R.L. Graves, D.L. Greene, E.W. Gregory, II, *Application of the Adiabatic Diesel to Heavy Trucks: A Technology Assessment*, ORNL/TM-9554, Oak Ridge National Laboratory, Oak Ridge, Tennessee, March 1986.

and R. Kowalski and F. Southworth, *The Transportation Sector in Costa Rica and Opportunities for Energy Conservation*, a report of the Energy Conservation Services Program, U.S. Agency for International Development, Office of Energy, Washington, DC, May 1985.

P.S. Hu, D.L. Greene and L.E. Till, *Motor Vehicle MPG and Market Shares Report: First Six Months of Model Year 1984*, ORNL/TM-9391, Oak Ridge National Laboratory, Oak Ridge, Tennessee, October 1984.

and P.S. Hu and A.B. Rose, *Transportation Energy Use and Efficiency in Tunisia*, ORNL-6066, Oak Ridge National Laboratory, Oak Ridge, Tennessee, August 1984.

"Highway Fuel Use: Trends and Factors," *Proceedings of the Energy Information Administration Symposium on Petroleum Information*, DOE/EIA-0425, Energy Information Administration, Washington, DC, September 1983.

G.F. Roberts and D.L. Greene, *Trends in Heavy Truck Energy Use and Efficiency*, ORNL/TM-8843, Oak Ridge National Laboratory, Oak Ridge, Tennessee, October 1983.

et al., *An Overview of the Wharton School Assessments of the Short-Term Integrated Forecasting System*, DOE/NBB-0046, Energy Information Administration, Office of Statistical Standards, Washington, DC, July 1983.

"Regional Demand Implications for Gasoline Supply Shortages," in T.R. Lakshmanan and P. Nijkamp, eds., *Systems and Models for Energy and Environmental Analysis*, Gower, UK, pp. 206–233, 1983.

and E. Hirst, J. Soderstrom and J. Trimble, *Estimating the Total Impact on Energy Consumption of Department of Energy Conservation Programs*, ORNL-5925, Oak Ridge National Laboratory, Oak Ridge, Tennessee, November 1982.

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and G. Kulp, G.H. Walton and D.B. Shonka, *Transportation Energy Use 1973–80: Changes, Trends, and Causes*, ORNL/TM-7953, Oak Ridge National Laboratory, Oak Ridge, Tennessee, April 1982.

G. Samuels, A.B. Rose, D.L. Greene and J.N. Hooker, “Energy Conservation in Transportation,” a chapter in Vol. III of *Advances in Energy Systems and Technology*, Peter Auer, ed., Academic Press, New York, 1982.

E. Hirst, D.L. Greene et al., *Energy Use from 1973 to 1980: The Role of Improved Energy Efficiency*, ORNL/CON-79, Oak Ridge National Laboratory, Oak Ridge, Tennessee, December 1981.

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J.N. Hooker, A.B. Rose and D.L. Greene, *End Use Energy Consumption Data Base: Transportation Sector*, DOE/EIA/CR-7405-01, U.S. Department of Energy, Washington, DC, February 1980.

A Statistical Analysis of State VMT Estimates in VMT Statistics, Lifetime VMT, and Current State Methods of Estimating VMT, ORNL/TM-6327, Oak Ridge National Laboratory, Oak Ridge, Tennessee, February 1979.

G. Kulp, D.L. Greene et al., *Regional Analyses of Highway Energy Use*, ORNL-5587, Oak Ridge National Laboratory, Oak Ridge, Tennessee, December 1979.

“A Regional Stock System Model of Highway Gasoline Demand,” in *Changing Energy Use Futures, Volume I*, Proceedings of the Second International Conference on Energy Use Management, Los Angeles, California, October 22–26, 1979.

and T.P. O’Conner, P.D. Patterson, A.B. Rose and D.B. Shonka, *Regional Transportation Energy Conservation Data Book*, ORNL-5435, Oak Ridge National Laboratory, Oak Ridge, Tennessee, September 1978.

Econometric Analysis of the Demand for Gasoline at the State Level, ORNL/TM-6326, Oak Ridge National Laboratory, Oak Ridge, Tennessee, July 1978.

An Investigation of the Variability of Gasoline Consumption among States, ORNL-5391, Oak Ridge National Laboratory, Oak Ridge, Tennessee, April 1978.

R.R. Schmitt and D.L. Greene, “Evaluating Transportation Innovations with the Intervening Opportunities Model,” *Proceedings of the Northeast American Institute for Decision Sciences*, April 1977.

M.G. Wolman, D.L. Greene and N.L. Froomer, *An Analysis of the Physical Characteristics of the Shenandoah River Which Affects Its Navigability and An Analysis of the Physical Characteristics of the Potomac River Which Affects Its Navigability*, prepared for the Baltimore District, U.S. Army Corps of Engineers, Chesapeake Research Consortium, pub. nos. 37S and 38S, resp., March 1975.

G. Power, M.G. Wolman et al., *Report on the Shenandoah River: An Investigation to Determine Navigability and Report on the Potomac River: An Investigation to Determine Navigability*, prepared for the Baltimore District, U.S. Army Corps of Engineers, Chesapeake Research Consortium, pub. nos. 37 and 38, resp., March 1975.

FORTHCOMING PUBLICATIONS

“OPEC and the Costs to the U.S. Economy of Oil Dependence: 1970-2010”, White Paper, The Howard H. Baker, Jr. Center for Public Policy, The University of Tennessee, Knoxville, Tennessee, December, 2012.

and C. Liu and S. Park, “Transition from Petro-Mobility to Electro-Mobility”, in *Transition to Renewable Energy Systems*, D. Stolten, ed., WILEY-VCH, Weinheim, Germany.

Sangsoo Park

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Educational Background

Ph.D., University of Tennessee	8/2008-Present
Major Field : Industrial Organization	
Minor Field : Environmental Economics	
M.A., North Carolina State University	8/2006-5/2008
M.E., Inha University, Incheon, Korea	9/2001-8/2003
B.E., Inha University, Incheon, Korea	3/1995-8/2001

Work & Teaching Experience

<i>Research Assistant for Dr. David Greene, The Howard H. Baker Center for Public Policy at the University of Tennessee</i>	Fall 2010-Present
Subject of Research: ‘Light-duty Alternative Vehicle Energy Transitions (LAVE-Trans) Model (2012) ‘Estimating the Costs and Benefits of Motor Vehicle Electrification in California’ (2011)	
<i>Teaching Assistant for Dr. Donna Bueckman</i>	Fall 2009-Spring 2010
Major tasks: Teaching Lab classes, “Introductory Economics” (Econ 201)	
<i>Research Assistant for Dr. William Neilson</i>	7/2009-7/2009
Major tasks: Literature review for Higher Education Production Function	
<i>Research Assistant for Richard Tucker, The former director of the Office of Institutional Research and Assessment (OIRA)</i>	9/2008-5/2009
Subject of Research: ‘A Comprehensive Analysis of the University of Tennessee Law School Applicants and Matriculates ’ Major tasks: Conducting status study of Law School Applicants and Matriculates data using STATA	
<i>Research Assistant at the Korea Labor Institute, Seoul, Korea</i>	2/2005-6/2006
Subject of Research: ‘A Survey for Practical Usage of IT Workforce’ Major tasks: Conducting Status study of 501 IT companies	
<i>Research Assistant at the Institute of Business and Economic Research at Inha University, Incheon, Korea</i>	2/2005-6/2006
<i>Research Assistant for Dr. Insoo Jeong, Vice president of the Korea Labor Institute, Seoul, Korea</i>	6/2003-5/2004
Subject of Research: ‘A comprehensive Study on the Unemployment Measures for the Youths in the Busan Area of Korea’	

Major tasks: Conducting Status study of 1,431 prospective college graduates of 14 colleges at Busan area in Korea

Research Assistant for Dr. Myung Soo Park, a Visiting Fellow of the Science and Technology Policy Institute, Seoul, Korea 7/2003-12/2003

Subject of Research: ‘An employment structural change analysis of Knowledge-based Service Industry’

Major tasks: Analyzing various raw data with SAS and Excel programs

Research Assistant at the Institute of Business and Economic Research at Inha University, Incheon, Korea 1/2003-5/2003

Subject of Research: ‘Large Business Groups in Korea’

Major tasks: Collecting and analyzing financial data of each business group and conducting basic econometric analysis

Research Assistant for Prof. Seh-Jin Chang 11/2002-4/2003

Subject of Research: ‘Inefficient Budget Spending: Causes and Remedies’

Major tasks: Collecting and analyzing budget data of OECD countries

Research Assistant for Prof. Jinbang Kim 9/2001-8/2003

Subject of Research: ‘The Chaebol of Korea: DB construction, analysis and evaluation’

Major tasks: Collecting and analyzing the ownership structure of the Korean Chaebol Companies

Teaching Assistant in the Dept. of Economics, Graduate School, Inha University, Incheon, Korea 9/2001-8/2003

Major tasks: Evaluation of students’ assignments and examination

Publications

Greene, D.L., Liu, C. and Park, S. and “Transition from Petro-Mobility to Electro-Mobility”, Transition to Renewable Energy. 3rd International Conference on Energy Process Engineering 2013 (forthcoming). 6/2013

Greene, D.L. and Park, S. “Analyzing the Transition to Electric Drive in California”, Howard H. Baker, Jr. Center for Public Policy, The University of Tennessee, Knoxville, Tennessee 2012

Greene, D.L., Park S. and Liu, C. “LAVE-Trans Model Documentation”, Howard H. Baker, Jr. Center for Public Policy, The University of Tennessee, Knoxville, Tennessee 2012

Kim, Sung-Teak and Sangsoo Park, [*“A Survey for Practical Usage of IT Workforce”*](#), Ministry of Information and Communication of Korea 5/2005

Jeong, Insoo and Sangsoo Park, [*“A comprehensive Study on the Unemployment Measures for the Youths in the Busan Area”*](#), Korea Labor Institute 1/2004

Park, Sangsoo, “An Empirical Study of Corporate Ownership Structure relative to Corporate Performance in the Largest Korean Chaebol Companies”, M.A. thesis, Department of Economics, Inha University 8/2003

Chang, Seh-Jin and Sangsoo Park, *“Inefficient Budget Spending: Causes and* 7/2003

Remedies", National Assembly of Korea

Kim, Jinbang and Sangsoo Park, "*The Chaebol of Korea: DB construction, Analysis and evaluation*", Institute of Business and Economic Research, Inha University 5/2003

Park, Sangsoo and Jinbang Kim, "*The ownership structure and performance of Korean business groups*" 3/2003

Working Papers and Works in Progress

"Market share and Willingness to Pay for Hybrid Electric Vehicles in the U.S. Auto market"

"Welfare Effects of Introducing Novel Products in the Market: A case of Hybrid Electric Vehicles"

"Effects of Permanent and Temporary Exchange Rate Changes on Firm Value: A firm-level approach"

Honors and Scholarships

J. Fred and Wilma D. Holly Scholarship (University of Tennessee)	Fall 2008 - Present
Graduate Research Assistantship (University of Tennessee)	Fall 2010 - Present
Graduate Teaching Assistantship (University of Tennessee)	Fall 2009 - Spring 2010
Graduate Research Assistantship (University of Tennessee)	Fall 2008 - Spring 2009
Graduate Teaching Assistantship (Inha University)	2 nd Sem. '01-1 st Sem. '03
Honor student Scholarship & Selected as an honor student (Inha University)	2 nd Sem. '00 – 1 st Sem. '01
Selected as an honor student (Inha University)	2 nd Sem. '99
Honor student Scholarship (Inha University)	2 nd Sem. '96 – 1 st Sem. '97

Activities

<i>President, Korean Graduate Student Association, University of Tennessee</i>	6/2010 – 6/2011
<i>Coordinator, Korean Graduate Student Association, University of Tennessee</i>	6/2009-5/2010
<i>Vice President, Korean Student Association, North Carolina State University</i>	6/2007-5/2008
<i>Mentor, Academic Fair, Department of Economics, Inha University</i>	5/2002
Presentation title: 'Privatization of Public Enterprises in Korea'	
<i>Lecturer, Academic Fair, Department of Economics, Inha University</i>	5/2001
Presentation title: 'Evaluation of Chaebol Reform Policies in Korea'	
<i>Executive Committee member of the student association, Department of Economics, Inha University</i>	3/1995-2/1997

Computer Skills

Proficient in MS Office (Word, PowerPoint, Excel)
LATEX
Econometric Computer Programs (STATA, SAS, SPSS, MATLAB)



Europass Curriculum Vitae

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 Date of birth April 30, 1981
 Gender Male



Work experience

Dates	Since September 2012
Occupation or position held	Managing Director
Main activities and responsibilities	Research light-duty & heavy-duty vehicle technologies, project & office management
Name and address of employer	ICCT – International Council on Clean Transportation Europe (Berlin / Brussels)
Type of business or sector	Non-profit research organization
Dates	December 2009 – August 2012
Occupation or position held	Senior Researcher
Main activities and responsibilities	Research light-duty & heavy-duty vehicle technologies, project management
Name and address of employer	ICCT – International Council on Clean Transportation (Washington DC, USA)
Type of business or sector	Non-profit research organization
Dates	July 2006 – December 2009
Occupation or position held	PhD student
Main activities and responsibilities	Development of VECTOR21 computer model, assessing future vehicle technology markets
Name and address of employer	DLR – German Aerospace Centre, Institute of Vehicle Concepts (Stuttgart, Germany)
Type of business or sector	Research organization
Dates	June 2004 – December 2009
Occupation or position held	Environmental Engineer
Main activities and responsibilities	Emission modelling (TREMOVE, etc.), Corporate Sustainability Report, vehicle data management
Name and address of employer	Daimler AG (Stuttgart, Germany)
Type of business or sector	Vehicle manufacturer

Education and training

Dates	September 2006 – December 2009
Title of qualification awarded	Dr.-Ing.
Principal subjects/occupational skills	Automotive Engineering (PhD)
Name and type of organisation providing education and training	University of Stuttgart (Germany)
Dates	October 2003 – April 2004
Title of qualification awarded	Dipl. chem. oec.
Principal subjects/occupational skills	Chemistry and Economics (Diploma / Master's equivalent)
Name and type of organisation providing education and training	University of Ulm (Germany)

Personal skills and competences

Mother tongue(s) **German**

Other language(s) **English, French, Spanish, Turkish, Russian**

Self-assessment

European level ()*

English

French

Spanish

Turkish

Russian

Understanding				Speaking				Writing	
Listening		Reading		Spoken interaction		Spoken production			
C2	Proficient user	C2	Proficient user	C1	Proficient user	C1	Proficient user	C2	Proficient user
B1	Independent user	B1	Independent user	A2	Basic user	A2	Basic user	B1	Independent user
A2	Basic user	A2	Basic user	A1	Basic user	A1	Basic user	A2	Basic user
A1	Basic user	A1	Basic user	A1	Basic user	A1	Basic user	A1	Basic user
A1	Basic user	A1	Basic user	A1	Basic user	A1	Basic user	A1	Basic user

(*) [Common European Framework of Reference for Languages](#)

Computer skills and competences MS Office incl. Access, Oracle Apex, PL/SQL, HTML

Other skills and competences Emission modelling: TREMOD (Germany), TREMOVE, HBEFA, COPERT, RAINS, GAINS, iTREN2030 (all Europe), MOVES, VISION (all U.S.)

Additional information

List of publications and presentations see www.xing.de or upon request

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Experience

Policy Analyst, International Council on Clean Transportation, San Francisco CA **May 2007-present**

- Conduct research on vehicle fuel economy/GHG emissions reduction regulations and policy measures in world's top vehicle markets, write reports, technical papers and policy briefs on a global or regional context
- Conduct quantitative studies on regional vehicle databases to analyze trends in vehicle fuel economy and efficiency technologies
- Co-lead light-duty vehicle fuel efficiency work in China, regularly communicate with regulators and stakeholders to understand policy windows, provide instant technical support to regulatory agencies, prepare formal comments to policy proposals, organize workshops that support policy development
- Manage and supervise interns on a variety of research projects, support program director to develop annual program goals, plans and budget

Policy Intern, County of San Diego Air Pollution Control District, San Diego CA **June-August 2006**

- Reviewed and researched fugitive dust emissions control policies and regulations of Californian counties
- Evaluated feasibilities and measures for local fugitive dust emissions control
- Prepared draft rule to control fugitive dust emissions in the San Diego county

Policy Intern, Resources For the Future, Washington DC **June-August 2005**

- Reviewed literatures on air quality control policy instruments, especially on emissions trading
- Interviewed regulators from US EPA and Chinese central and local environmental agencies and researchers on power plant emissions control, conducted case studies on Chinese provincial and regional air pollution control measures and evaluations
- Drafted a research paper on policy measures to improve air quality of urban cities in China

Education

Master of Public Affairs, University of Texas at Austin **December 2006**

GPA: 3.75/4.0

Thesis: China's Economic Development and Environmental Pollution Accidents

Key courses: Public Administration and Management, Policy Development, Public Financial Management, Urban Economy Development Policy, Environmental Economics, Advanced Policy Economics, Applied Quantitative Analysis

Bachelor of Law/Economics (Dual degree), Peking University **July 2001**

Skills

- Fluent in English and Mandarin
- Experienced researcher and analyst of vehicle fuel economy and emissions control regulations and policies, strong knowledge in fiscal incentive policies, knowledge in vehicle efficiency and emissions control technologies

- Solid quantitative and analytical skills, experienced analyst of large vehicle database, ability of economic modeling and statistical analysis
- Proficient with MS Word, Excel, PowerPoint, familiar with SAS, experience of STATA

Publications

- He H., and Tu J., "The New Passenger Car Fleet in China: Technology Assessment and International Comparisons", Report, International Council on Clean Transportation, 2012
- Maxwell R., He H., "In-use Testing for CO₂ and Fuel Economy in the United States", Working paper, International Council on Clean Transportation, 2012
- Fung F., He H., Sharpe B., Kamakate F., and Blumberg K., "Overview of China's Vehicle Emissions Control Program (中国机动车排放控制措施评估)", Report, International Council on Clean Transportation, 2011
- He H. and Bandivadekar A., "A Review and Comparative Analysis of Fiscal Policies Associated with New Passenger Car CO₂ Emissions, Report, International Council on Clean Transportation, 2011
- He H., Fung F., "CAFE Data Collection and Verification", Working paper, International Council on Clean Transportation, 2010
- An F., Gordon D., He H., Kodjak D., and Rutherford D., "Passenger Vehicle Greenhouse Gas and Fuel Economy Standards: A Global Update", Report, International Council on Clean Transportation, 2007

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Experience

Senior Researcher and Aviation Lead, International Council on Clean Transportation May 2007 – present

Served as the ICCT's program lead for aviation and country lead for Japan. Prepared technical reports analyzing international best practices in promoting fuel-efficient light and heavy-duty vehicles, reducing heavy-duty emissions, and controlling the climate impact of aircraft. Participated as a technical observer to the Civil Aviation Organization's (ICAO) environmental working groups. From 2010 to 2011, co-lead ad hoc group responsible for developing certification procedures to support an ICAO CO₂ standard for new aircraft. Oversaw consulting projects for government agencies on aviation emissions, including Argonne National Lab and the European Aviation Safety Administration.

Senior Engineer, Transportation and Energy Systems, TIAX LLC July 2006 – April 2007

Supervised technical assessments of clean transportation technologies, including electric drive and hydrogen fuel cell vehicles

Research Assistant, National Economic & Social Development Board, Royal Thai Government June – Aug 2000

Advised the Royal Thai Government under Dr. Douglas Webster, NESDB Senior Urban Advisor

NSF Undergraduate Research Assistant, Department of Chemistry, University of California at Riverside June 1995 – Aug 1995

Conducted research related to aerosol particulates emitted from Southern California pyrotechnic displays

Education

Doctor of Philosophy Sept 2000 – Sept 2006

Stanford University, Department of Civil and Environmental Engineering

Fulbright Graduate Research Fellow Sept 2002 – Dec 2003

Kyoto University, Department of Civil Engineering Systems

Master of Science Sept 1999 – June 2000

Stanford University, Department of Civil and Environmental Engineering

Bachelor of Arts Sept 1992 – June 1996

University of Minnesota at Morris, Department of Chemistry

Publications and Reports

- Minjares, R.; Rutherford, D. An Integrated Policy Strategy for Maximizing Co-benefits of Light-Duty Dieselization in Asia. Edited by Zusman, E.; Srinivasan, A.; and Dhakal, S.; Earthscan Press. 2012.
- Economon, T.; Copeland, S.; Alonso, J.; Zeinali, M.; Rutherford, D. Design and Optimization of Future Aircraft for Assessing the Fuel Burn Trends of Commercial Aviation. 49th Aerospace Sciences Meeting of the American Institute of Aeronautics and Astronautics (AIAA). Orlando, Florida. 4 to 7 January 2011.
- Rutherford, D.; Zeinali, M. "Efficiency Trends for New Commercial Jet Aircraft: 1960 to 2008." International Council on Clean Transportation. November 2009.
- Rutherford, D.; Ortolano, L. Air Quality Impacts of Tokyo's On-Road Diesel Emissions Regulations. *Transportation Research D: Transport and Environment*. 2008, **4**, 239-254.
- Walsh, M.; Kodjak, D.; Rutherford, D. "A Model Regulatory Program For Reducing Exhaust and Evaporative Emissions From Heavy-Duty Vehicles and Engines." International Council on Clean Transportation. October 2007.
- An, F.; Gordon, D.; Hui, H.; Kodjak, D.; Rutherford, D. "Passenger Vehicle Greenhouse Gas and Fuel Economy Standards: A Global Update." International Council on Clean Transportation. July 2007.
- Liu, D.Y.; Rutherford, D.; Kinsey, M.; Prather, K.A. Real-Time Monitoring of Pyrotechnically Derived Aerosol Particles in the Troposphere. *Anal. Chem.* 1997, **69**, 1808-1814.

Other Papers

- "Observations on Analysis of Mission Fuel Metrics." CAEP WG3, Gilbert, Arizona. CAEP/09-WG3-CO2-8-Flimsy06. February 15, 2011.
- "Recommended Fuel Efficiency Metric for an ICAO Aircraft CO₂ Standard." CAEP WG3, Gilbert, Arizona. CAEP/09-WG3-CO2-8-WP08. February 14, 2011.
- "Update on ICSA Work on Metrics." CAEP WG3 Cluster Metrics Workshop, Atlanta, Georgia. January 26, 2012.
- "Certification of a Mission Fuel-Based CO₂ Metric." CAEP WG3, London, England. CAEP/09-WG3-CO2-7-WP12. November 9, 2011.
- "Projection of Aviation Energy Use and Related Characteristics." Consultant report to Argonne National Laboratory, October 31, 2011.
- "An Environmentally Effective Metric System." ICAO Committee on Environmental Protection (CAEP) Steering Group, Beijing, China. CAEP/09-SG/20112-WP/18. September 13, 2011.
- "Perspectives on Systems Modeling." CAEP WG3, Hartford, Connecticut. CAEP/9-WG3-CO2-6-IP19. July 20, 2011.
- "An Environmentally Effective Metric System." CAEP WG3, Hartford, Connecticut. CAEP/9-WG3-CO2-6-WP10. July 19, 2011.
- "Supplemental ICSA Perspectives on the Metrics Workshops." CAEP WG3, Geneva, Switzerland. CAEP/09-WG3-CO2-5-Flimsy/3. May 26, 2011.
- "Sensitivity Test for Importance of EO Symmetry on Correlating Parameters." CAEP WG3 Metrics Workshop, Geneva, Switzerland. May 23, 2011.
- "Analysis of Technology Strategies and Notional Limit Margins for Candidate CPs." CAEP WG3 Metrics Workshop, Geneva, Switzerland. May 23, 2011.

“The Implications of MTOW Outliers for Metric Assessment.” CAEP WG3 Metrics Workshop, Bonn, Germany. May 3, 2011.

“Comparison of Historical Trends of Efficiency Improvements at Various Evaluation Options.” CAEP WG3 Metrics Workshop, Bonn, Germany. May 3, 2011.

“Report of the Certification Procedures ad-hoc Group.” CAEP WG3, Savannah, Georgia. CAEP/09-WG3-CO2-4-WP13. March 3, 2011.

“The Purpose of a CO₂ Standard.” ICAO Committee on Environmental Protection (CAEP) Steering Group, Toulouse, France. CAEP/09-SG/20101-WP/23. November 9, 2010.

“Test Cycles Used in Vehicle Efficiency Standards.” CAEP WG3, Geneva, Switzerland. CAEP/09-WG3-CO2-3-WP/16. September 20, 2010.

“Mass as a ‘What is Transported’ Term in Efficiency Standards.” CAEP WG3, Geneva, Switzerland. CAEP/09-WG3-CO2-3-WP/11. September 20, 2010.

“What Is Transported (WIT) Subteam Final Report.” CAEP WG3, MAPah group, August 26, 2010.

“Speed Subgroup Final Report.” CAEP WG3, MAPah group, August 26, 2010.

“Comparing the Environmental Effectiveness of Candidate Metrics and Test Points.” CAEP WG3, Florence, Italy. CAEP/09-WG3-WP/2-18. June 9, 2010.

“Data Needed to Support WG3 CO₂ Standard Modeling.” CAEP WG3, Atlanta, Georgia. CAEP/09-WG3-WP/1-9. March 17, 2010.

“Trends in Aircraft Efficiency and Design Parameters.” CAEP WG3, Atlanta, Georgia. CAEP/09-WG3-WP/1-10. March 17, 2010.

“Applicability of a CAEP/9 CO₂ Standard for New Aircraft.” CAEP/8. Montreal, Canada. CAEP/8-WP/66. February 3, 2010.

“Thresholds on a CAEP/9 CO₂ Standard for New Aircraft.” CAEP/8. Montreal, Canada. CAEP/8-WP/67. February 3, 2010.

“Historical Efficiency Trends for Newly Delivered Aircraft.” CAEP WG3, Montreal, Canada. CAEP/08-WG3-IP/7-5. September 29, 2009.

“Draft ICSA Research Priorities on Aircraft Design and a CAEP/9 CO₂ Standard.” CAEP WG3, Montreal, Canada. CAEP/08-WG3-IP/7-6. September 29, 2009.

“A Critical Year.” Special Section on Aviation Alternative Fuels, ICAO Journal. Vol. 64, No 4.

“Guidance on WG3 Scoping Analysis on a Potential CO₂ Standard for New Aircraft.” ICAO Committee on Environmental Protection (CAEP) Steering Group, Salvador, Brazil. CAEP/08-SG/20093-WP/43. June 25, 2009.

“Characterizing the CO₂ Intensity of Commercial Aircraft under a Potential Airframe Standard.” CAEP WG3, London, UK. April 1, 2009.

“NGO Views on Necessary Elements of a GIACC Proposal on GHG Emissions from International Aviation.” Group on International Aviation and Climate Change (GIACC), Montreal, Canada. February 17, 2009.

Honors and Awards

Shorenstein Asia-Pacific Research Center Takahashi Fellow (2005).

Stanford IIS/Japan Fund Graduate Fellow (2003).

Japan Economic Foundation/IIE Fulbright Graduate Fellow (2002).

Stanford Graduate Fellowship in Science and Engineering (1999 – 2001).

US EPA Science to Achieve Results (STAR) Fellowship (1999 – 2001).

Japanese National Language Proficiency Test, Level I Designation (1999).

Selected Presentations

- “Ready for Takeoff? The Race to Develop a Global Framework on Aviation GHGs.” University of California – Davis ITS seminar. March 9, 2012
- “Historical and Projected Energy Intensity for New Aircraft, 1990 – 2050.” Argonne National Laboratory. October 17, 2011
- “Status of Efforts on HD Efficiency in Other Countries/Regions.” Meeting on Potential Harmonization of Heavy-Duty Fuel Economy/GHG Regulations. MLIT Headquarters, Tokyo, Japan. January 31, 2011.
- “US Fuel Economy/GHG Standards for Motor Vehicles.” Waseda University, January 12, 2011.
- “ICCT’s Aviation Program and Work on an ICAO CO₂ Standard.” US EPA Mobile Source Technical Review Subcommittee. May 4, 2010.
- “The Role and Design of a CO₂ Standard for New Aircraft.” 2degrees Webinar. April 14, 2010.
- “Emerging Policies to Control Aviation Emissions.” 2009 Haagen-Smit Symposium. California Air Resources Board, June 2, 2009.
- “Emerging Policies to Control the Climate Impact of Commercial Aviation.” Department of Aeronautics & Astronautics, Stanford University. May 12, 2009.
- “The Role of Aviation Alternative Fuels in Climate Change Mitigation.” Workshop on Aviation Alternative Fuels. International Civil Aviation Organization, Montreal, Canada, February 10, 2009.
- “Overview of HD Emissions and Efficiency Projects.” National Traffic Safety and Environment Laboratory, Tokyo, Japan. January 7, 2009.
- “An Integrated Policy Strategy for Maximizing Co-Benefits of Light-Duty Dieselization in Developing Asia.” Institute for Global Environmental Strategies. Hayama, Japan, January 5, 2009.
- “Passenger Vehicle Fuel Efficiency Standards in Asia: the Risks of Regulating by Weight.” Better Air Quality – Asia 2008. Bangkok, Thailand, November 12, 2008.
- “Aviation and Climate Change: Impacts and Mitigation.” Flying in a Carbon-Constrained World: Aviation’s Role in Oil Dependence and Climate Change, University of Puget Sound, April 25, 2008.
- “International Best Practices in Controlling Light and Heavy-Duty Vehicle Emissions.” Department of Civil Engineering, University of Hong Kong, November 7, 2007.
- “Urban Transport and Climate Change: A Global Perspective.” Global Warming and the City of Sao Paulo: Causes & Effects. (Sixth Municipal Conference on Cleaner Production). Sao Paulo, Brazil. August 22, 2007.
- “Policy Options for Hydrogen Fuel Cell Vehicles and Infrastructure.” DoE 2010-2025 Scenario Analysis for Hydrogen Fuel Cell Vehicles and Infrastructure, January 31, 2007.
- “The Implications of California’s Alternative Fuels Strategy for Electric Drive Technologies.” Electric Utilities Environmental Conference, January 24, 2007.
- “Recent Developments in the Regulation of Diesel Pollution in Japan.” Regional Science Council Speaker Series, US EPA Region Nine, February 21, 2006.

KATHERINE BLUMBERG
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SUMMARY OF QUALIFICATIONS

- Fourteen years experience doing research, writing, and advocacy on urban environmental issues, with a focus on transportation, air quality, and climate change.
- Strong technical and engineering skills and ability to effectively communicate complex scientific concepts.

EDUCATION

M.S., Civil and Environmental Engineering, University of California, Berkeley, CA	May 2004
M.S., Energy and Resources Group, University of California, Berkeley, CA	May 2004
B.A., American Studies, Wesleyan University, Middletown, CT	May 1992

PROFESSIONAL EXPERIENCE

2004–present	International Council on Clean Transportation, San Francisco, CA Global Programs Director & Mexico Lead From inception to a staff of 25, helped to build a non-profit organization that provides technical expertise and policy-making assistance to governments throughout the world. <ul style="list-style-type: none">• In charge of global programs researching transportation's impact on climate and human health and tracking transportation policies worldwide.• Have worked in China, India, Brazil, Colombia, and Mexico on fuel quality standards and passenger and heavy-duty vehicle emissions and fuel economy standards.• Currently working with to help government agencies in Mexico develop four separate regulatory programs for fuel quality, passenger vehicle fuel economy, heavy-duty engine emissions, and heavy-duty vehicle fuel efficiency.
2002–2004	The William and Flora Hewlett Foundation, Menlo Park, CA Consultant Wrote technical and policy papers on new transportation technologies and fuels. Provided rapid-response analysis on emerging issues.
2003–2004	University of California, Berkeley, CA Graduate Student Instructor and Researcher In the Energy and Resources Group and Civil and Environmental Engineering Department.
2001–2003	California Public Utilities Commission, San Francisco, CA Graduate Student Researcher Provided analysis of energy efficiency proposals and programs, solar incentive programs and large electricity transmission project. Staffed the Self-Generation Working Group.
1998–2001	Delta Institute, Chicago, IL Associate Managed the environmental quality program, targeting clean up and better management of the great lakes. Worked with local community groups in Chicago and Detroit to plan pollution prevention projects and air toxics monitoring and clean up efforts.
1996–1998	University of Chicago Cancer Research Center, Chicago, IL Project Coordinator Developed and led research efforts, interventions, and outreach projects on cancer and nutrition for adolescents, patients and at-risk groups.
1992-1995	Safe Place, Austin, TX Children's Activity Specialist Designed children's therapeutic group program and coordinated and supervised a large volunteer staff. Successfully developed and facilitated a bilingual parenting education/support group.

PRELIMINARY COST PROPOSAL

Task	Labor	Benefits	Subs, consultants	Travel	Overhead	Total
1: Enhancement of Existing Model	\$7000	\$2100	\$38842	\$6000	\$2428	\$56370
2: Model Peer Review	\$1500	\$450	\$22376	\$0	\$784	\$25110
3: Incorporate international policies	\$3500	\$1050	\$25274	\$0	\$1175	\$30999
4: Innovative Incentives	\$3500	\$1050	\$25274	\$0	\$1175	\$30999
5: Electrification Metrics	\$2500	\$750	\$17970	\$0	\$653	\$21873
6: Project Report	\$5000	\$1500	\$46920	\$3000	\$2612	\$59032
Total	\$23000	\$6900	\$176656	\$9000	\$8828	\$224384

CARB portion= 90% of project total, \$201, 946

Cost-share portion= 10% of project total, \$22,438

The budget includes salary and benefits for key project staff at ICCT (equivalent of 46 days), as well as fees for subcontractors (David Greene -- 68 days, Sangsoo Park -- 132 Days, Chuck Shulock -- 72 days), and peer reviewers (9 days). The overhead costs include all equipment, copying and printing, mail/phone/fax charges, as well as any materials and supplies and miscellaneous charges.

Due to the relevance of the project to it's mission, the ICCT will leverage funding from the ClimateWorks Foundation to cost share 10 percent of the total costs of the budget. The total funding request from CARB is therefore \$224,384 - \$ 22,438 = **\$ 201,946 over a 30 month period**, inclusive of a six month period for CARB and RSC to provide comments on the draft final report and preparation of amended final report. The ICCT will also assume any costs associated with preparation and submission of a journal publication associated with the results of the proposed research.