THE CENTER FOR
CLIMATE STRATEGIES

March 6, 2015

George Hohmann
Contract and Purchasing Manager
Metropolitan Washington Council of Governments
777 North Capitol Street, NE, Suite 300
Washington, DC 20002

Subject: WASHCOG Request for Proposal: Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region, RFP No. 15-010

Dear Mr. George Hohmann,

The Center for Climate Strategies, Inc. (CCS), along with a highly qualified team of local, regional, and national experts, respectfully submits the accompanying proposal to the Metropolitan Washington Council of Governments (COG) in response to Request for Proposal entitled, "Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region" As requested, enclosed are one (1) original, five (5) printed copies, and one (1) USB drive of CCS' proposal. CCS acknowledges and accepts the terms and conditions of the RFP and the subsequent amendment.

CCS will act as the prime contractor to fulfill all of the services outlined in the RFP. The rest of the CCS Team includes Cambridge Systematics (CS), Dr. David von Hippel (independent subcontractor), KB Environmental (KBE), Johnson Consulting Group, and Sage Energy. The last 3 of these subcontractors are COG-certified Disadvantaged Business Enterprises (DBEs). Certification forms are provided in Attachment C.

CCS is a public purpose, nonpartisan, nonprofit 501(c)(3), partnership organization that is funded by private foundations, donors, and governments at the program and project levels. Since 2004, CCS has provided consulting services in over 40 States in the US, the border states of Mexico, and Canadian and Chinese provinces, and municipalities of Ukraine and the Philippines. CCS specializes in comprehensive planning, baselines, and integrated micro- and macroeconomic analysis of economy-wide, clean energy, climate mitigation, and renewable and energy efficient policies, technologies, and best practices that can be designed and financed in ways to improve energy security and positive environmental and economic outcomes. Through our work, we have developed extensive expertise as well as tools, databases, and modeling techniques that can be used to support work under each of the five Support Areas for which we are submitting a proposal. CCS is proposing to include its key subcontractors on each of the five support areas that have supported CCS on prior projects that involve experience related to the scope of work for each area.

Should there be any technical questions regarding this proposal, Mr. Tom Peterson, CCS President and CEO, may be contacted at (202) 293-4591 or via email at tpeterson@climatestrategies.us. Contractual or cost matters should be directed to our Financial Assistant, Ms. Cecilia Sutter at (202) 293-4599 (office) or via email at csutter@climatestrategies.us.

Sincerely,

Thomas D. Peterson
President and CEO

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Multi-Sector Greenhouse Gas Mitigation

Executive Summary

In October, 2014, at a joint meeting of Metropolitan Washington Air Quality Committee (MWAQC) and the Climate, Energy and Environmental Policy Committee (CEEPC), the members of these two committees asked that MWAQC and the North Capital Region Transportation Planning Board (TPB) affirm support for the Metropolitan Washington Council of Governments' (COG's) existing regional greenhouse gas emission reduction goals. They also asked that COG convene a multi-sector, multi-disciplinary professional working group to identify implementable local, regional and state actions in four sectors (Energy, Transportation, Land Use, Built Environment) and quantify benefits, costs, co-benefits, and implementation timeframes, and to consider exploration of greenhouse gas (GHG) reduction goals, measures and/or targets for all sectors.

In December 2014, MWAQC and TPB affirmed the Region's greenhouse gas (GHG) reduction goals adopted by COG and committed staff and resources to support the multi-sector, multi-disciplinary professional working group convened by COG. In January 2015, COG convened a Multi-Sector Working Group (MSWG) consisting of transportation, land use planning, and energy/environmental professional staff from COG's member jurisdictions. The MSWG is being facilitated by COG's Deputy Executive Director, with staff support from subject matter experts in transportation, environment, energy and land use.

The MSWG is charged with the following objectives:

1. Identifying viable, implementable local, regional, and state strategies for reducing GHGs in each of the four sectors (Energy, Transportation, Land Use, and the Built Environment).
2. Analyzing and quantifying the benefits, costs, co-benefits and implementation timeframes of these GHG reductions strategies.
3. Exploring specific GHG emission reduction goals, measures and/or targets for the four sectors.
4. Jointly developing an action plan for the region.

The Center for Climate Strategies (CCS) has assembled a locally organized Team supported by national experts to assist COG and the MSWG meet the objectives listed above. The CCS Team will provide both the technical and facilitative support needed to prepare a Technical Report that quantifies the benefits, costs, and co-benefits of implementable GHG reduction strategies in each of four sectors: Energy Supply; Transportation; Land Use; and Built Environment. With support from the CCS Team, the strategies will be developed by the MSWG in three different subgroups: Land Use, Transportation, and Energy/Environmental.

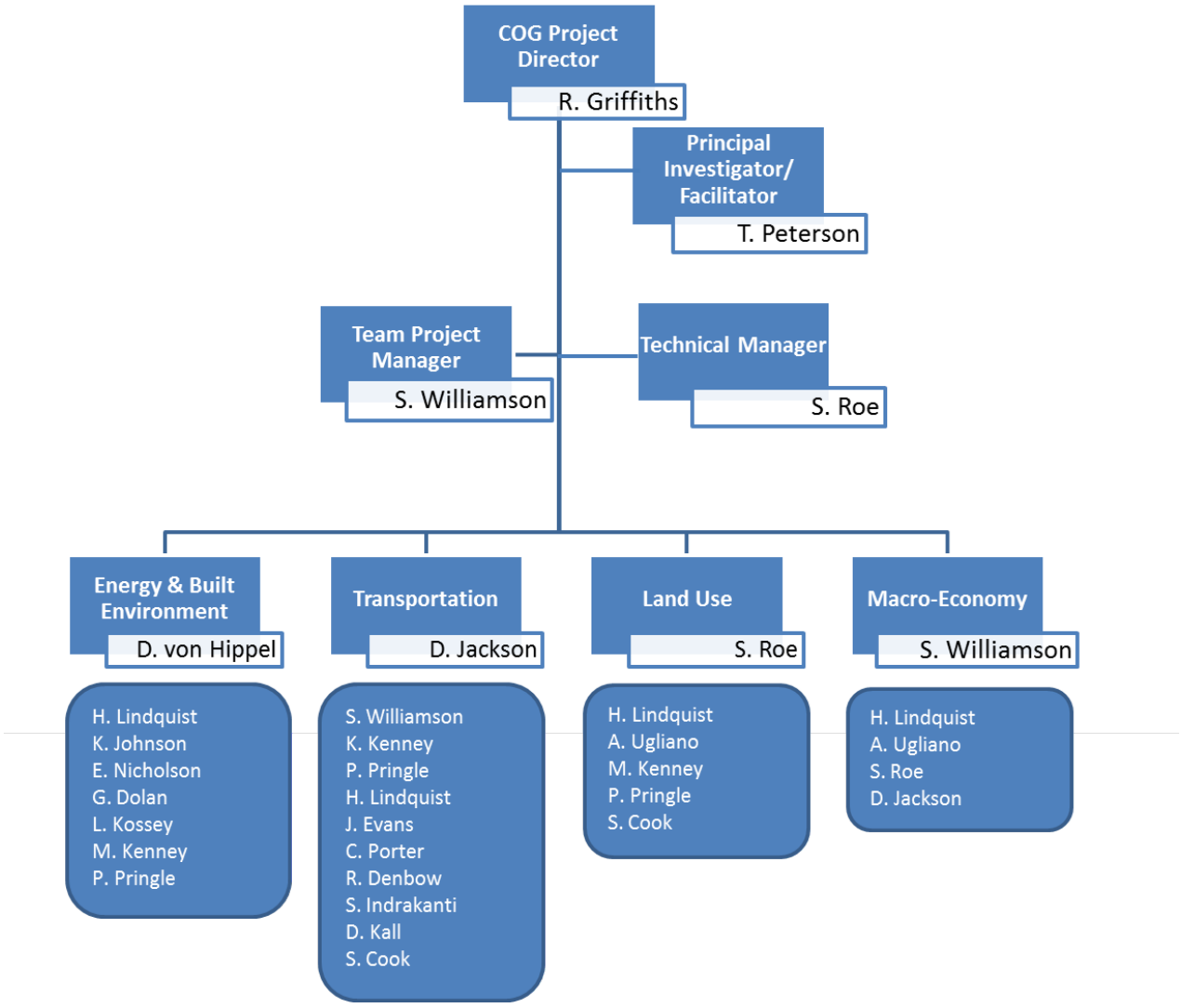
The CCS Team consists of the Center for Climate Strategies as the prime contractor, Cambridge Systematics (CS) as the lead technical support firm for the Transportation sector, Dr. David von Hippel (independent subcontractor) as the lead technical support analyst for the Energy Supply and Built Environment sectors, the Johnson Consulting Group and Sage Energy will support technical analysis of strategies for the built environment, and KB Environmental (KBE) will provide technical support across sectors on GHG baseline construction and micro-economic analysis of mitigation strategies.

Chapter 1 provides a summary of the qualifications of the CCS Team members including key staff experience and summaries of recent relevant projects. Resumes of key staff are provided in Attachment A. Chapter 2 provides a technical approach to each of the tasks outlined in the RFP. Chapter 3 contains suggested revisions to the project schedule, a summary of the level of effort by staff and task, and a discussion on optional approaches and tasks, including the associated cost impacts. The Cost Estimate for addressing the scope of work in the RFP is provided in Attachment B. Chapter 4 provides references for each CCS Team member. Attachment C provides certifications for the DBE members of the CCS Team.

Chapter 1. Qualifications of the CCS Team and Personnel

The CCS Team assembled for this project includes: the Center for Climate Strategies as the prime contractor; Cambridge Systematics (CS), as the Transportation Sector technical lead; Dr. David von Hippel, as the Energy Supply and Built Environment sectors technical lead; the Johnson Consulting Group and Sage Energy to provide additional technical support for the Built Environment sector (Tasks 4 and 6); and KB Environmental who will provide additional technical assistance across sectors in baseline construction and strategy analysis. Figure 1-1 below provides an organizational chart for the CCS Team, including the key staff assigned to the project. CCS, CS, and KBE all worked together on a recent regional GHG baseline project for the South Jersey Transportation Planning Organization (SJTPO). The level of effort anticipated for all project staff and their expected availability during the key months of the project are both addressed in Chapter 3.

Figure 1-1. Project Organizational Chart



The Center for Climate Strategies

CCS helps governments and their stakeholders address energy, economic, and environmental issues by fostering consensus-based actions through collaboration and advanced technical assistance. Since 2004, CCS has partnered with over 40 U.S. states, territories (as well as Mexican states and Canadian provinces and municipalities of Ukraine and the Philippines), dozens of local government officials, and over 1,500 stakeholders through high-level, high visibility projects to address complex and difficult issues related to energy, climate change and economic development. CCS worked with over 20 US states (including New Jersey[1], New York, Maryland and Pennsylvania), the six northern Mexican Border States and local planning agencies such as the Southern California Association of Governments (SCAG) to develop GHG emissions inventories and forecasts to support climate action planning and analysis.[2] CCS' proposed Co-Principal Investigator for this project, Mr. Stephen Roe, led the development of the North Jersey Transportation Planning Authority's (NJTPA's) regional inventory and forecast.[3] CCS, CS and KBE served on the contractor team that recently completed work on a regional GHG inventory for the South Jersey Transportation Planning Organization (SJTPO).[4] Based in Washington, DC, CCS is a public purpose, nonpartisan, nonprofit 501(c) (3), partnership organization that is funded by private foundations, donors and governments at the program and project levels.

Since 2005, CCS has supported state and local governments to develop GHG inventories and forecasts, formulate energy and climate action plans, and verify/validate the GHG emission/mitigation estimates of state and local government agencies. This includes work in over 40 states/provinces and local jurisdictions in the U.S., Mexico, Canada, China, Ukraine, and the Philippines. Since state and local partners are often interested in maintaining consistency with national inventory methods, CCS has gained substantial experience in how the national inventories are constructed for reporting to the United Nations Framework Convention on Climate Change (UNFCCC) as well as national (EPA) and regional (multi-state) standards in the US. Through work with NJTPA, SCAG, international local jurisdictions, and work on upcoming mitigation planning protocols with the World Resources Institute, CCS has gained expertise in how local level inventories should be constructed to best fit the needs of local planning agencies (e.g. municipalities, counties).

In providing local and state/provincial planning support, CCS gained considerable experience with communicating and presenting emissions data to planners in order to support analysis of mitigation actions across all source/sink sectors. The approaches used by CCS to communicate energy, land use, materials management and emissions data recognize the differing perspectives between local governments and state/national governments regarding energy/carbon footprints and appropriate actions for reducing emissions and improving energy and economic security. Our local inventory support includes the development of full energy-cycle estimates for fuel combustion sources and materials management, consumption-based emission estimates for sectors like electricity consumption and waste management, and extension of pollutant coverage to include criteria and toxic air pollutants, and complex land use change and resource use issues (including waste and water). GHG inventories prepared by CCS cover all source/sink sectors and Kyoto gases, and in 13 states, have also covered black carbon (another pollutant with positive climate-forcing potential).

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[1] For NJ, CCS developed the first state-wide inventory and follow-on GHG mitigation planning technical assistance.

[2] The SCAG inventory and forecast report and Climate and Economic Development Final Reports can be found on SCAG's Sustainability website at: http://sustain.scag.ca.gov/Pages/Documents.aspx.

[3] NJTPA GHG Inventory and Forecast home page: http://www.njtpa.org/Planning/Regional-Studies/Recently-Completed-Studies/Region-wide-Greenhouse-Gas-Emissions-Inventory-Pro/RegionalGreenhouseGasInventory.aspx

[4] See the following link to a summary and the final GHG inventory report: http://www.sjtpo.org/onthego.html#GreenhouseGas

Members of CCS' staff also have significant background in air quality management. Work includes years of assistance to US EPA, States and local areas on emissions inventory development, control strategy analysis, and cost analysis of new control programs. Relevant to this project is technical guidance developed for US EPA Office of Air Quality Planning & Standards on developing multi-pollutant emissions inventories addressing GHGs, as well as criteria and toxic air pollutants.

Key Staff (Project Role):

Thomas Peterson (Overall Project & Built-Environment Subgroup Facilitator)
Tom Peterson founded CCS in 2004 to help governments and stakeholders understand and formulate responses to climate change. Over the past decade, this included developing and implementing a widely recognized template for comprehensive, multi-objective, consensus-based planning and analysis that led to the development of 22 U.S. state plans, national scale up and integration of comprehensive sub national Climate Action Plans in the US, the Low Emissions Development Strategies (LEDS) for the six Border States of Mexico and municipalities of Ukraine, the Low Carbon Development (LCD) Planning and Analysis System for the Provinces of China, and the Green Growth program startup for the Democratic Republic of the Congo.

He has designed and directed numerous sub national and national policy development and capacity building initiatives and assessments in the US and abroad. He has collaborated with many national and regional philanthropies, government agencies, and other funding institutions to mobilize capacity for sub national, stakeholder based approaches to policy and agreements on progressive actions on climate change.

His posts over the past 33 years include Senior Advisor to the White House Climate Change Task Force, LEGIS Fellow to the Office of US Senator Joe Lieberman, Economist with the US Environmental Protection Agency, and Vice President of DSL Capital Corporation. Mr. Peterson is an Adjunct Professor and Teaching Fellow at the Center for Advanced Governmental Studies/Global Security Center at Johns Hopkins University, as well as the Energy and Climate Center at Johns Hopkins University. He is known for his expertise and innovations on climate policy development; climate, energy and economic security integration; and stakeholder consensus building.

Mr. Peterson holds a Bachelor of Science in Biology with a concentration in economics from the College of William and Mary, a Master of Environmental Management with a concentration in Natural Resource Economics and Policy from Duke University, and an MBA from the University of Texas at Austin with a concentration in Marketing and Product Development. He is a native and resident of Virginia.

Stephen Roe (Project Technical Manager & Land Use Subgroup Facilitator/Lead Analyst)
Stephen Roe is the Technical Program Manager at CCS. He has 29 years of experience in air quality and climate change consulting, environmental management, and process engineering. His areas of expertise include the development of emission inventories and forecasts for greenhouse gases/aerosols, toxic air pollutants, and criteria air pollutants. He also has extensive experience in control effectiveness and microeconomic analysis of mitigation programs covering all of these pollutants. Mr. Roe has provided technical support and facilitation of climate action planning projects in dozens of regions, states and provinces in the US, Canada, Mexico and China. Of particular relevance to this project is his management of a regional GHG baseline development project for the North Jersey Transportation Planning Authority, support on a similar project for the South Jersey Transportation Planning Organization and baseline development climate change mitigation analysis for the Southern California Association of Governments. He has facilitated the work of technical workgroups on dozens of action plans addressing the agriculture, forestry and other land use, and waste management sectors.

Mr. Roe leads the development of CCS' Action Planning Toolkit, a linked spreadsheet-based system for developing energy and GHG emissions baselines, assessment of policies/action responses (including multi-criteria assessment), goal setting, micro-economic analysis of action plan policies, integration of individual plan policy results into complete plan metrics, and interaction with macro-economic modeling techniques. He also leads CCS' aligned work in the development of a curriculum that covers action planning processes, GHG baseline development, policy selection and design, micro-economic analysis methods and macro-economic analysis. Mr. Roe is also an experienced greenhouse gas inventory and emission reduction project verifier with work covering California's mandatory reporting program, The Climate Registry, and the Climate Action Reserve. He holds a Bachelors Degree in Biology from Florida State University and a Masters Degree in Environmental Chemistry & Toxicology from California State University, Sacramento.

Scott Williamson (Project Manager & Macro-Economics Analyst)
Scott Williamson is a Program Management Officer for CCS. He specializes in the management of action planning projects, as well as technical work on transportation policy analysis and macroeconomic analysis. He has worked recently on a low-carbon development project for the city of Chongqing in China, in partnership with the Chinese Academy of Sciences, as well as on economic-impact analyses of clean-fuel standards for the states of Oregon and Washington. Prior to that, Mr. Williamson completed policy-design work and quantitative analysis in several climate action planning efforts. He also recently researched and developed emissions profiles for construction processes used in building major road projects. Beyond transportation and economics, his experience is wide-ranging, covering research and quantitative analysis of pension management and infrastructure finance strategies, as well as management of a strategic-communication and public-outreach effort on transportation issues at local and state levels. He holds a Master of Public Policy Degree in Environmental and International-Development Policy from Georgetown University, a Juris Doctor from the University of Illinois, and a B.A. in Political Science from the University of Chicago.

Holly Lindquist (Analyst: All Sectors)
Holly Lindquist has 13 years of experience in emission inventory development, verification, and policy analysis. Her emission inventory experience includes development of emission estimates, estimation methodologies, and emission factors, for criteria air pollutants (CAP), greenhouse gases (GHG), and hazardous air pollutants (HAP). Ms. Lindquist has developed inventories for many source sectors, including transportation; residential, commercial, and industrial (RCI) fuel use; industrial processes; fossil fuel industry; agriculture; forestry and other land use (FOLU); and waste management sectors. She has supported climate change stakeholder projects in both US and Mexican states by conducting research to support baseline and policy development, estimating costs and benefits for proposed mitigation policies, and supporting technical workgroup facilitation. Ms. Lindquist has also supported GHG inventory verification projects for 9 corporate reporters to North American emissions registries. She holds a Master of Science in Environmental Science and a Master of Science in Chemistry from the University of North Carolina at Chapel Hill, and a Bachelor of Arts in Chemistry from Transylvania University.

Dr. David von Hippel, Independent Consultant (Energy & Built Environment Lead Analyst)
David F. von Hippel, is an independent consultant who has been providing senior technical expertise to CCS for the development of climate action plans since CCS' beginning in 2004. In addition to his superior technical and analytical skills, he is also an experienced facilitator of work groups and especially skilled at communicating technical material in layman's terms. He has over 30 years of experience in the energy and environmental fields, including work on development of Climate Action Plans for numerous states and regions involving development and quantitative analysis of GHG emissions mitigation policies in the Residential, Commercial/Institutional, and

Industrial (RCII) sectors and in the Energy Supply sector. He has facilitated and/or provided analytical support to Technical Working Groups for RCI, Energy Supply, Energy Supply and Demand, on many projects, including in Montana, Washington (state), North Carolina, Arizona, New Mexico, Minnesota, and the Midwest (for the Midwestern Governors' Association). He also has worked extensively on development of cost-effectiveness analysis and related cost-curve preparation for energy- and GHG-saving measures in the RCII sectors in numerous jurisdictions and venues, including for Vermont, Utah, Hawaii, the Western Regional Air Partnership, the Northwest Energy Coalition, the State of Oregon, and the Energy Trust of Oregon. In addition, Dr. von Hippel has worked internationally for over 25 years, including energy analysis and planning at the national level (including energy efficiency and microeconomic analysis), utility integrated resource planning, demand-side management planning and related analysis, air pollution inventory development, and work on a host of other issues.

Cambridge Systematics

Cambridge Systematics (CS) is deeply committed to sustaining our environment and conserving natural resources – ensuring that a healthy environment and top quality transportation services go hand-in-hand. Our policy work with Federal, State, and regional agencies integrates sustainable energy and GHG mitigation considerations into agencies' strategic policy development, planning methods, and decision-making. Our extensive knowledge of transportation data sources and analysis methods supports robust analysis of energy and GHG impacts of transportation projects, policies, and programs – helping agencies identify the most effective strategies. We have led groundbreaking national research into GHG mitigation strategy effectiveness, such as the Moving Cooler study, which analyzed the effectiveness of nearly 50 GHG reduction strategies at a national scale, and the U.S. Department of Transportation (DOT) Report to Congress on Transportation's Role in Reducing U.S. GHG Emissions. CS has developed transportation energy and GHG emissions inventory and/or forecasts, reduction strategies, and implementation plans for agencies, including the Maryland and Oregon DOTs, the Massachusetts Department of Environmental Protection, NJTPA, SJTPO, the California Energy Commission, various regional agencies in California including Los Angeles Metropolitan Transportation Authority and the Metropolitan Transportation Commission, and others. Our expertise spans the passenger and freight sectors as well as traffic operations, demand management, land use, and vehicle and fuel technologies. We also have been working recently with the Georgetown Climate Center to help the northeast and mid-Atlantic regions understand GHG emissions trends in the transportation sector and to recognize the potential emission benefits and economic outcomes of different investment, pricing, and policy approaches.[5]

In 2010 and 2011, Cambridge Systematics led development of a comprehensive corridor vision for the Maryland Department of Transportation (MDOT) that integrates energy efficiency and emission reduction strategies from land use, land conservation, multimodal transportation, energy supply, and energy consumption to significantly reduce GHG emissions from the corridor across all emission sectors. The U.S. 40 Carbon Neutral Corridor project was conceptualized to support the objective of creating an example geographic area focused feasibility plan to

[5] A number of recent Cambridge Systematics supported publications, including the Transportation Energy Futures reports are available here for review: http://www.camsys.com/kb_pubs_enviro.htm

help Maryland improve air and water quality and significantly reduce its carbon footprint by 2035, and to achieve carbon neutrality in the long-term[6].

For more than 30 years, we have helped public and private sector clients address issues related to emissions from trucking, rail, air, and marine activity through developing innovative tools and strategies, and we are working now on the next generation of policies, programs, and planning tools to address these needs. We have provided technical assistance to the Federal Highway Administration (FHWA), the U.S. Environmental Protection Agency (EPA), States, metropolitan planning organizations (MPOs), and city agencies with respect to the development of emissions model inputs as well as the design of control measures to meet air quality standards.

Cambridge Systematics has already successfully worked on more than 11 projects using the Motor Vehicle Emission Simulator (MOVES) model to perform various tasks such as conformity analysis, evaluating emissions reduction strategies, and linking MOVES to existing transportation models. We are currently leading research for FHWA and NCHRP to improve inputs to the MOVES emissions model for both regional and project level analysis, and have assisted regional agencies in developing appropriate MOVES inputs.

Cambridge Systematics has been developing and applying travel demand forecasting models since our formation in 1972. Our modelers, analysts, and statisticians comprise the largest group of seasoned experts in the industry. Due to our expertise in travel demand and micro-simulation modeling we have the unique capability to link emissions models, including MOVES, to transportation models. CS has developed MOVES based air quality pre- and post-processors for travel demand models for many of the clients listed above. Cambridge Systematics is also currently using MOVES to evaluate changes in emissions resulting from highway operations strategies for the FHWA.

Cambridge Systematics has a wealth of experience working with transportation agencies in the Metropolitan Washington region to understand critical transportation needs, develop multimodal transportation strategies and plans to address these needs, and improve the strength of the tools required to understand the connection between transportation infrastructure and policy decisions to the performance of the transportation system. This experience includes on-going hands-on experience developing and applying the Transportation Planning Board (TPB) regional travel demand model. Multimodal transportation planning experience includes work with many of the major transportation agencies in the region, including MWCOG directly, as well as work with Maryland DOT, Maryland Transit Administration, District of Columbia DOT, DC Office of Planning, Fairfax County DOT, Northern Virginia Transportation Authority, Virginia Department of Transportation (VDOT), and Virginia Department of Rail and Public Transportation. Project examples include the I-66 Multimodal Study (VDOT), TransAction2040 Northern Virginia Regional Transportation Plan (Northern Virginia Transportation Authority), Fairfax County Bicycle Master Plan (Fairfax County DOT), Maryland Strategic Goods Movement Plan (Maryland DOT), DC DOT Right Size Parking Study, and currently as the on-call modeling consultant for the Transportation Planning Board.

[6] More details on the Carbon Neutral Corridor Study, including the final report, is available here: http://www.camsys.com/kb_cases_MDOT.htm

Key staff (Project Role):

David Jackson (Transportation Sector Facilitator & Lead Analyst)
David L. Jackson, AICP, is a Senior Associate of Cambridge Systematics with 14 years of experience in transportation planning, with emphases in air quality, travel modeling and performance measure analysis, short and long-range metropolitan area planning and project prioritization, and transportation system impacts on climate change. At CS, Mr. Jackson has served as a project manager or a technical lead on a diverse set of national, state, regional and corridor specific transportation planning projects. Mr. Jackson has led technical efforts with a diversity of states and regions to develop GHG emissions analysis and air quality planning and assessment tools including Oregon, Maryland, Los Angeles Metropolitan Transportation Authority, San Diego Association of Governments, North Jersey Transportation Planning Authority, South Jersey Transportation Planning Authority, Metroplan Orlando, and the Atlanta Regional Commission. Recently Mr. Jackson led work with Georgetown Climate Center developing a unique bottom-up transportation sector GHG emission inventory and forecast approach for the Transportation and Climate Initiative, resulting in the development of a flexible, user-friendly data tool estimating GHG emissions at the county, regional, state, and mega-region level for the mid-Atlantic and northeast states. Mr. Jackson also brings extensive experience working with transportation agencies in the Washington region, including work with Maryland Department of Transportation (MDOT), District Department of Transportation (DDOT), Virginia Department of Transportation (VDOT), Virginia Department of Rail and Public Transportation (DRPT), Fairfax County Department of Transportation, and recently directly with MWCOG as a lead analyst on the Regional Bus Parking Study. Prior to joining CS in 2008, Mr. Jackson led the model applications group at the Atlanta Regional Commission (ARC) - with responsibility for leading regional air quality conformity analysis, project prioritization, and regional scenario testing.

Jay Evans (Sr. Transportation Analyst)
Mr. Evans is a Principal of Cambridge Systematics with more than 17 years of experience. Mr. Evans has extensive project management, travel demand forecasting, and model development experience, including work with all of the major travel demand forecasting software packages. For example, he recently has served as Project Manager for the MWCOG/TPB Contract for Assistance in Travel Demand Forecasting and Application (Cube) and the Delaware Valley Regional Planning Commission (DVRPC) Travel Model Upgrade Project (VISUM). Mr. Evans also has served as Project Manager for the Durham-Chapel Hill-Carrboro (North Carolina) Nonmotorized Model Development Project (TransCAD). He serves as the Principal-in-Charge of the important NCHRP Project 8-61 – Travel Demand Forecasting: Parameters and Techniques. He also has strong travel demand model application experience, including as Project Manager on the Virginia DRPT's Transit General Planning Consultant contract, including the I-95/I-395 HOV/HOT Lane Transit/TDM Study, which had a significant and challenging travel demand and behavior forecasting element. For the acclaimed Traveler Response to Transportation System Changes Handbook update (TCRP Report 95 Series), Mr. Evans served as Co-Principal Investigator and as a lead or contributing chapter author to seven of the published volumes. He is a registered Professional Engineer in the District of Columbia, Maryland, and Virginia.

Christopher Porter (Sr. Transportation Analyst)
Christopher Porter is a Principal of CS with 18 years of experience in transportation and land use, air quality and greenhouse gas analysis, policy and program evaluation, and performance measurement. He is a nationally recognized expert in transportation GHG strategy analysis and emission estimation. He recently supported the Massachusetts DOT in estimating the GHG benefits of its five-year capital plan, and previously supported the

Commonwealth in developing a transportation GHG inventory and strategies to meet targets established under the Massachusetts Global Warming Solutions Act. Mr. Porter was a lead author of the USDOT Report to Congress on Transportation's Impact on Climate Change and Solutions which studied the potential fuel savings and air pollution reductions of transportation climate change mitigation strategies, as well as a major contributor to the Moving Cooler report which evaluated the nationwide potential effectiveness and costs of 50 GHG reduction strategies. Mr. Porter served as an advisor to a project for the North Jersey Transportation Planning Authority (NJTPA) to develop a regional GHG emissions mitigation plan and supported the development of a strategic plan for reducing emissions associated with freight movement in Connecticut. He has led national research projects on emission reduction methods and strategies, serving as Principal Investigator of National Cooperative Highway Research Program (NCHRP) 25-38 to develop guidelines on inputs to the MOVES model, and leading NCHRP 25-25 Task 59 to provide information on the interactions between transportation-related particulate matter, ozone, air toxics, climate change, and other air pollutant control strategies. In the D.C. region he has led research on the impact of TDM and transit on trip generation and parking needs in Fairfax County, evaluated TDM strategies for the I-66 multimodal corridor study, and is providing oversight to a project for D.C. DOT to develop a right-size parking tool.

Rich Denbow (Sr. Transportation Analyst)
Mr. Denbow recently joined Cambridge Systematics after working as the Director of Technical Programs at the Association of Metropolitan Planning Associations (AMPO) in various capacities for more than 14 years. At AMPO, Mr. Denbow provided technical, policy, and regulatory support to Metropolitan Planning Organizations (MPOs) for any and all issues related to surface transportation planning, including funding, performance based planning and programming, air quality, sustainability, livability, climate change, safety, management and operations, travel modeling, and MAP-21 implementation and reauthorization. Prior to AMPO, Mr. Denbow was a self-employed consultant for more than five years, and before that, a project manager for ICF Consulting, where he provided technical and policy consulting services to federal, state, and local clients in the areas of transportation, environmental, and air quality planning, including transportation conformity, mobile source programs, transportation control measure analysis, State Implementation Plan (SIP) development and voluntary emissions reduction programs.

David Kall (Transportation Analyst)
Mr. Kall is an Associate of CS with eight years of experience in the areas of transportation conformity, air quality analysis, and vehicle emissions modeling using both MOBILE6 and MOVES. He is the Deputy Project Manager of NCHRP Project 25-38, Input Guidelines for MOVES, which focuses on data sources and methods for developing local MOVES inputs. While at CS, Mr. Kall has supported numerous projects utilizing all versions of the MOVES model from the draft release in 2009 to the current version, MOVES2010b. He has supported several areas in transitioning from the MOBILE6 model to the MOVES model, including the Atlanta Regional Commission (ARC), Indianapolis MPO, Chattanooga TPO, and Florida DOT. As part of these efforts, he has redesigned air quality postprocessors to work with the structure of MOVES, prepared local MOVES inputs, conducted MOVES runs, and provided training on setting up and running MOVES. Finally, he has used MOVES in a number of research projects, including a Transit Cooperative Research Program project entitled “Assessing and Comparing Environmental Performance of Major Transit Investments” and an FHWA project that uses MOVES in project-level mode to understand the emissions impacts of highway operational strategies.

KB Environmental

KB Environmental Sciences, Inc. (KBE) specializes in providing air quality, noise, hazardous materials, climate change and health risk assessment services to a wide array of private and public clients located throughout the east coast and across North America. These services include (but are not limited to) climate action plans, impact mitigation strategy development and work with MOVES, NONROAD as well as other analytical tools. With an emphasis on transportation-related facilities, there are few companies with the level of expertise and breadth of experience in these highly technical fields. KBE has successfully completed such services for highway departments, planning agencies and private developers resulting in outcomes and products that are easily understood and applied. KBE is also a certified DBE firm in all 50 U.S. States and by the Metropolitan Washington Unified Certification Program.

Key staff:

Mike Kenney (Sr. GHG Mitigation Analyst: All Sectors)

Mr. Kenney is Vice President and one of the co-founders of KB Environmental Sciences, Inc. (KBE). Mike's responsibilities include project management as well as hands-on technical involvement with a variety of assignments associated with transportation-related air quality, greenhouse gas/climate change and haz-mat issues. He also has considerable experience with regulatory agency coordination and environmental analyses in support of both regional- and project-level development and sustainability plans. Project types include (but are not limited to) roadways, airports, seaports, private developments and military installations.

Paola Pringle (GHG Analyst: All Sectors)

Mrs. Pringle predominantly specializes in mobile source air quality assessments but also involved in air permitting and compliance, regulatory agency coordination, air emission inventories, and air dispersion modeling. Paola also has extensive experience with air quality tools/models such as: ROADMAP, CAL3QHC, CAL3QHCR, ISC/AERMOD, BPIP, AP-42, SCREEN3, INPUFF, MOBILE6.2, MOVES, EDMS, FDEP's EAOR, TRI-MEweb, e-GGRT, and TANKS programs. She has particular experience in assessing criterial pollutants and greenhouse gases and is among the first to successfully obtain the U.S. EPA specialty training for MOVES.

Dr. Katherine Johnson, Johnson Consulting Group (Built Environment Support)

Dr. Katherine Johnson, President of Johnson Consulting Group is a certified DBE in the State of Maryland. Her firm is headquartered in Frederick, MD. For more than 20 years, Dr. Johnson has been actively involved in both determining the potential for energy efficiency technologies as well as analyzing the effectiveness of programs designed to increase overall market acceptance. In addition, Dr. Johnson has written extensively on market barriers to energy efficiency installations in the built environment. Dr. Johnson has conducted several technical, market, and potential analyses on the viability of premium energy efficiency measures in various markets including:

- **Arkansas Public Service Commission**: As project leader, she is currently leading the discussion on quantifying non energy benefits (NEBs) for the investor-owned utilities, and addressing specific concerns relating to carbon pricing for energy efficiency and conservation programs. She is also overseeing a statewide potential study conducted by Navigant Consulting to determine the overall technical, economic, and market potential for the state.
- **Board of Public Utilities, New Jersey:** As a subcontractor to Summit Blue, Katherine conducted in-depth interviews with building professionals to measure the overall effectiveness of New Jersey's residential new construction programs.
- **Buckeye Power:** Dr. Johnson completed a cost-benefit analysis and review of avoided cost assumptions and market penetration rates for Buckeye Power's Cool Returns HVAC program. This analysis also included factoring in an assessment of the associated Greenhouse Gas Emissions associated with this program, and estimated the effects of this program at both the power supply and individual utility cooperative level.
- **City Utilities of Springfield (MO):** Among the work products, Dr. Johnson directed the cost-benefit analysis for the program evaluation, supervised the impact evaluation, and developed case studies based on a desk review and program analysis for several commercial and institutional lighting installations.
- **Colorado Governor's Office:** Developed the market and technical potential for the Governor's Office to determine the feasibility of a statewide program for geothermal heat pumps. Also developed four stand-alone case studies featuring GHP installations costs, savings, and benefits for installations in four locations throughout Colorado.
- **Delta-Montrose Electric Association:** Completed a comprehensive market assessment and literature review of lighting trends in the residential market. Project included developing a financial analysis of energy efficient lighting for residential applications that expanded to small commercial applications in 2006.

Sage Energy

Sage Energy Consulting, LLC (Sage Energy) is an energy efficiency and renewable energy firm specializing in the development and evaluation of programs and projects for state and local governments and mid-sized commercial companies. Sage Energy, headquartered in Annapolis, Maryland, specializes in energy solutions and greener operations that benefit both our clients' bottom lines and our environment. Sage Energy offers the unique perspective and experience of designing and evaluating programs, and drafting regulations and policies, to achieve government sector goals – with unparalleled experience in the Mid-Atlantic. Sage Energy applies this experience toward maximizing value for its commercial clients.

Through sustainable practices and technologies, Sage Energy assists clients in creating a built environment that reduces operating costs and improves health and productivity. Sage Energy helps clients navigate the ever-changing grants, tax credits, incentive programs, and financing mechanisms to reduce upfront and ongoing project costs. Sage Energy leads clients in surpassing their objectives in the areas of energy efficiency, renewable energy, water conservation, climate change and green building. Founded in 2004, Sage Energy is a Maryland-certified MBE/DBE.

Key Staff (Project Role):

Geri Nicholson (Sr. Analyst Built Environment)

Ms. Nicholson is founder and president of Sage Energy Consulting, LLC (Sage Energy) – an energy efficiency and renewable energy firm specializing in solutions that substantially improve the environment and the bottom line for its clients. She has twenty years of comprehensive experience in the fields of energy efficiency, renewable energy, resource economics, global climate change, and sustainability. Since 1998, she has advised Maryland Governors, legislators, department secretaries and energy office directors on energy, sustainability and climate change technical and policy issues.

Gretchen Dolan (Analyst Built Environment)

Gretchen Dolan, Research Analyst with Sage Energy, possesses 18 years of experience in energy and telecom research, market analysis, and project management, with a concentration in Maryland markets. Her work with Sage Energy also includes research on renewable energy and climate change initiatives, financing mechanisms for various municipal and state government projects, and market sector research in energy efficiency management and initiatives, especially regarding the Maryland EmPOWER Programs.

Table 1-1 below provides a summary of relevant projects carried out by members of the CCS Team. For Dr. David von Hippel, past performance examples are included within some of the CCS project summaries.

Table 1-1. Past Performance Examples for the CCS Team

Project Title and Description	Dates
The Center for Climate Strategies	
South Jersey Transportation Planning Organization (SJTPO) Regional GHG Inventory CCS was part of a contractor team led by AKRF, Inc. (and also including CS and KBE) that developed a regional 2010 GHG inventory covering the SJTPO region and each of the four counties within it. As part of this project, the consulting team also provided recommendations for developing a GHG forecast for the region. CCS addressed the agriculture, forestry and other land use, and waste management sectors. The GHG baseline design included unique features meant to provide SJTPO with the best possible baseline for assessing mitigation actions and for alignment with regional inventories in the rest of NJ. Mr. Stephen Roe of CCS had led the development of a similar regional inventory and forecast for the 13-county North Jersey Transportation Planning Authority prior to this project; http://www.climatestrategies.us/library/library/view/931. This included the use of full energy-cycle emissions accounting (to capture the upstream GHGs associated with fuel and electricity supplies) among other features. http://www.climatestrategies.us/library/library/view/1073. **Key personnel:** Stephen Roe, Holly Lindquist Loretta Bauer, Tom Peterson	12/1/2013 – 06/30/2014

Southern California Association of Governments Socioeconomic Impact of AB32/SB375 CCS supported SCAG's Southern California Climate and Economic Development Project (CEDP), http://www.climatestrategies.us/library/library/view/1053), a path-breaking partnership initiative focused on producing favorable economic and environmental outcomes that support regional planning and implementation in compliance with California Senate Bill (SB) 375 and Assembly Bill (AB) 32. While the emphasis of this project was on reducing GHG emissions and vehicle miles travelled (VMT) as mandated in legislation, the policies analyzed also intended to offer important tangible benefits, including stimulating economic development and job growth (such as co-location of jobs and housing), improving the region's natural resources and environment (such as critical area protection), reducing criteria air pollutant emissions, achieving greater social equity (including environmental justice), and enhancing the quality of life for residents of Southern California. This project served as a model for the rest of the country in its comprehensive and regional approach to integrating economic and environmental improvements. The first phase of the project resulted in the completion of a GHG inventory and forecast for the region covering all source and sink sectors; identification of 20 draft policy options for further analysis and development that addressed SB 375 compliance related transportation issues; and identification of 23 additional draft policy options in other sectors that addressed regional implementation of AB 32. These policy options were identified by a Project Stakeholder Committee (PSC) and technical workgroups (TWGs) drawn from diverse parties in the SCAG region, including a wide range of municipalities. Working with CCS and SCAG, they intensively screened of over 600 potential options that could potentially integrate GHG reduction, economic advancement, energy security, health, and equity issues in the region, and narrowed them to a top set of the most promising options for further development and analysis. The second phase of the CEDP focused on analyzing economic and other key feasibility impacts of the policy options, developed their design and implementation mechanisms, quantified GHG reductions and costs, as well as macroeconomic impacts (e.g. jobs, economic growth). **Key personnel:** Tom Peterson, Stephen Roe, David von Hippel, Scott Williamson, Adam Rose, Dan Wei.	04/28/2010 – 12/31/2012
Oregon Department of Energy Microeconomic Cost Curves Development From May - July 2013, CCS and its team of subcontractors successfully completed a complicated project for the Oregon Department of Energy to develop information and tools to assist in developing the Oregon Ten Year Energy Action Plan in a comprehensive and current format that addressed multiple objectives, including carbon and jobs. This work was not an analysis of the Ten Year Energy Action Plan (in either draft or final form). This project involved the following two primary components: · Marginal Abatement Cost Curves for GHG Mitigation Measures: Development of a set of marginal abatement cost curves for GHG mitigation measures across all sectors, constructed using Oregon-specific data and analysis wherever possible; and · Foundational Modeling: Using the marginal abatement cost curve results, along with other	04/25/12 – 07/30/12

necessary components, to conduct preliminary baseline macroeconomic modeling to estimate the potential economic growth and job impacts of GHG emissions reduction measures, which will serve as a foundation for future policy analysis and potential additional modeling related to the Ten Year Energy Action Plan. The study was undertaken at the request of Oregon stakeholders involved in the preliminary phase of the Energy Plan development. While not an economic analysis of the draft Plan's recommended actions, the report by CCS provided a basis for informing the final Energy Plan. The final report is available at: http://www.oregon.gov/energy/GBLWRM/Pages/GhG-MACC.aspx. **Key personnel:** Tom Peterson, Stephen Roe, David von Hippel, Scott Williamson	
Development of Abatement Curves for the New York State Climate Action Plan Support In 2008, CCS began an engagement with the NYSERDA to develop both a comprehensive GHG emissions inventory and forecast for NY and, using a bottom-up approach, collect and analyze data to develop NY-specific abatement cost curves for GHG mitigation and carbon sequestration technologies and best practices for all sectors of the economy including electricity generation, transportation, and distribution; residential, commercial, and industrial fuel use and industrial non-fuel use; transportation and land use; and agriculture, forestry and waste management sectors. *[Note that in January 2012, CCS delivered a revised and expanded draft I&F that covered additional work, including all source/sink sectors, a consumption-based inventory for the state and a black carbon inventory]*. CCS worked with NYSERDA and a team of technical experts that served as advisors and reviewers. This work in part set the stage for the second phase of the project to support NY in developing a statewide Climate Action Plan that began in Jan. 2010. CCS provided TWG facilitation, technical assistance and analysis during the stakeholder phase of the project and continues to provide technical assistance. CCS organized, facilitated, and prepared summaries and analyses for 7 in-person and 78 TWG meetings via teleconference between January and October 2010. CCS also supported and attended 9 in-person meetings of the stakeholder advisory group and the Climate Action Council during the year. CCS created and managed the project web site, attended and supported 1 public informational meeting, managed public comments submitted electronically and assisted in preparing the Interim Draft Report. Ongoing work includes finalizing the mitigation policy recommendations and scenarios, preparation of a macroeconomic study of the plan's impacts on employment, Gross State Product, income and consumer energy prices, and preparation of the final plan report. http://www.climatestrategies.us/library/library/view/108. **Key personnel:** Tom Peterson, Stephen Roe, Randy Strait, Bill Dougherty, Mike Lawrence, Lewison Lem, Scott Williamson	09/01/2008 - 08/31/2011
Kentucky Climate Action Plan (Phases I & II) – Technical and Facilitation Support Governor David Beshears and Secretary Len Peters of the Kentucky Energy and Environment Cabinet (KEEC) led development of a state energy plan in 2008 that included partial consideration of GHG	08/01/2010 - 01/30/2012

issues. In 2009, they requested assistance from CCS in expanding this work to a fully comprehensive state energy and climate plan. CCS served as the facilitator for all of the KCAPC and TWG meetings throughout the process and also performed all of the quantification analysis of the projected GHG reductions and costs/ savings associated with selected priority policy options. Work began in late 2009 with development of the project website and a comprehensive inventory and forecast of Kentucky GHG emissions (http://www.climatestrategies.us/library/library/view/125). During Phase 1 of the process the KCAPC approved the GHG inventory and forecast for Kentucky, developed a set of five sector based Catalogs of State Policy Options and narrowed the list of over 300 potential policies down to a set of about 50 top priority policies for further analysis. Phase 2 of the process commenced in August 2010 and the Council completed the design of each of the policy options and a set of proposed GHG reduction goals for the Commonwealth. CCS worked with the KEEC and KCAPC to quantify emission reductions and costs and prepare the final report and action plan (KCAPC summary - http://www.climatestrategies.us/library/library/view/932). Six KCAPC meetings and 30+ TWG meetings were held. **Key personnel:** Tom Peterson, Randy Strait, Stephen Roe, Bill Dougherty, Lewison Lem, Scott Williamson	
Pennsylvania Climate Change Action Plan – Technical and Facilitation Support PA is required by state law to revise its climate action plan every 3 years. Currently, CCS is supporting PA in revising the macroeconomic modeling analysis to incorporate revisions to the GHG mitigation and carbon sequestration policies that the state is making to its climate action plan. This work is expected to be completed by June 2013. In 2008, the PA Department of Environmental Protection (DEP) contracted with CCS to provide technical and economic analysis support services to their Climate Change Advisory Committee (CCAC), and the CCAC's five Subcommittees in evaluating GHG mitigation actions. A GHG inventory and forecast for the state was prepared for the 1990-2025 time period. This PA I&F covered all source and sink sectors. The PA DEP, CCAC, and Subcommittees worked together to develop a set of 52 sector-specific work plans in the form of policy measures and/or reduction strategies for which the emission reductions, costs and cost savings, cost-effectiveness, and macroeconomic impacts were estimated. CCS completed a macroeconomic analysis using the REMI Policy Insight+ Model on 42 of the options that could be quantified. The results show the potential to provide a net gain of $5.13 billion in GSP and 54,000 new jobs for the state of Pennsylvania by the year 2020 and to cut GHG emissions 36% below business as usual 2000 levels. The CCAC recommendations in tandem with existing state and federal actions could reduce state emissions by as much as 42% from 2000 levels by 2020. CCS also prepared meeting materials and presentations for the CCAC and Subcommittees and supported the CCAC website. PA 2009 Climate Action Plan: http://www.climatestrategies.us/library/library/view/583. **Key personnel:** Tom Peterson, Randy Strait, Stephen Roe, Adam Rose, Dan Wei, Alec Miller	Present – 09/30/15 02/25/2009 - 09/01/2009

Florida Energy & Climate Action Plan – Technical and Facilitation Support CCS provided technical and facilitative support to the Governor's Action Team on Energy and Climate and the FL Department of Environmental Protection in the development of a statewide Energy & Climate Action Plan. This work included the development of a full GHG inventory & forecast (1990-2025) covering all sectors and TWG facilitation for all climate change mitigation sectors and an adaptation workgroup, and facilitation of an Action team of 28 high level representatives and six TWGs with over 100 participants over a nine month period.. A macroeconomic impact analysis of implementation of the Energy & Climate Action Plan was also prepared, with landmark results that supported immediate investment in energy efficiency and renewable energy to support economic growth and recovery by the US Department of Energy. The Florida plan included several major recommendations that became enacted by the Florida legislature. Additionally, the plan included a program to establish a carbon reserve associated with large scale restoration of the Everglades. 2008 FL Climate Action Plan: http://www.climatestrategies.us/library/library/view/65. **Key personnel:** Tom Peterson, Stephen Roe, Randy Strait, David von Hippel, Lewison Lem, Scott Williamson	01/15/2008 – 09/30/2008
Cambridge Systematics	
Maryland Department of Transportation (MDOT) Climate Action Plan. For the Maryland DOT, Cambridge Systematics has led strategy and policy development, technical assessments including emission modeling and cost effectiveness analysis, and stakeholder coordination activities to support MDOT's internal process to address the language and intent of the 2009 Greenhouse Gas Reduction Act. Cambridge Systematics has worked with Maryland DOT over multiple phases since 2009, including development of Maryland DOT's Climate Action Plan in 2009 and 2011 and transportation sector inputs into the 2013 Maryland Greenhouse Gas Reduction Act Plan. Cambridge Systematics is currently working with Maryland DOT to develop an update to their 2011 Climate Action Plan and provide support to update the Maryland Greenhouse Gas Reduction Act Plan. 2011 MDOT Climate Action Plan: http://www.mdot.maryland.gov/Office_of_Planning_and_Capital_Programming/Plans_Programs_Reports/Documents/Climate_Change_2011.pdf **Key personnel:** David Jackson, Suseel Indrakanti, Chris Porter	Multiple phases, 1/2009 to Present
North Jersey Transportation Planning Authority Regional GHG Mitigation Plan. For NJTPA, Cambridge Systematics developed a Regional GHG Emissions Mitigation Plan. The project convened a Steering Committee that assisted in identifying critical strategies, and then conducted an analysis of the effectiveness and cost effectiveness of the priority transportation strategy	12/2011 to 3/2013

options by place type, including vehicle technology (including electric vehicle deployment), low-carbon fuels, vehicle-miles traveled reduction, and system efficiency. The project also evaluated the potential benefits of bundling GHG emission reduction strategies at the place type level, and conducted a "What If" regional analysis for the 13-county NJTPA region. The Plan's deliverables include: development of strategy cards that summarize all strategy outcomes and implementation considerations; a final report and appendices depicting all plan findings and recommendations; and an interactive GHG reduction strategy spreadsheet tool for future NJTPA application and use in regional scenario testing and long-range transportation plan development. NJTPA Regional GHG Mitigation Plan: http://www.njtpa.org/Planning/Regional-Studies/Current-Studies/Greenhouse-Gas-%28GHG%29-Mitigation-Plan/NJTPA-Regional-Greenhouse-Gas-Mitigation-Plan.aspx **Key personnel:** David Jackson, Suseel Indrakanti, Chris Porter	
NREL Transportation Energy Futures. Cambridge Systematics supported led the development of a series of reports produced as a result of the Transportation Energy Futures project, a U.S. Department of Energy (DOE)-sponsored multi-agency project created to identify new strategies for reducing greenhouse gases (GHG) and petroleum dependence related to transportation. The TEF project explores how combining several strategies could significantly reduce GHG emissions and petroleum use. These reports provide analysis to inform decisions about transportation energy research investments, and the role of advanced transportation energy technologies and systems in the development of new physical, strategic, and policy alternatives. NREL Transportation Energy Futures: http://www.camsys.com/kb_pubs_enviro.htm **Key personnel:** Chris Porter, Suseel Indrakanti, David Kall	
I-66 Multimodal Study For VDOT, Cambridge Systematics led a team to identify a range of practical short-term and visionary long-term multimodal and corridor management solutions that can be implemented to reduce congestion and improve overall mobility within the section of I -66 inside the Capital Beltway (I -495), includi complementary and mutually supporting multimodal transportation improvement options and range of mobility options – strategy, project, policy, or program – were examined as part of the study. These mobility options include: bus and rail service and infrastructure enhancements; HOV, toll, and managed lane options; bus-on-shoulder use; regional and activity center focused TDM pro-grams; integrated corridor management measures; active traffic and demand management strategies; ITS enhancements; incident man-agement enhancements; and bicycle and pedestrian network and option improvements. Costs were identified or developed for all mobility options. Each mobility option was evaluated through use of the TPB model, resulting in a select group that underwent more detailed analysis based on evalu-ation criteria and associated performance measures (e.g., level of service, etc.),	7/2011 - 8/2013

conceptual-level criteria (e.g., environmental impacts, etc.), and key measures of effectiveness (e.g., mode share, person throughput, etc.) to determine packages of mobility options. I-66 Multimodal Study: http://www.virginiadot.org/projects/northernvirginia/i-66_multimodal_study.asp **Key personnel:** Jay Evans, David Jackson, Feng Liu, Chris Porter	
KB Environmental	
South Jersey Transportation Planning Organization (SJTPO) Regional Greenhouse Gas (GHG) Emissions Inventory This assignment involved the collaboration of several team members in the development of the "first ever" GHG emissions inventory for this region of the N.E. United States. Extensive coordination between team-member, subject-matter experts as well as the staff of the SJTPO was required (this project also included CCS and CS as team members). KBE's specific role was the preparation of the GHG emissions inventories for non-road transportation-related sources (i.e. aircraft, off-road equipment) region-wide, county-level and municipal level under current conditions. A similar assessment of future-year conditions is presently underway.	12/1/2013 – 06/30/2014
Johnson Consulting Group	
Johnson Consulting Group is the lead contractor serving as the Independent Evaluation Monitor (IEM) on behalf of the Arkansas Public Service Commission. Johnson Consulting Group is managing a wide range of Evaluation, Measurement & Verification tasks for the Parties Working Collaboratively (PWC), which include utilities, third-party implementers, and intervener groups. As the IEM, the Johnson Consulting Group completes an annual reports, supervises the updates to the Technical Reference Manual serves as the meeting facilitator and prepares white papers, reports, presentations and supporting testimony on a variety of topics including energy policies, carbon management, non-energy benefits, as well as best practices in EM&V. In 2013, Johnson Consulting Group was also appointed to be the facilitator for the Weatherization Collaborative, developed by the APSC in order to develop a unified statewide approach to offering weatherization programs. For the past seven months, the Johnson Consulting Group team has conducted a review of current weatherization programs, completed a literature review of best-in-class weatherization programs, and completed a gap analysis. Dr. Johnson developed a straw man weatherization approach for the utilities to consider, which was approved by the Commission in December 2014.	2010 - Present
Sage Energy	
For Montgomery County (as subcontractor to SAIC) Sage Energy developed various aspects of a "GreenMap" to provide guidance to Montgomery County in the implementation of the *Climate Protection Plan*. Sage Energy provided technical and policy analysis on proposed County actions to	June 2009 – April 2010

reduce greenhouse gas emissions in the areas of energy use (renewables, residential, commercial, and transportation), forestry and agriculture, land use planning, and education and outreach. Sage Energy provided both quantitative and qualitative analysis on the cumulative environmental benefits (including and specifically GHG emissions) of various proposed on-site renewable energy projects and renewable energy loan programs. Ancillary benefits of the program were qualitatively assessed. Additionally, Sage Energy's tasks included evaluation and baseline development of steps already taken; development of implementation steps; and, performance management plans (including metrics and survey guidelines) for a comprehensive commercial building program and the Home Energy Loan Program. Sage Energy also provided both quantitative and qualitative analysis for the energy reduction, environmental, and health benefits of various proposed programs, especially: Natural Resources Conservation Program and Urban Tree Planting. Performance metrics were developed to evaluate success of outreach and marketing campaigns. Sage Energy provided quantifiable benefits to assist senior staff in defending and promoting programs, clear and implementable program plans with performance metrics to track progress and performance, and funding and programmatic synergies to ease implementation	

Chapter 2. Scope of Work

The CCS Team's approach to the seven tasks laid out in the RFP's Scope of Work (SOW) is summarized below. Details are provided in the Draft Work Plan provided as Attachment A to this proposal.

Task 1. Finalize the CCS Team's Work Plan and Schedule

Under this task, the CCS Team will review the draft Work Plan with the COG's Project Director and finalize it. The draft Work Plan consists of the relevant portions of this proposal including the approach to tasks in this Chapter, the project staffing in Chapter 1, and the revised schedule and cost estimate in Chapter 3. Regarding the project's schedule, the Team has developed revisions from some of the key dates listed in the RFP (these are addressed in Chapter 3). Figure 1 below provides the CCS Team's understanding of the project schedule based upon the dates provided in the RFP. After carefully reviewing the dates listed in the RFP and aligning it with the technical and stakeholder outreach related requirements of the study, it is the CCS Team's opinion that the RFP dates may not allow sufficient time for the formative work needed to complete Tasks 2 and 3. Key reasons are as follows:

- *Required time and effort for GHG baseline development:* while the RFP mentions a 2005 and 2012 GHG inventory, a business as usual (BAU) GHG forecast or "GHG baseline" will be needed as the primary reference against which the benefits of each strategy analyzed in the Action Plan are measured. COG has also indicated the availability of a GHG forecast developed from a 2008 baseline. Data from these inventory and forecast projects are expected to be used as starting points for the construction of a baseline; however, the Team's experience indicates that supplementation will be needed in order to construct an appropriate baseline for this project. Careful consideration of the GHG accounting system used in constructing the baseline is a critical issue in order to assure that it both: a) adequately measures the Region's carbon footprint; and, b) accounts for the GHG impacts of all activities occurring within its boundaries (in some cases regardless of where the emission actually occurs), including complex issues related to wastewater and watershed/storm water functions.

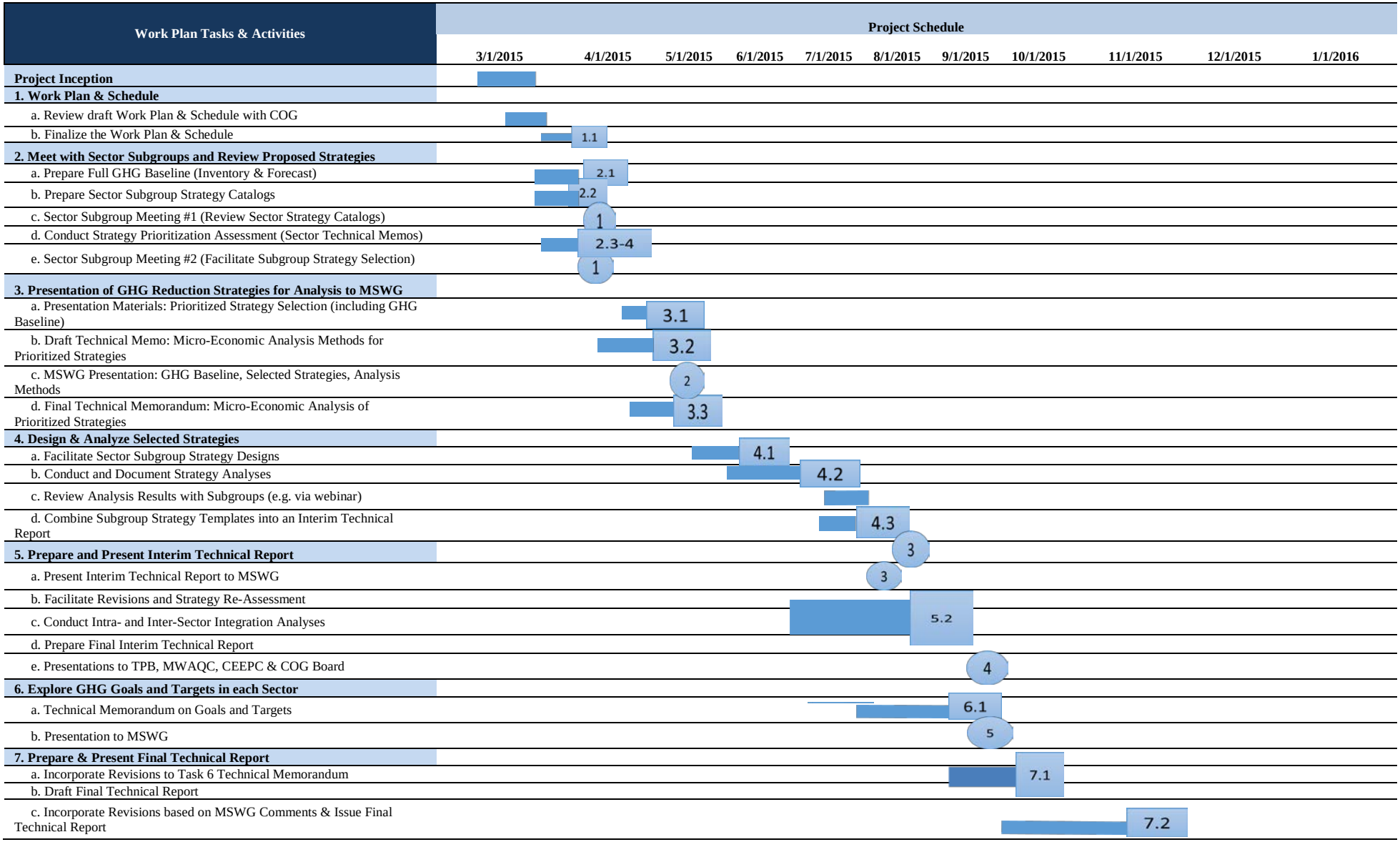
  For regional GHG planning, simplified systems for constructing GHG baselines often do not capture key GHG sources due to their more complex and broader geographic nature. These would include, for instance, the upstream GHG emissions associated with fuel supplies and embedded GHGs in water supply or materials consumption (and hence waste generation). For the on-road transportation sector, accounting for emissions can be done strictly on a geographic basis (i.e. direct emissions tied to fuel consumption on each roadway link) or attribution can be made based on trip origin/destination. The latter of these can provide better indications of an individual jurisdiction's role as a trip generator or attractor, and hence a better metric for understanding the GHG reduction potential of different strategies (particularly those regarding travel demand management). These baseline accounting issues will need to be discussed with COG at the outset of the study and included in the Final Work Plan.

- *Time available to select prioritized GHG strategies:* the CCS Team intends to work through a multi-criteria assessment (MCA) screening to assist the MSWG in prioritizing strategies for analysis in Task 4 from a menu of many dozen possibilities across all sectors. Regardless of the level of interaction with

each MSWG subgroup, our experience in conducting similar stakeholder projects is that this may take more time than initially provided for in the RFP and require an exceptional level of efficiency and timeliness. We realize, given our extensive transportation planning experience within the region, that the region's diversity, in terms of socioeconomics, development and land use structure, travel patterns and transportation system features, may lead to differing sub regional conclusions for developing regionally applied strategies and require expert facilitation of agreements on stepwise tasks and workflow.

- *Required time and effort for GHG strategy design:* in Figure 2-1 below, the Team has added an additional component to Task 4 to address the development of individual strategy (policy measure) designs. The RFP addresses the requirements to select the prioritized strategies under Task 3; however, prior to analysis of each strategy in Task 4, the CCS Team and MSWG will need to develop key, specific design details in order to drive the benefits and costs analysis. This will require expert decision support and an added level of effort by subgroups. Details are provided in the Task 4 approach.

Figure 2-1. Project Schedule Based on RFP



Legend for Figure 2-1

Milestone/Deliverables

1.1 - Final Work Plan & Schedule
2.1 - Technical Memo: Regional GHG Baseline (Inventory & Forecast)
2.2 - Draft Sector Strategy Catalogs
2.3 - Sector Technical Memos on Strategy Prioritization
2.4 - List of Prioritized Strategies by Sector
3.1 - Draft Technical Memorandum: Selected Strategies and Analysis Methods
3.2 - MSWG Presentation [May 8, 2015]
3.3 - Final Technical Memorandum: Selected Strategies and Analysis Methods
4.1 - Strategy Templates Containing Complete Designs
4.2 - Strategy Templates Containing Analysis Results
4.3 - Interim Technical Report: All Sector Strategy Templates
5.1 - Presentation of Interim Technical Report [July 31, 2015]
5.2 - Final Interim Technical Report
5.3 - Presentations: TPB, MWAQC, CEEPC & COG Board [September 2015]
6.1 - Technical Memorandum on Goals & Targets
6.2 - Presentation to MSWG [September 25, 2015]
7.1 - Draft Final Technical Report
7.2 - Final Technical Report
7.3 - Presentations: TPB, MWAQC, CEEPC & COG Board [December 2015; January 2016]

In-Person Meetings

1 - Task 2 Sector Subgroup Strategy Selection Meetings []
2 - Task 3 MSWG Meeting [May 8, 2015]
3 - Task 5 Interim Technical Report Presentation to MSWG [July 31, 2015]
4 - Task 5 Interim Technical Report Presentations to TPB, MWAQC, CEEPC & COG Board [September, 2015]
5 - Task 6 Presentation to MSWG [September 25, 2015]
6 - Task 7 Final Technical Report Presentations [December 2015; January 2016]

To allow for enough time on Tasks 1 - 4, the entire length of the project could be extended, the length of time devoted to Tasks 5-7 could be reduced, some streamlining could possibly be instituted for Tasks 1-4 without sacrificing critical quality and detail (and require careful thought and high levels of collaboration), or some combination of the these approaches could be used. The CCS Team believes that a minimum of an additional three months is optimal to allow for sufficient input and review by both COG and the MSWG on all work products and that the entire project could be completed within 1 year.

The CCS Team also recognizes that hard dates for completion of the project are in place. Therefore, our revised schedule provided in the attached Draft Work Plan maintains the key dates for presentation of results. The bottom-line in our view on maintaining COG's desired scheduled is associated with the level of MSWG interaction and input into the project. We recommend, to the extent practical given resources and schedule, that the critical starting point in COG's multisectoral GHG emission planning should build from a technically rigorous benefits analysis framework. Overtime, regional priorities, technologies, regulations, political perspectives will change - the technical framework should be fact-based and flexible to support the evolution of COG's approach. Ultimately, the CCS Team is flexible in terms of the approach selected, and plans to work with COG staff and the MSWG collaboratively to determine the approach with the most value to the long term success of the region's greenhouse gas mitigation planning.

The CCS Project Manager will meet with COG to review the Work Plan and its schedule. Additional key project staff will either attend the meeting or be invited to attend via teleconference/webinar. While the Team understands the need to be flexible around specific meeting dates, it will still be important to get a clear understanding of all meeting dates to assure that all project participants can incorporate these into their calendars (given the aggressive first 3-4 months of the schedule). We expect that the Work Plan will serve as a working document throughout the project, recommending that the CCS project management team meet regularly (biweekly) with COG staff to discuss schedule status, progress, risks, and approaches to mitigate risks.

Task 1 Deliverable: Detailed CCS Team Work Plan and Schedule

The Toolkit has been used successfully in a variety of comparable efforts both domestically and internationally. Example outputs from the Toolkit will be used to illustrate how the tools within it support step-wise action planning. The Toolkit brings significant free-value to COG, as it is already been tested and successfully applied. In other efforts, we have found that the development of an organized data, analysis, and reporting framework is often under-accounted for in terms of resource requirements. In the case of the CCS Team approach, the framework already exists, and simply needs to be tailored to the COG region approach.

Task 2. Meet with Sector Subgroups and Review Proposed Strategies

Throughout this project, the CCS Team will employ its Action Planning Toolkit to support each phase of the project. The Toolkit is summarized in Figure 2-2 below. Note that the categorization of sectors is flexible and will be revised to fit the four sectors addressed by the Region's Action Plan. The Team would be happy to provide a presentation of the full Toolkit or specific components of it, if this is of interest to COG. It is essentially a linked set of MS Excel-based tools that offers significant flexibility and transparency in support of each phase of an action planning project. Effectively this Toolkit approach is consistent with the overall coordination and technical activities anticipated in Tasks 2 through 4.

While not specified in the RFP, a GHG baseline will need to be constructed and/or confirmed for the project prior to the initial meeting with subgroups **(Item #1 in the Toolkit)**. Starting points will include the previous regional inventory and forecast data provided by COG; however, the Team anticipates that additional input data and analysis may be required in

order to construct a GHG baseline that is adequate for regional GHG action planning. Considerations within an up-to-date baseline could include: proposed new medium/heavy duty vehicle standards post-2018, updated market projections of electric vehicle penetration into the regional fleet, most recent cooperative land use forecasts (Round 8.3, October 2014), data or assumptions used to drive carbon intensity estimates of the region's power supply, electricity demand forecasts, land use forecasts, and others.

The CCS Team intends to build a baseline with the following features that are likely to be different from current regional or county-level baselines which may have been constructed with more introductory tools (e.g. ICLEI-based[7], EPA State Inventory Tool[8]) or guidance materials (e.g. US Inventory EPA Regional GHG Inventory Methods[9]). These tools and guidance materials have important end uses; however, our Team has found them to be lacking in terms of accounting for GHG emissions that are most useful to local and regional-scale GHG mitigation planners and forming the best basis for a baseline that fully characterizes the GHG impacts associated with a sub national economy (in particular, a sub-state regional economy[10]). Features the CCS Team will incorporate include the following:

- Both direct emissions (e.g. fuel combustion) and upstream energy-cycle emissions for all stationary and mobile fuel combustion sources (broken out separately);
- For the on-road sector, allocation of direct emissions to the Metro Washington jurisdictional boundaries, as well as to sub-jurisdictions based on trip origin-destination (each reported separately based on information within the TPB travel demand forecasting model);
- Development of upstream energy-cycle emissions for the wastewater treatment and solid waste management sectors (addresses embedded emissions associated with potable water sourcing and treatment);
- For electricity supply: an assessment of the carbon intensity (including transmission and distribution losses) of the regional grid and the associated electricity consumption emissions; as well as an assessment of the carbon intensity of the *marginal generation resources*[11]. For use in subsequent analysis of energy efficiency and renewable energy strategies, it is the marginal resource metrics (avoided electricity system emissions and costs) that should be used rather than metrics associated with all grid-based power.

[7] The International Council on Local Environmental Initiatives (ICLEI) Clean Air and Climate Protection tools are an example.
[8] EPA SIT home page: http://epa.gov/statelocalclimate/resources/tool.html.
[9] EPA has provided but not published the following guidance document: *Draft Regional Greenhouse Gas Inventory Guidance*, US EPA, State Climate and Energy Program, June 14, 2010.
[10] Please see the links to final reports for the North Jersey Transportation Planning Authority's or the South Jersey Transportation Planning Organization's GHG inventory and forecasting projects provided as footnotes in Chapter 1.
[11] The "marginal generator" is the last power plant that is brought online (dispatched) or taken offline to match supply and demand in any given hour. Therefore, the "marginal resource mix" represents generation from the last set of power plants dispatched/taken off-line to balance supply with demand.

Figure 2-2. CCS Team Action Planning Toolkit

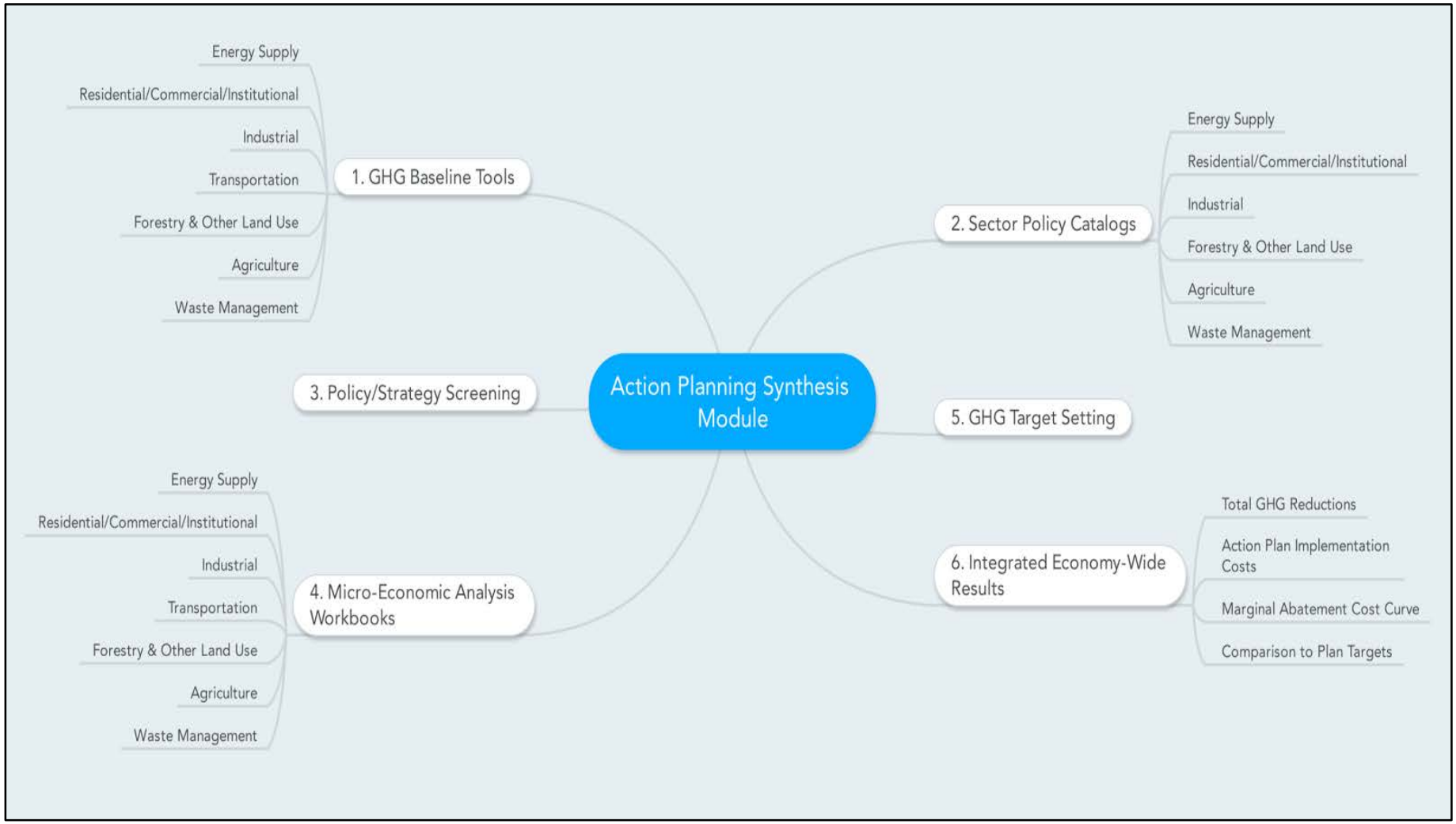


Figure Notes: GHG Baseline Tools and the Sector Policy/Strategy Catalogs will support the work under Task 2 to conduct Policy/Strategy Screening and the selection of a prioritized set of strategies presented in Task 3 via multi-criteria analysis (MCA). The selected strategies are then analyzed under Task 4 using the sector-based Micro-Economic Analysis Workbooks. Integrated Economy-Wide Results are then presented in the Interim Report under Task 5. Under Task 6, the Team returns to the previous MCA analysis as a starting point to build up sector-level GHG reduction targets and a regional goal.

The features noted above certainly add to the level of effort required to construct a baseline; however, much of this work would need to occur anyway within Task 4 in order to support strategy analysis. Bringing this work forward into the baseline development and review phase will help the MSWG: better understand the factors contributing to regional GHG emissions (including on a full energy-cycle accounting basis); and to prioritize strategies for analysis. The Team will allocate the level of effort on baseline construction to be consistent with the mitigation areas of most interest to COG and the MSWG. So, while a full baseline will be needed to assess future targets, simpler approaches will be developed and applied for some sectors as compared to others (e.g. significant effort wouldn't likely be expended for detailed assessment of future aircraft emissions or industrial sources, unless COG and the MSWG believe that there is sufficient local to regional influence over these sources).

In addition to the GHG baseline, another key project input that needs to be assembled prior to engaging the subgroups is a set of strategy (policy option) catalogs that will serve as the starting point for a multi-criteria (multi-objective) assessment (MCA) of all strategies **(Item 2 in the Toolkit)**. Fortunately, CCS has catalogs that can serve as the starting point for each of the MSWGs. A sample section of a catalog for the Energy Supply (ES) sector is shown in Figure 2-3 below. Each Action (or Strategy) is linked to a text description which is not shown in the figure. The MSWG will have input as to which criteria are used in constructing each sector's catalog. We also recognize that the region as a whole, as well as participants in the MSWG have already invested extensive resources in multi-sector GHG emissions planning over the last 7 to 8 years. Building from the value created through these prior efforts, along with the CCS Team national experience, will bring to COG a robust understanding of the universe of potential approaches, including particularly the potential for "stretch" GHG reduction strategies. The catalog approach described above will inform the first meeting of each Sector Subgroup. The objectives of the first meeting are to: build and review the list of potential strategies, identify strategic opportunities for grouping/combination, discuss the criteria for screening strategies (including key objectives and co-benefits), and pinpoint the range of possible analysis methodologies for each.

Following the first meeting of each Sector Subgroup, once the catalogs have been fully populated, the MCA analysis **(Item 3 in the Toolkit)** can be performed and then completed by reviewing summary charts, which help to differentiate sector strategies based on the criteria selected (e.g. GHG reductions plus potential direct costs, macroeconomic impacts, air quality benefits, etc.). The MCA analysis is driven by a combination of quantitative, semi-quantitative and qualitative criteria.

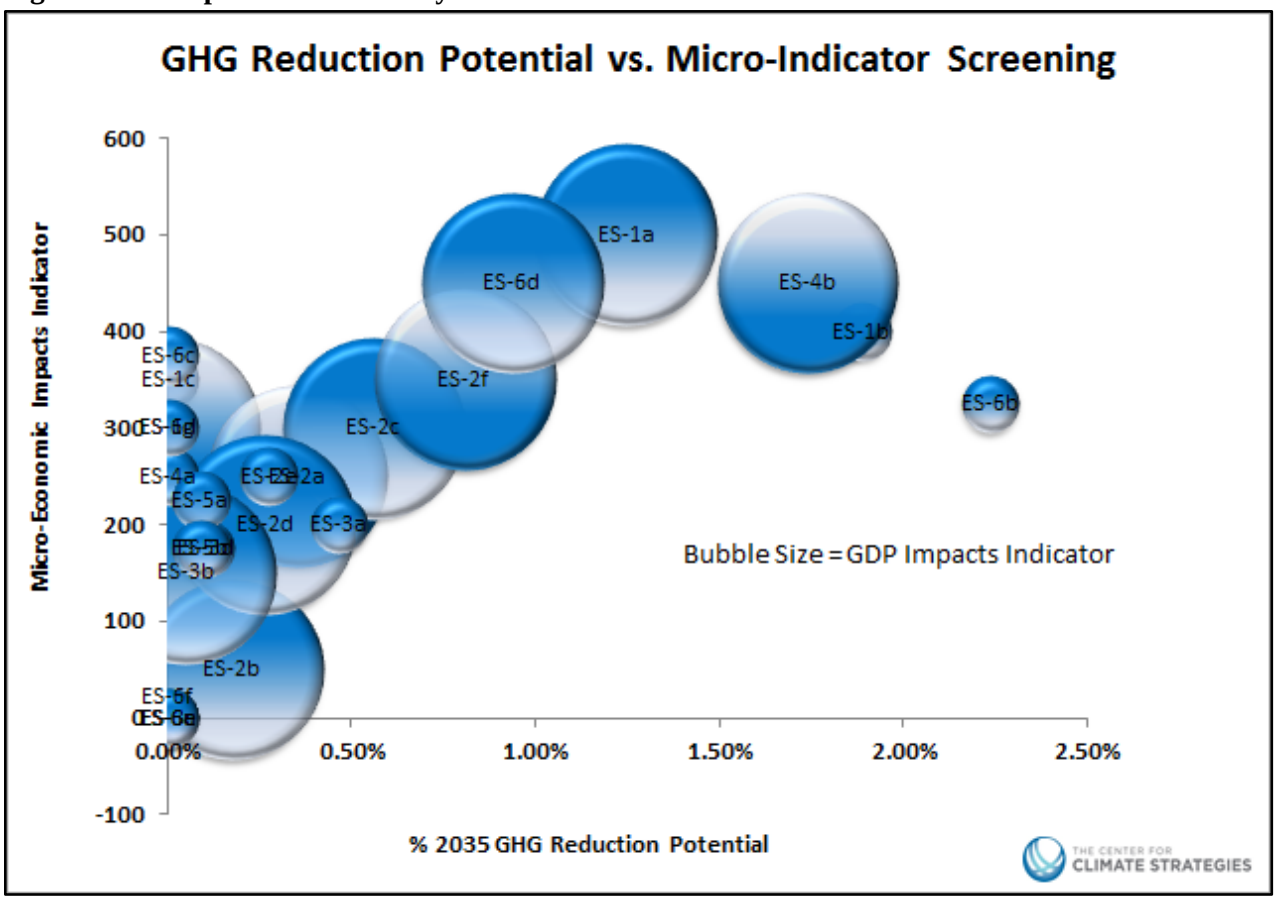
Quantitative screening-level assessments of potential GHG reductions are tied back to the GHG baseline. Reduction potential is screened using expert judgement rankings of the technical/market potential and likely penetration of each strategy against the baseline. Other criteria include direct (micro-economic) cost screens which are driven by estimates constructed from previous meta-analysis of sub-national action planning processes that have analyzed or implemented similar strategies. An indirect (macroeconomic) screen is also suggested. This criterion indicates the likely impacts on jobs or local economic growth of different strategies. Screening is based on the application of a macro-screening tool previously developed by CCS and six discrete economic development strategies. The Team expects that another screening criterion that will be of interest to the MSWG will be related to air quality. If so, a screening method will be developed and applied for expected impacts to local/ regional criteria air pollutants (note that this screening is separate from the assessment of air pollution co-benefits under Task 4, which is done in association with the detailed analyses of selected strategies).

Examples of MCA summary analyses shown as either bubble charts or spider charts are provided below in Figure 2-4. The criteria are a blend of both quantitative and qualitative data, since the screening-level GHG reductions are tied directly to the baseline. The results of the MCA will assist each Sector Subgroup in their strategy screening assessments (meeting #2 of each Sector Subgroup), and reach consensus on a prioritized list of strategies on the most effectual strategies to be presented to the MSWG in Task 3 and analyzed in Task 4. An experienced CCS Team Member will facilitate the population and review of sector catalogs and the subsequent MCA screening and prioritization of strategies for analysis under Task 4.

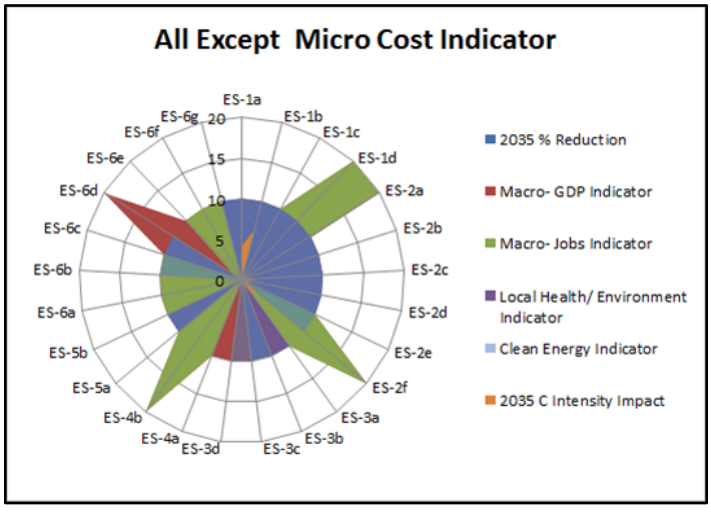
Figure 2-3. Sample Section of an Energy Supply Strategy Catalog

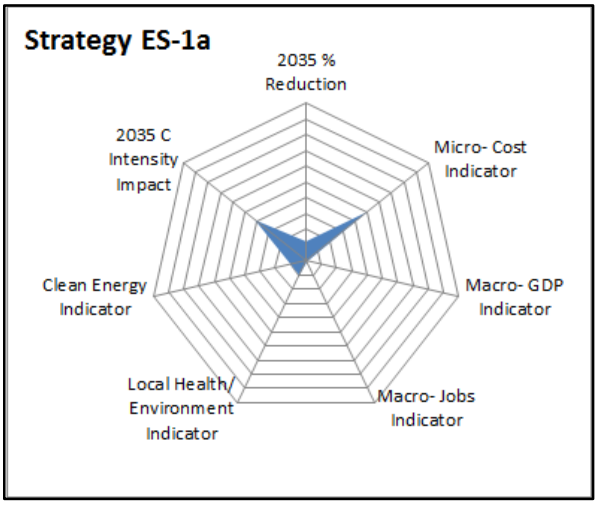
Action Number	Low Carbon Development Action	Upper Limit (%) of 2035 BAU GHG 7,210 Tg CO2e BAU GHG	Realistic Screening Potential (%) of 2035 BAU GHG	Micro-economic Costs/ Savings Indicator	Potential Macroeconomic Impact by 2035		Potential Impacts on Local Health and Environment	2035 Carbon Intensity Screening 336 g CO2e/ ¥2010	Potential Impacts on Clean Energy Goals	Related Implemented or Planned Actions	Priority for Analysis
					Gross State Product	Employ-ment					
Group 1: RENEWABLE ENERGY											
ES-1a	Renewable Portfolio Standard	3.8%	1.2%	500	+	+	+	4.2	+		`
ES-1b	Green Power Purchases and Marketing	3.8%	1.9%	400	U	U	+	6.3	+		
ES-1c	Grid Based Renewable Incentives or Barrier Removal	0.001%	0.001%	350	U	U	+	0.004	+		Y
ES-1d	Offshore Wind Development Issues	0	0	300	-	-	+	-	+		
Group 2: ADVANCED FOSSIL ENERGY											
ES-2a	Advanced Fossil Fuel Technology Incentives, Support, or Requirements	1.1%	0.35%	250	-	-	+	1.2	+		Y
ES-2b	Support Efficiency Improvements at Existing Fossil Fuel Power Plants	0.35%	0.17%	50	+	+	+	0.58	+		
ES-2c	Support Repowering of Existing Plants (incentives/barrier removal)	1.7%	0.56%	300	+	+	+	1.9	+		
ES-2d	Biofuel Co-firing at New and Existing Fossil Fuel Power Stations	0.52%	0.26%	200	+	+	+	0.87	+		
ES-2e	Ramp-Up Decommissioning of Inefficient Thermal Plants	0.55%	0.27%	250	U	U	+	0.92	+		Y
ES-2f	Create Policies and Incentives to Support Carbon Capture and Storage or Reuse (CCSR) and Supporting Infrastructure	2.7%	0.8%	350	-	-	U	2.70	+		

Figure 2-4. Sample MCA Summary Charts



Bubble charts (above) help workgroup members visualize anticipated performance of strategies based on 3 separate criteria. In this case, energy supply strategies are plotted against one another using GHG reduction potential, direct (micro-economic) costs, and economic activity (GDP). Spider charts (below) can be used to visualize more than 3 separate criteria for groups of strategies or individual strategies.





Task 2 Deliverables: Meetings with each MSWG Sector Subgroup
Technical Memoranda on Proposed Subgroup Strategies

Task 3. Presentation of GHG Reduction Strategies for Analysis to MSWG

The CCS Team will prepare a Technical Memorandum that contains the set of prioritized policies and the details of the methods to be used to analyze the direct costs and benefits of implementing each. Development and communication of such guidance is standard practice for CCS in its support of action planning processes. An example of a recent "Quantification Memo" can be found at the link footnoted below.[12]

The CCS Team will provide a presentation of the selected prioritized strategies by sector and a summary of the Quantification Memo to the full MSWG. During the meeting, the CCS Team's lead facilitator and other team members will provide responses to suggestions for modifications to the list of strategy priorities and will assist the MSWG to identify synergies among strategies both within and between sectors. This will be a critical point in the project that will have obvious resource implications, so careful facilitation and management of expectations will be required. CCS' Lead Facilitator has provided similar service in dozens of stakeholder projects, so the Team is well-positioned here to assist COG.

For initial budgeting purposes, the CCS Team has budgeted for development and analysis of 16 - 20 strategies (e.g. 4 to 5 per sector). The actual number will be dependent on the level of complexity in strategy selection and design (design is discussed under Task 4, but could also be moved up to Task 2, if needed). In some cases, a single strategy might have multiple objectives, each with their own GHG impacts.

Task 3 Deliverables: May 8th Meeting with MSWG

Draft and Final Technical Memorandum on Recommended Strategies for Detailed Analysis

Task 4. Design and Analyze Selected Strategies

The RFP indicates that this is the task where analysis of the costs and benefits of each priority strategy selected in Task 2 and confirmed by the MSWG in Task 3 will be conducted. However, there is a critical step needed prior to quantitative analysis: Policy Design.

Consider the following example strategy from the RFP: "Increase proportion of electric vehicles in fleet to 15% by 2030". The goal and timing here provide a good start toward a policy design that can then be quantified; however, there are some key missing pieces. First, what is the expected baseline penetration of electric vehicles during this time-frame (and even through 2050, which is the planning horizon specified by COG)? Are there any specifications around the types of vehicles being targeted (e.g. private light-duty cars/trucks, delivery vehicles, etc.)? Third, are there any specifications for strategy implementation that speak to the source of electric power that will be used to charge the future vehicle fleet? Our previous work has indicated that the carbon intensity of

[12] Example Quantification Memo can be found here: http://www.climatestrategies.us/library/library/view/1102.

power expected to be used for vehicle charging (largely off-peak sources) can result in very low and potentially negative benefits as compared to baseline gasoline powered vehicles. Without sufficient detail provided in a policy design, these types of questions are all left up to the analyst for gap-filling, and that process might not align well with the thinking of COG and the MSWG.

Following the conclusions of the May 8th MSWG meeting on prioritized strategies, the Team will work with the Sector Subgroups to develop a design for each strategy that can then be analyzed for direct net energy and GHG benefits and direct net societal costs. The Team suggests the use of a standard policy or strategy design template to guide the development of each strategy. An example template can be reviewed at the link in the footnote below[13]. The template provides for the development of a clear and comprehensive strategy design in the first four sections:

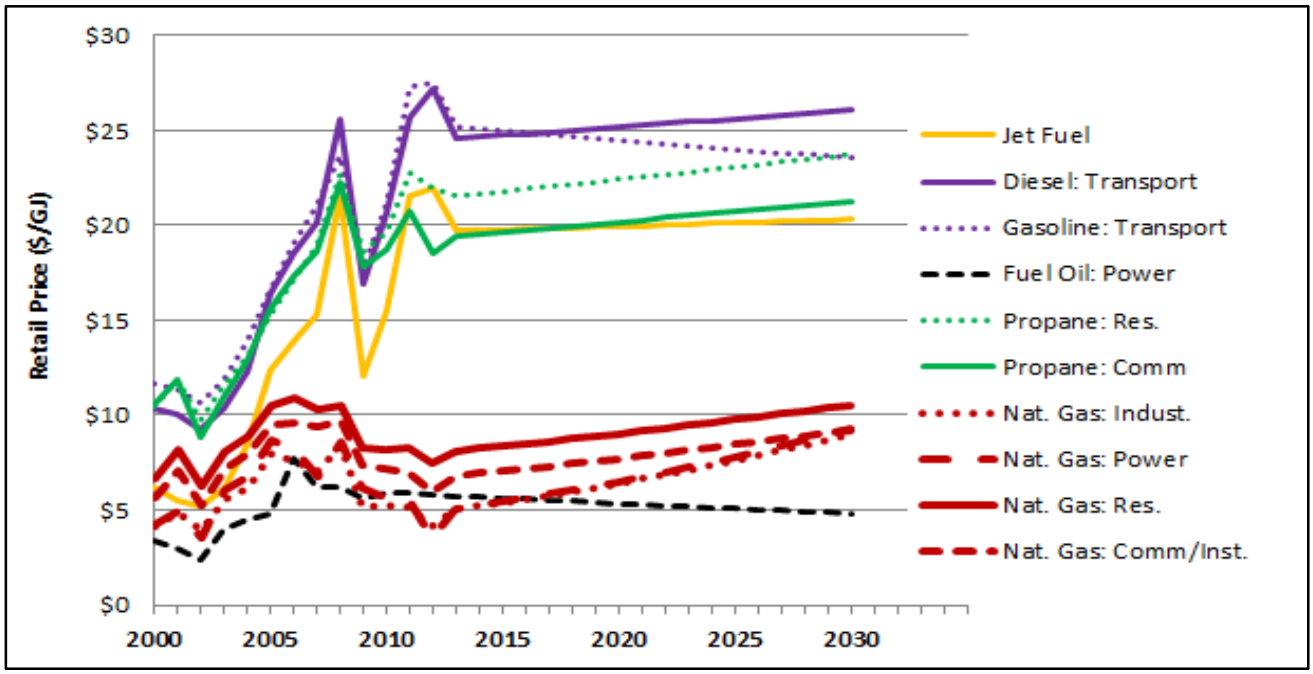
- *Strategy Description*: starting point for this comes from the strategy catalogs completed in Task 2;
- *Causal Chain for GHG Reductions*: developed by the Team's analytical lead; this diagram indicates the intended/unintended strategy impacts and how each of those cascade to a GHG impact;
- *Strategy Design*: numeric goals and timing for implementation; and
- *Implementation Mechanisms*: details on implementation needs - technical support, financial assistance, external grants/other incentives, voluntary agreements, rules/regulations.

In particular, the Implementation Mechanisms section provides the details on costing assumptions needed to analyze net direct societal costs. The rest of the strategy template is used to document related strategies/programs already in place, the estimated costs and benefits (discussed further below), key uncertainties, additional benefits and costs, feasibility issues, and status of approval by the stakeholder group (if needed). Our Team envisions a collaborative process between our lead sector analysts and the MSWG subgroups to put these designs in place. Discussion with COG is needed to determine how this interaction can be achieved within the schedule constraints of the project.

Once a set of strategy designs are in place, the Team will begin quantitative analysis of GHG reductions and costs. This is referred to as micro-economic analysis (**Item 4 in the Toolkit**), since it pertains only to the direct impacts of each strategy, not indirect (macro-economic) impacts, such as job creation and overall economic growth. The CCS Team will use a set of standardized MS Excel workbooks for each sector to conduct the analysis of each strategy against the BAU baseline ("sector micro-workbooks"). To initiate the construction of these workbooks, a set of cross-sector (also referred to as "common") forecast data will be constructed and inserted into each sector workbook. Figure 2-5 provides an example of these data for forecasted fuel prices. Other key common forecast data include: population and employment forecasts, GHG direct and upstream emission factors, electricity system avoided costs and carbon intensity (based on the region's marginal resource mix), and land use/land cover data. Again, as noted previously, the CCS Toolkit is already organized to consider all these components of the Task 4 analysis - the need here is to update the Toolkit content to reflect regional context.

[13] Sample Strategy Template: http://www.climatestrategies.us/library/library/view/1103.

Figure 2-5. Sample Cross-Sector or "Common" Forecast Data



The standard worksheet structure of each sector "micro-workbook" is as follows:

1. *Introduction*: includes a description of the contents of each worksheet;
2. *Sector Summary Results*: shows summarized results of GHG reductions and costs for each strategy analyzed within the sector;
3. *Strategy "Stand-Alone" Analysis Sheets:* one for each sector strategy, contains the workup of all GHG reductions and direct net societal costs for the strategy; standard tables for net energy, GHG, and cost impacts; export tables for inter-sector integration (assessment of policy overlaps in other sectors); and follow-on macro-economic modeling (if included in project scope). The term "stand-alone" refers to the concept that each strategy at this stage is analyzed by itself against baseline (BAU) conditions (with no interaction/overlap considered with other strategies). Common terminology in transportation planning would be to refer to each of these sheets as "sketch-planning analyses";
4. *Intra-Sector Integrated Strategy Sheets:* one, as needed, for each bundle of policies within the sector where overlaps or interactions require an integration assessment to address of overlaps within the sector;
5. *Common Forecast Data:* as described above, this common data set is used in all sectors during micro-analysis; assures consistency of input data across sectors.
6. *Sector-specific Data Lookups:* common analysis data specific to each sector (e.g. GHG, energy and other baseline data).
7. *Export Sheets:* for exporting sector results to the Synthesis Module for inter-sector integration analysis; and for exporting required macro-economic modeling input data (when part of the project scope).

Within each strategy analysis, the over-arching equation we will apply for calculating net costs/benefits of any strategy is as follows:

Net Change = SS – BAU

Where:

- Net Change = impact on quantified metric (such as energy use reduction or energy production, GHG reduction, direct societal cost), typically on an annual basis
- SS = metric value in the Strategy Scenario (as a result of implementation)
- BAU = metric value under business as usual conditions

Whether the analytical end-point is an energy or emissions value or an annualized cost, the result is always calculated as a net change induced by the strategy as compared to BAU conditions. Within each sector "micro-workbook" the individual strategy analyses are worked up using a common format that promotes understanding/communication of results to stakeholders and subsequent integration of results across strategies (intra-sector integration) and across sectors (inter-sector integration). Figure 2-6 provides sample standard result summaries from an analysis of a strategy to increase urban forest canopy above BAU levels. This sample demonstrates that some strategies, even those in the land use sector, will have energy impacts in addition to the primary objective (in this case, increased carbon sequestration levels above baseline). The Toolkit provides the results in a form that maximizes transparency and understanding of how the overall results were constructed.

While not specified in the RFP, the Team also plans to conduct the intra- and inter-sector integrative analyses in order to provide COG and the MSWG with fully-integrated results that indicate the net GHG reductions and costs for the entire Regional Action Plan. These assessments are needed to minimize the potential for double-counting GHG reductions across strategies. An obvious and key area of interaction is between electricity supply and demand focused strategies. Since all GHG benefits and costs associated with electricity system impacts are measured against a defined BAU marginal resource mix, a re-assessment is needed to determine whether combined system impacts (i.e. all new electricity supply plus net demand reductions) exceed the size of the forecasted marginal resources. If so, then these resources will need to be redefined (additional generation sources added), and the avoided electricity system metrics recalculated. The recalculated metrics (avoided electricity system costs and carbon intensity) are then used to adjust all of the related strategy results. Another similar area of interaction (same idea of supply and demand as in the electricity sector) is the combination of transportation vehicle or fuel technology strategies with travel demand management strategies.

Other intra- and inter-sector overlaps and interactions are possible. These will be identified, adjustments will be made, and the integrated results documented in the Interim Technical Report under Task 5. Results will include the total regional GHG reductions achieved by each strategy through 2050 and for key benchmark years, the net present value of direct societal costs for implementing each strategy, charts showing the expected emissions trajectory for the region as compared to BAU, and a marginal abatement cost curve for the Action Plan strategies. Example summary materials are shown under Task 5.

CCS team members have led GHG mitigation strategy analysis across all the sectors discussed in the RFP. This analysis has ranged from the use of detailed supply and demand models (including in-depth experience with the TPB travel demand model), emission models (including MOVES2014), and economic models such as REMI to the development of context sensitive sketch-level planning tools. Given the schedule for this project, the Team

will employ sketch-level approaches within the Toolkit's standardized formats which are informed by existing COG analysis using more rigorous tools (e.g. TPB travel demand model).
Outside of the Transportation sector, the Team's modeling approaches tend to be custom-built within the Toolkit with the starting points always pointing back to the baseline. Standard energy supply and consumption modeling systems don't offer the level of flexibility often needed at the sub-state level of analysis; so our sketch-planning analyses for the Built Environment will be constructed from the bottom-up using information from the baseline as a starting point. Depending on strategy and analytical requirements, other modeling tools external to the Toolkit are often used to generate inputs to a sketch-level analysis. These could range from Argonne National Labs GREET Model to assess the carbon intensity of fuel supplies to the U.S. EPA's LandGEM model, which is used to model landfill methane emissions. In all cases, each sketch-level analysis needs to have direct ties to the methods and assumptions used to construct the baseline.

The Team favors the use of these more transparent worksheet approaches to those that rely on a modeling system that does not allow for external review and understanding. This transparency and reviewability is particularly important to ensure that the assumptions underlying the sketch methods reflect regional data and relationships. For example, in the case of the transportation sector, the outcomes of the sketch-level approach should generally mimic the outcomes generated through use of the regional travel demand model for demand related strategies, or MOVES2014 for supply strategies.

CCS Team members have developed sketch-level analysis approaches for the analysis of strategies across all sectors. This includes municipal, regional, and state-level approaches in Los Angeles, Orlando, Atlanta, Northern New Jersey, the greater Los Angeles region, and dozens of U.S. States and international States/Provinces.

As specified in the RFP, the Team will report out reductions of air pollution emissions along with GHG reductions. In some cases, these values will flow directly from the modeling approaches used to analyze GHGs (e.g. criteria pollutant emission reductions based on MOVES2014). However, for other strategies, the air pollutant reductions will need to be estimated from other sources. For example, avoided air pollutant emissions from electricity supply need to be consistent with those developed for GHGs. So, if a source like EPA's eGRID was used for the avoided GHG emissions, then we would also want to use eGRID to construct a consistent set of avoided criteria air pollutant emissions. Other co-benefits will often be documented qualitatively, unless they are produced as standard output of our direct micro-economic analyses (e.g. energy impacts, waste reduction, water reduction, materials consumption). Co-benefits documented qualitatively could include a reduction in commuting time, as an example.

Task 4 Deliverables: Technical Memorandum on Strategies, Analyzed Data, Models and Documentation

Figure 2-6. Sample Standard Strategy Analysis Summary Tables: Urban Forests

Net Change in GHG Emission & Energy Consumption

	BAU Energy & Emissions	Policy Scenario Energy & Emissions											
Year	Total BAU Emissions	Total New Plantings to Increase Canopy	Total Plantings to Replace Ash	Total Plantings to Replace Other Lost Trees	Urban Core Plantings	Cumulative Urban Core Plantings	Strategic Suburban Plantings	Cumulative Strategic Plantings	Other Suburban Plantings	Cumulative Other Suburban Plantings	Carbon Sequestered - Urban Plantings	Carbon Sequestered - Suburban Strategic Plantings	Carbon Sequestered - Suburban Other Plantings
	Tg CO_2	Trees	Trees	Trees	Trees	Trees	Trees	Trees	Trees	Trees	Tg CO_2	Tg CO_2	Tg CO_2
2015	0	1,868,510	127,356	38,405	203,427	203,427	1,322,276	1,322,276	508,568	508,568	(0.0006)	(0.0038)	(0.001)
2016	0	1,868,510	127,356	38,405	203,427	406,854	1,322,276	2,644,553	508,568	1,017,136	(0.0012)	(0.0075)	(0.003)
2017	0	1,868,510	127,356	38,405	203,427	610,281	1,322,276	3,966,829	508,568	1,525,703	(0.0017)	(0.011)	(0.004)
2018	0	1,868,510	127,356	38,405	203,427	813,708	1,322,276	5,289,105	508,568	2,034,271	(0.0023)	(0.015)	(0.006)
2019	0	1,868,510	127,356	38,405	203,427	1,017,136	1,322,276	6,611,381	508,568	2,542,839	(0.0029)	(0.019)	(0.007)
2020	0	1,868,510	127,356	38,405	203,427	1,220,563	1,322,276	7,933,658	508,568	3,051,407	(0.0042)	(0.027)	(0.010)
2021	0	1,868,510	127,356	38,405	203,427	1,423,990	1,322,276	9,255,934	508,568	3,559,975	(0.0055)	(0.036)	(0.014)
2022	0	1,868,510	127,356	38,405	203,427	1,627,417	1,322,276	10,578,210	508,568	4,068,542	(0.0068)	(0.044)	(0.017)
2023	0	1,868,510	127,356	38,405	203,427	1,830,844	1,322,276	11,900,486	508,568	4,577,110	(0.0081)	(0.053)	(0.020)
2024	0	1,868,510	127,356	38,405	203,427	2,034,271	1,322,276	13,222,763	508,568	5,085,678	(0.0094)	(0.061)	(0.023)
2025	0	1,868,510	127,356	38,405	203,427	2,237,698	1,322,276	14,545,039	508,568	5,594,246	(0.011)	(0.074)	(0.029)
2026	0	-	127,356	38,405	16,576	2,254,274	107,745	14,652,784	41,440	5,635,686	(0.013)	(0.084)	(0.032)
2027	0	-	127,356	38,405	16,576	2,270,851	107,745	14,760,529	41,440	5,677,126	(0.014)	(0.093)	(0.036)
2028	0	-	127,356	38,405	16,576	2,287,427	107,745	14,868,274	41,440	5,718,567	(0.016)	(0.103)	(0.040)
2029	0	-	127,356	38,405	16,576	2,304,003	107,745	14,976,018	41,440	5,760,007	(0.017)	(0.112)	(0.043)
2030	0	-	127,356	38,405	16,576	2,320,579	107,745	15,083,763	41,440	5,801,447	(0.019)	(0.126)	(0.048)
2050	0	-			-	2,352,517	-	15,291,361	-	5,881,293	(0.040)	(0.258)	(0.099)
2060	0	-			-	2,352,517	-	15,291,361	-	5,881,293	(0.042)	(0.275)	(0.106)
2070	0	-			-	2,352,517	-	15,291,361	-	5,881,293	(0.042)	(0.275)	(0.106)
2080	0	-			-	1,335,381	-	8,679,980	-	3,338,454	(0.023)	(0.150)	(0.058)
2085	0	-			-	318,246	-	2,068,598	-	795,615	(0.004)	(0.025)	(0.010)
Sum	**0.00**	**20,553,609**	**2,165,057**		**2,352,517**		**15,291,361**		**5,881,293**		**(2.0)**	**(13)**	**(5.1)**

Net Change in GHG Emission & Energy Consumption (Continued)									
							Energy & Emissions Change		
Suburban Strategic Plantings - Energy Offset	Suburban Strategic Plantings - Natural Gas Offset	Suburban Strategic Plantings - Electricity GHG Offset	Suburban Strategic Plantings - Natural Gas GHG Offset	Suburban Strategic Plantings - Upstream Natural Gas GHG Offset	Suburban Strategic Plantings - Upstream Electricity GHG Offset	Total Policy	Total In-State GHG Reductions	Carbon Sequestration Only	Out-of-State GHG Reductions
MWh	TJ	Tg CO_2e	Tg CO_2e	Tg CO_2e	Tg CO_2e	Tg CO_2e	Tg CO2	Tg CO2e	Tg CO2e
0	0.00	0.00	0.0000	0.0000	0.0000	(0.01)	(0.01)	(0.01)	0.0000
(6,008)	(0.07)	(0.01)	(0.0000)	(0.0000)	(0.0005)	(0.02)	(0.02)	(0.01)	(0.0000)
(18,025)	(0.22)	(0.02)	(0.0000)	(0.0000)	(0.0014)	(0.04)	(0.03)	(0.02)	(0.0000)
(36,051)	(0.43)	(0.03)	(0.0000)	(0.0000)	(0.0028)	(0.06)	(0.06)	(0.02)	(0.0000)
(60,084)	(0.72)	(0.06)	(0.0000)	(0.0000)	(0.0048)	(0.09)	(0.09)	(0.03)	(0.0000)
(90,126)	(1.08)	(0.08)	(0.0001)	(0.0000)	(0.0073)	(0.13)	(0.13)	(0.04)	(0.0000)
(126,177)	(1.51)	(0.12)	(0.0001)	(0.0000)	(0.010)	(0.18)	(0.17)	(0.05)	(0.0000)
(168,236)	(2.01)	(0.16)	(0.0001)	(0.0000)	(0.014)	(0.24)	(0.22)	(0.07)	(0.0000)
(216,303)	(2.58)	(0.20)	(0.0001)	(0.0000)	(0.019)	(0.30)	(0.28)	(0.08)	(0.0000)
(270,379)	(3.23)	(0.25)	(0.0002)	(0.0001)	(0.023)	(0.37)	(0.34)	(0.09)	(0.0001)
(330,463)	(3.94)	(0.30)	(0.0002)	(0.0001)	(0.028)	(0.45)	(0.42)	(0.11)	(0.0001)
(396,556)	(4.73)	(0.36)	(0.0002)	(0.0001)	(0.033)	(0.52)	(0.49)	(0.13)	(0.0001)
(462,649)	(5.52)	(0.42)	(0.0003)	(0.0001)	(0.038)	(0.60)	(0.56)	(0.14)	(0.0001)
(528,741)	(6.31)	(0.48)	(0.0003)	(0.0001)	(0.043)	(0.68)	(0.63)	(0.16)	(0.0001)
(594,834)	(7.10)	(0.53)	(0.0004)	(0.0001)	(0.048)	(0.75)	(0.70)	(0.17)	(0.0001)
(660,927)	(7.88)	(0.59)	(0.0004)	(0.0001)	(0.054)	(0.83)	(0.78)	(0.19)	(0.0001)
(1,982,780)	(23.7)	(1.76)	(0.0012)	(0.0004)	(0.158)	(2.31)	(2.15)	(0.40)	(0.0004)
(2,313,243)	(27.6)	(2.05)	(0.0014)	(0.0004)	(0.185)	(2.66)	(2.47)	(0.42)	(0.0004)
(2,313,243)	(27.6)	(2.05)	(0.0014)	(0.0004)	(0.185)	(2.66)	(2.47)	(0.42)	(0.0004)
(1,261,769)	(15.1)	(1.12)	(0.0008)	(0.0002)	(0.101)	(1.45)	(1.35)	(0.23)	(0.0002)
(210,295)	(2.51)	(0.19)	(0.0001)	(0.0000)	(0.017)	(0.24)	(0.22)	(0.04)	(0.0000)
(99,469,449)	**(1,186)**	**(88)**	**(0.060)**	**(0.018)**	**(7.95)**	**(116)**	**(109)**	**(20)**	**(0.018)**

Net Societal Costs

	BAU Costs	Policy Scenario Costs									Net Costs		
	Total BAU Costs	Capital Planting Costs - Urban Core	Capital Costs - Suburban	Annualized Capital	Maintenance Costs - Urban	Maintenance Costs - Suburban	Strategic Suburban Electricity Savings	Strategic Suburban Natural Gas Savings	Stormwater Runoff Savings	Total Policy Costs	Net Policy Costs	Total Discounted Policy Costs	Cost Effectiveness
Year	**MM$**	**MM$**	**MM$**	**MM$**	**MM$**	**MM$**	**MM$**	**MM$**	**MM$**	**MM$**	**MM$**	**MM$2014**	**$2014/tCO$_2$e**
2015	$0.00	$45.77	$366.17	$30.36	$5.82	$6.10	$0.00	$0.00000	$0.00	$42.3	$42.3	$39.5	
2016	$0.00	$46.69	$373.49	$61.33	$11.87	$12.44	($0.00)	($0.00000)	($0.2)	$85.4	$85.4	$74.4	
2017	$0.00	$47.62	$380.96	$92.91	$18.17	$19.03	($0.00)	($0.00000)	($0.8)	$129	$129	$105	
2018	$0.00	$48.57	$388.58	$125.13	$24.71	$25.88	($0.01)	($0.00000)	($1.6)	$174	$174	$132	
2019	$0.00	$49.54	$396.35	$157.99	$31.50	$33.00	($0.01)	($0.00001)	($2.6)	$220	$220	$156	
2020	$0.00	$50.53	$404.28	$191.51	$38.56	$40.39	($0.01)	($0.00001)	($4.0)	$266	$266	$177	
2021	$0.00	$51.55	$412.37	$225.70	$45.89	$48.06	($0.02)	($0.00001)	($5.8)	$314	$314	$194	
2022	$0.00	$52.58	$420.61	$260.58	$53.49	$56.03	($0.03)	($0.00002)	($7.8)	$362	$362	$209	
2023	$0.00	$53.63	$429.03	$296.15	$61.38	$64.29	($0.03)	($0.00003)	($10)	$412	$412	$222	
2024	$0.00	$54.70	$437.61	$332.43	$69.56	$72.86	($0.04)	($0.00003)	($13)	$462	$462	$233	
2025	$0.00	$55.79	$446.36	$369.44	$78.05	$81.75	($0.05)	($0.00004)	($16)	$513	$513	$241	
2026	$0.00	$4.64	$37.10	$372.52	$80.20	$84.00	($0.06)	($0.00005)	($20)	$517	$517	$227	
2027	$0.00	$4.73	$37.84	$375.66	$82.41	$86.31	($0.07)	($0.00006)	($24)	$521	$521	$213	
2028	$0.00	$4.82	$38.60	$378.86	$84.67	$88.68	($0.08)	($0.00007)	($28)	$524	$524	$201	
2029	$0.00	$4.92	$39.37	$382.12	$86.99	$91.11	($0.09)	($0.00008)	($32)	$528	$528	$189	
2030	$0.00	$5.02	$40.16	$385.45	$89.37	$93.60	($0.09)	($0.00009)	($36)	$532	$532	$178	**$565**
2050	$0.00			$6.70	$134.62	$141.00	($0.28)	($0.00026)	($161)	$121	$121	$10.3	
2060	$0.00				$164.10	$171.88	($0.33)	($0.00031)	($229)	$107	$107	$4.56	
2070	$0.00				$200.04	$209.52	($0.33)	($0.00031)	($279)	$130	$130	$2.80	
2080	$0.00				$138.42	$144.98	($0.18)	($0.00017)	($185)	$97.8	$97.8	$1.06	
2085	$0.00				$36.42	$38.15	($0.03)	($0.00003)	($34)	$40.4	$40.4	$0.31	
Sum	**$0.00**	**$591**	**$4,730**	**$7,843**	**$8,763**	**$9,179**	**($14)**	**($14)**	**($9,809)**	**$15,962**	**$15,962**	**$4,262**	**$39**

Task 5. Prepare and Present an Interim Technical Report

The Team will prepare a draft Interim Technical Report and deliver a presentation of it to the full MSWG under this task. It will consist of the following:

- *Executive Summary*: summarizing the GHG baseline, strategy selection and design process, micro-economic analysis of strategies, "stand-alone" strategy results, and fully integrated results;
- *Sector Appendices*: one for each sector that contain a summary of sector-level results, and the completed policy templates with all of the details on policy design, implementation mechanisms, analysis methods, and results.

During the MSWG meeting, the Team's Lead Facilitator will attempt to achieve consensus on any required revisions to the draft Interim Technical Report. Where consensus agreement cannot be reached, the Team will incorporate discussion of these areas of disagreement into the final Interim Technical Report.

Presentations of results will also be made by COG staff to the TPB, MWAQC, CEEPC and the COG Board. The Team will assist COG staff in preparing these presentations and will accompany COG staff at the presentations and participate, as needed. Action Plan results will be provided in a variety of forms. Samples are provided in Table 2-1 and Figures 2-7 through 2-10 below. Regional Action Plan results will be provided at a sector level as well as across sectors as shown in these examples.

Task 5 Deliverables: Interim Technical Report

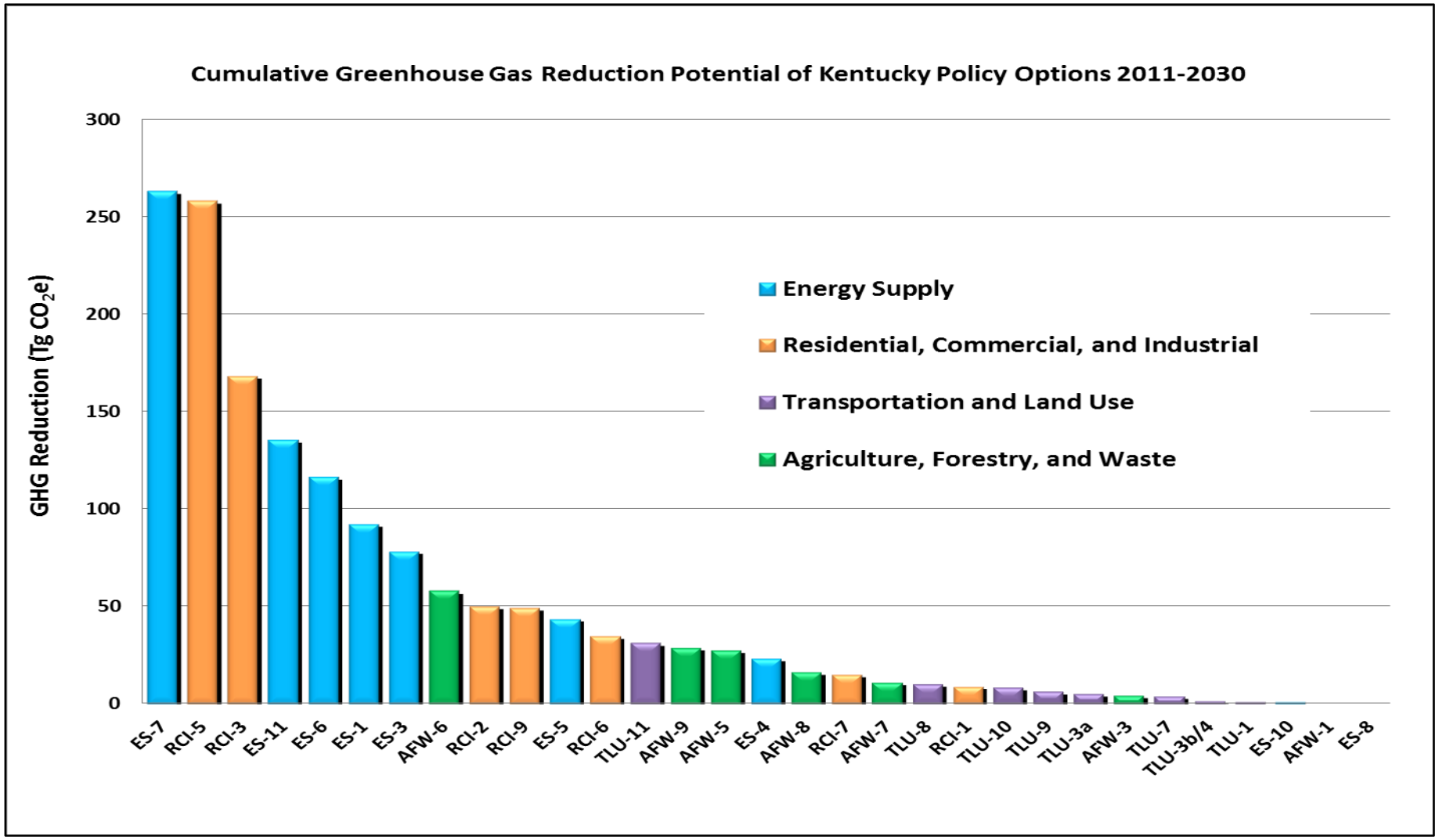
Presentations to TPB, MWAQC, CEEPC, and COG Board

Table 2-1. Summarized Results of the Baja California Climate Action Plan

Policy ID	Policy Name	2020 Annual Reductions (Tg CO_2e)	2030 Annual Reductions (Tg CO_2e)	Cumulative 2016-2030 (Tg CO_2e)	NPV Costs/ Savings 2016-2030 ($2012MM)	Cost Effectiveness ($2012/t CO_2e)
ES-1	Micro-Hydro Renewable Energy Generation	0.047	0.065	0.78	$231	$294
ES-2	Energy Supply Diversification	0.94	1.3	16	$6,814	$425
ES-3	Distributed Energy Supply for Building	0.013	0.019	0.22	$6.9	$31
ES-4	Photovoltaic Panel Electricity Generation	0.018	0.025	0.30	$150	$505
Energy Supply Sector Totals		**1.0**	**1.5**	**17**	**$7,201**	**$415.17**
RCII-1	Energy Efficiency: Residential Shell Improvement	0.019	0.019	0.26	($309)	($1,172)
RCII-2	Energy Efficiency: New Housing Appliances	0.016	0.016	0.43	($290)	($675)
RCII-3	Energy Efficiency: Existing Buildings	0.58	0.58	8.2	($10,952)	($1,342)
RCII-4	Finance Incentives for Machinery Energy Efficiency	0.27	0.73	6.1	($11,771)	($1,915)
RCII-5	Solar Water Heaters on Housing	0.44	0.44	6.1	($8,800)	($1,435)
RCII-6	Flow Water Heaters for Residential Sector	0.14	0.14	2.0	($3,095)	($1,559)
Residential, Commercial, Industrial & Institutional Sector Totals		**1.5**	**1.9**	**23**	**($35,217)**	**($1,523)**
TLU-1	Black Carbon Control Measures	0.046	0.000	0.30	$60	$196
TLU-2	Alternative Fuels	0.034	0.078	0.77	($188)	($242)
TLU-3	Onroad Fleet Efficiency	0.0033	0.0079	0.070	($81)	($1,150)
TLU-4	Increase efficiency in urban mobility	Dropped from final CAP results.				
TLU-5	Smart Growth Planning	0.011	0.036	0.28	($480)	($1,716)
TLU-6	Energy Efficient Government Fleet	0.000084	0.00011	0.0015	$2.3	$1,609
Transportation & Land Use Sector Totals		**0.10**	**0.12**	**1.4**	**($686)**	**($480)**
AFOLU-1	Manure Management: Non-Dairy Livestock	0.00037	0.00037	0.0048	$3.4	$714
AFOLU-2	Manure Management: Dairies	0.020	0.021	0.27	$31	$117
AFOLU-3	Utilization of Wheat Straw	N/A; GHG reductions and costs are reported with the ES-2 policy totals.				
AFOLU-4	Bioethanol Production from Sweet Sorghum	N/A; GHG reductions and costs are reported with the TLU-2 policy totals.				
AFOLU-5	Livestock Grazing Management	0.069	0.12	1.31	$1,117	$855
AFOLU-6	Urban Forestry	0.00005	0.0006	0.0034	$17	$5,514
Agriculture, Forestry and Other Land Use Sector Totals		**0.090**	**0.14**	**1.6**	**$1,169**	**$739**
WM-1	Landfill Gas Management	0.27	0.32	3.9	$258	$67
WM-2	Indirect Potable Water Re-Use	0.025	0.035	0.43	($226)	($532)
WM-3	Water Reclamation	0.041	0.071	0.76	($415)	($545)
WM-4	Biodiesel Production	N/A; GHG reductions and costs are reported with the TLU-2 policy totals.				
Waste Management Sector Totals		0.34	0.43	5.1	($383)	($76)
Total Integrated Plan Results		**3.0**	**4.1**	**49**	**($27,916)**	**($575)**

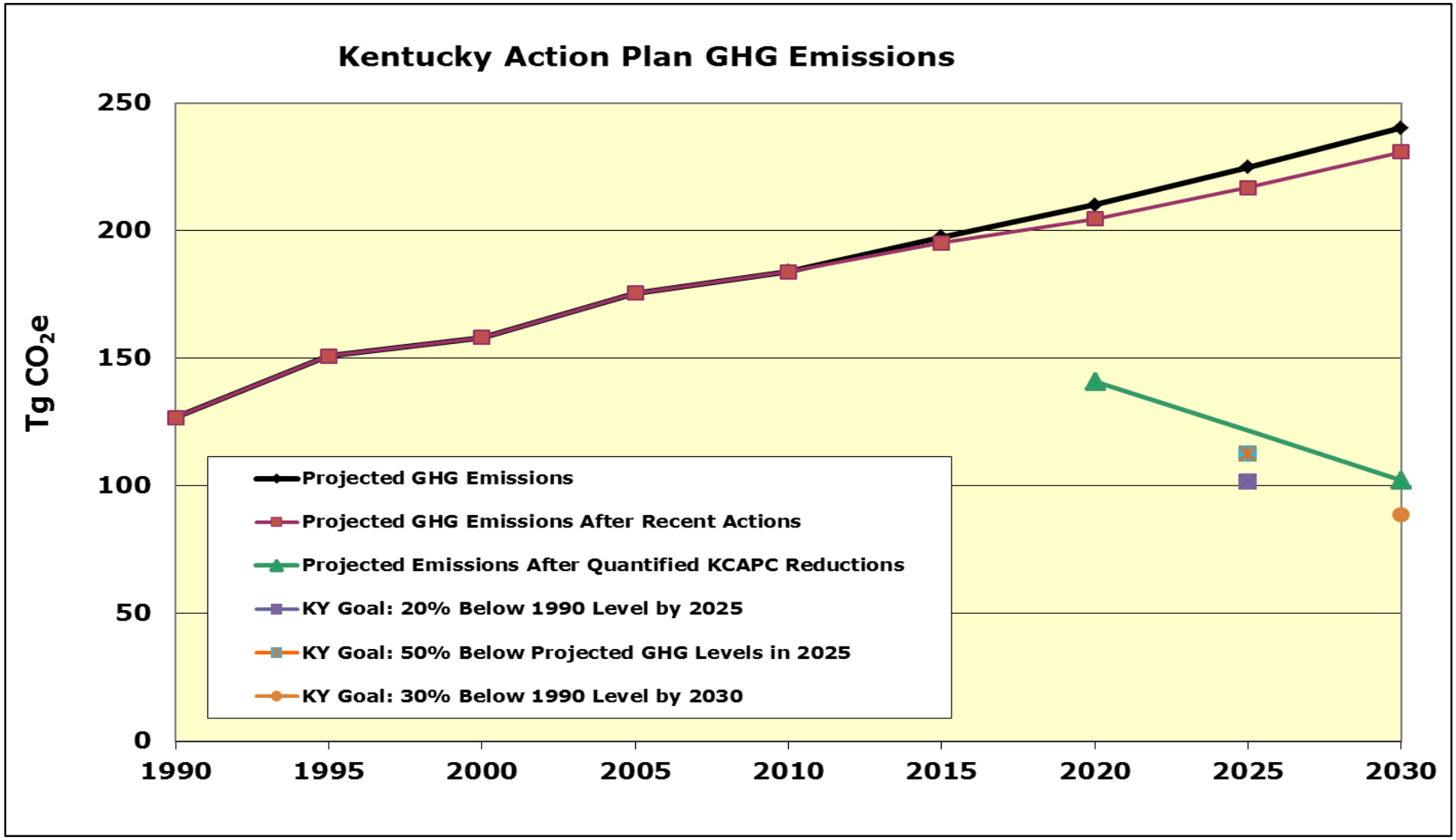
Note: ES - Energy Supply; RCII - Residential, Commercial, Institutional & Industrial; TLU - Transportation & Land Use; AFOLU - Agriculture, Forestry & Other Land Use; WM - Waste Management. Tg CO_2e - teragrams of carbon dioxide equivalent. Currency is Mexican Pesos.

Figure 2-7. Sample Action Plan Quantified GHG Reductions



Note: Tg CO_2e = teragrams of carbon dioxide equivalent emissions.

Figure 2-8. Sample Progress Toward Targets Charting



Note: Tg CO_2e = teragrams of carbon dioxide equivalent emissions.

Figure 2-9. Sample Comparison of Policy/Strategy Cost Effectiveness

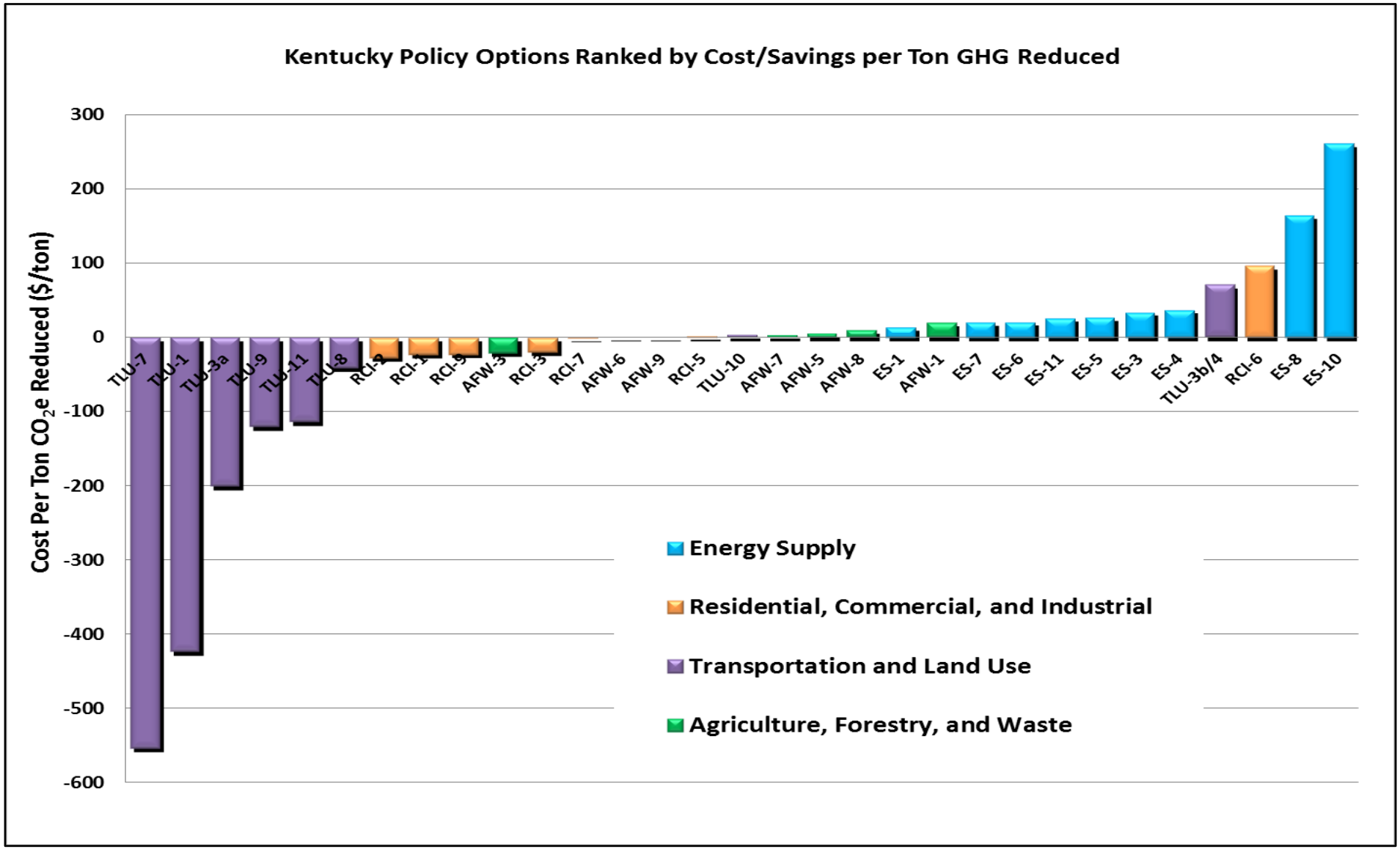
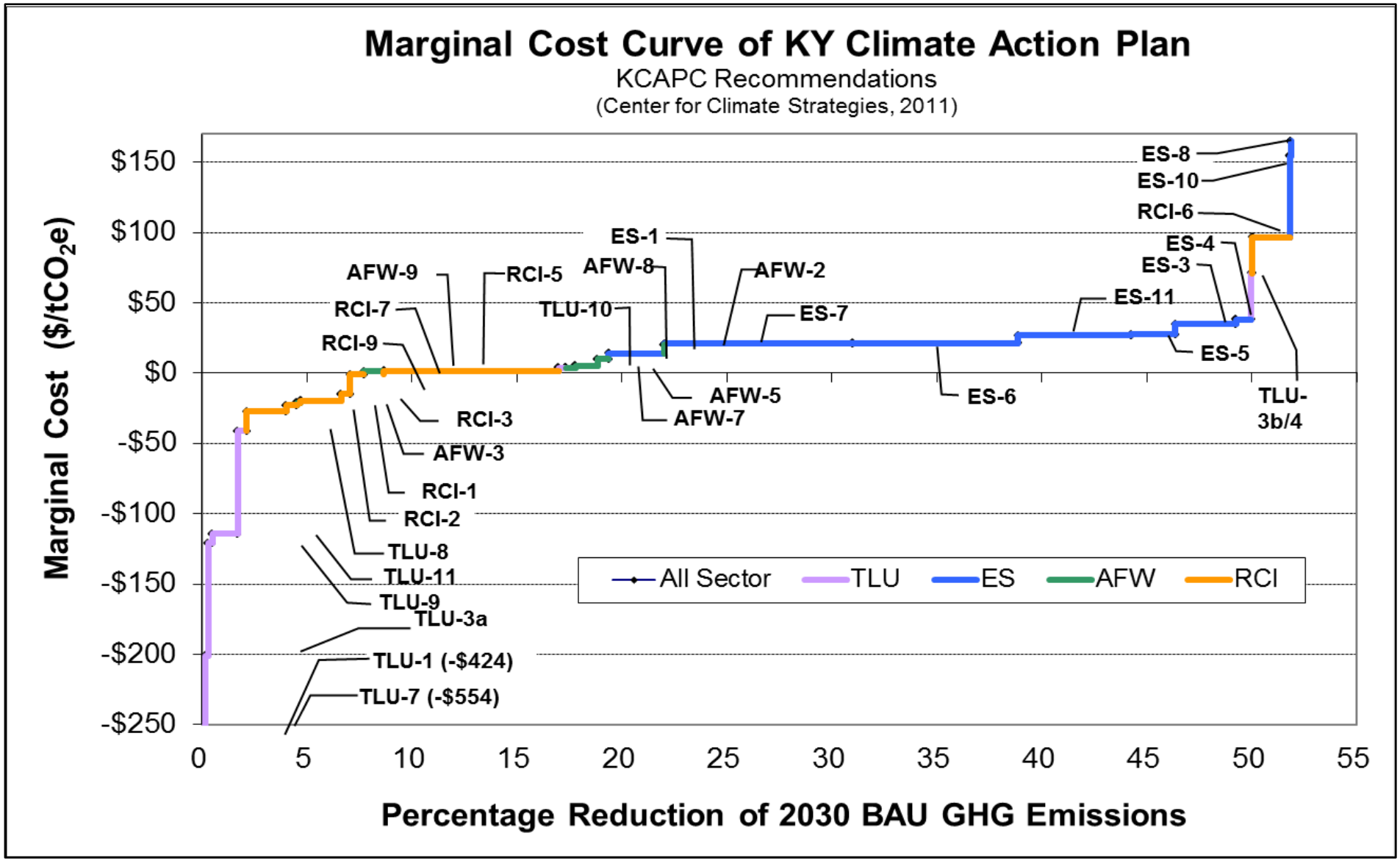


Figure 2-10. Sample Marginal Abatement Cost Curve



Note: tCO_2e = metric tons of carbon dioxide equivalent emissions. TLU - Transportation & Land Use; ES = Energy Supply; AFW - Agriculture, Forestry & Waste Management; and RCI - Residential, Commercial & Industrial.

Task 6. Explore GHG Goals and Targets in Each Sector

In this task, the CCS Team will return to the sector-level strategy catalogs analysis developed under Task 2 with the subgroups and the associated MCA under Task 3 to identify additional goals and targets that would fall into three tiers:

1. Achievable goals and targets with currently viable and implementable strategies
2. Stretch goals and targets with strategies that could become viable in the future if certain changes were made in state and local regulations and future investments were made in them
3. Goals and targets that would require action by other levels of government

The RFP didn't specify a distinction between what would be considered a goal or a target. The Team assumes that goals refer to overall GHG reduction goals (e.g. economy-wide) adopted by COG, while targets could be sector specific, and possibly even specific to a subsector (e.g. on-road transportation within the Transportation sector). For much of this task, the CCS Team will return to the GHG reduction screens within the Task 2 MCA analysis as a starting point to assess the GHG reduction potential for each of the strategies not selected for analysis under Task 4. These screening-level assessments differ from the more detailed analyses of GHG reduction potential conducted for the micro-economic analysis in Task 4 in that, while they are tied back to the GHG baseline, the reduction potential is based on expert judgement of CCS Team analysts on the technical or market potential of each strategy, as well as a judgement of the likely penetration of each strategy (to correct for segments of the targeted source population that would be exceedingly expensive to address). Finally, these screening estimates need to factor in some consideration of overlap among strategies in order to avoid double-counting reductions.

Within each sector, the Team will construct a list of the remaining strategies in the catalog that appear to be the most promising (both economically and environmentally) based on the MCA analysis with the prior input from the subgroups (i.e. a "mid-tier" of priority underneath the "top-tier" strategies selected under Task 2). Another key required input will be an assessment of timing for implementation of each strategy. The Team plans to use a combination of its expert judgement and input from each subgroup to inform a reasonable implementation schedule for each strategy (i.e. start year and end year). The associated screening-level reductions in each sector will then be built up on top of those estimated for the priority strategies analyzed under Task 4 in order to gauge an appropriate target for that sector.

As indicated in the RFP, the third-tier strategies to be addressed will include such national standards as increased CAFE standards or possible carbon sequestration of fossil-fueled power plants. Another important strategy to consider here will be varying methods of compliance with CAA Section 111d requirements by utilities that supply power to the regional grid (e.g. changes in compliance approaches than were factored into the regional GHG baseline). These third-tier strategies will be added to the results for mid-tier strategies to indicate their possible combined GHG reduction impacts.

Each of the sector-level assessments will be combined to assess an economy-wide GHG goal for the region (e.g. via implementation of all top- and mid-tier strategies, with and without possible national strategies). The Team will document the results of this and targeting and goal assessment in a technical memorandum and present the results to the full MSWG. Comments from COG and the MSWG will be addressed and reflected in the related materials presented in the Final Report under Task 7.

Task 6 Deliverables: Technical Memorandum on Exploration of GHG Goals and Targets

Task 7. Prepare and Present a Final Technical Report

The Team will develop a Final Technical Report that includes all of the material developed under Task 5 for the Interim Technical Report, as well as the Task 6 Technical Memorandum. This report will include revisions based on comments received from COG and the MSWG on both task deliverables. CCS Team staff will support COG in the presentations of the Final Technical Report to TPB, MWAQC, CEEPC and the COG Board. This will include accompanying COG staff at these presentations and participating in those presentations, as requested.

Task 7 Deliverables: Draft and Final Report; COG presentations.

Chapter 3. Services, Pricing and Schedule

The Team's cost estimate is provided as Attachment B to this proposal. From that estimate, Table 3-1 below provides a summary table of the hours budgeted for the team to conduct the services outlined in Chapter 2. The CCS Team's cost proposal meets the COG DBE participation goal of 19% for this contract.

A revised project schedule is shown as Figure 3-1 below which addresses some of the Team's concerns around scheduling mentioned in Chapter 2. Note, however, that the Team still believes that the project should be constructed to cover 1 year if possible, rather than the roughly 8 months shown in Figure 3-1. This schedule assumes that a contract is in place by mid-March and that the Work Plan is finalized by March 28. While some adjustments have been made to better accommodate the time required to conduct Tasks 2-4, the time available remains very constricted. Work on these tasks would need to be completed within 3 - 4 months. While technically-possible, this amount of time allows for minimal interaction and review by the MSWG subgroups. One way to alleviate some of this constriction is to push back the dates of meetings 3-5 by 4 to 6 weeks. The Team remains confident that the final report delivery date (end of November) and the final report presentations on the project scheduled for December and January could still done at those times.

Table 3-1. Proposed Labor Hours by Staff by Task

Staff	Affiliation	RFP Task							Total	Availability (4/15 - 9/15)
		1	2	3	4	5	6	7		%
Thomas Peterson	CCS	8	20	16	8	18	12	20	102	25%
Stephen Roe	CCS	12	48	16	64	10	20	16	186	35%
Scott Williamson	CCS	32	48	16	32	16	24	24	192	40%
Loretta Bauer	CCS	24	-	-	-	-	-	-	24	40%
Holly Lindquist	CCS	-	68	16	80	18	32	8	222	50%
Arianna Ugliano	CCS	-	88	24	120	20	44	28	324	60%
David Jackson	CS	4	32	24	32	28	16	16	152	50%
Jay Evans	CS	-	2	2	8	4	-	4	20	25%
Chris Porter	CS	-	4	4	8	2	2	2	22	35%
Rich Denbow	CS	-	4	12	8	16	4	4	48	50%
Suseel Indrakanti	CS	-	24	8	58	4	-	2	96	75%
David Kall	CS	-	8	4	32	16	-	-	60	60%
Stacy Cook	CS	-	28	4	-	12	32	12	88	60%
David von Hippel	Independent	-	64	10	60	8	36	8	186	50%
Katherine Johnson	Johnson	-	28	6	-	4	28	4	70	20%
Geri Nicholson	Sage Energy	-	-	-	16	4	-	-	20	55%
Gretchen Dolan	Sage Energy	-	-	-	40	8	-	-	48	30%
Laura Kossey	Sage Energy	-	-	-	60	16	-	-	76	20%
Mike Kenney	KBE	-	-	2	38	4	4	2	50	50%
Paola Pringle	KBE	-	-	8	160	12	24	8	212	50%
Total Hours		**80**	**466**	**172**	**824**	**220**	**278**	**158**	**2,198**	

Figure 3-1. Revised Project Schedule

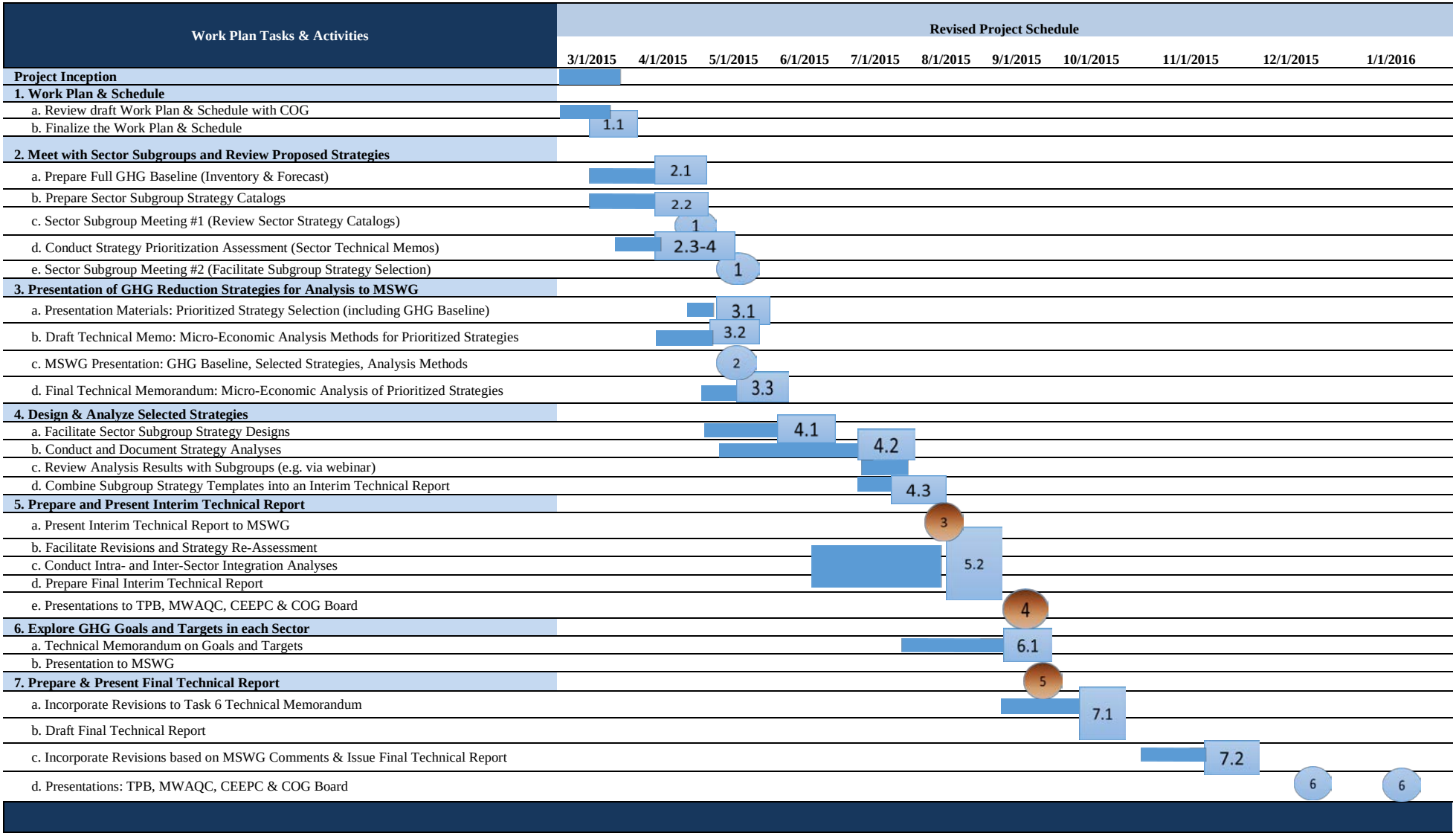


Figure 3-1 Legend

Milestone/Deliverables

1.1 - Final Work Plan & Schedule

2.1 - Technical Memo: Regional GHG Baseline (Inventory & Forecast)

2.2 - Draft Sector Strategy Catalogs

2.3 - Sector Technical Memos on Strategy Prioritization

2.4 - List of Prioritized Strategies by Sector

3.1 - Draft Technical Memorandum: Selected Strategies and Analysis Methods

3.2 - MSWG Presentation [May 8, 2015]

3.3 - Final Technical Memorandum: Selected Strategies and Analysis Methods

4.1 - Strategy Templates Containing Complete Designs

4.2 - Strategy Templates Containing Analysis Results

4.3 - Interim Technical Report: All Sector Strategy Templates

5.1 - Presentation of Interim Technical Report [July 31, 2015]

5.2 - Final Interim Technical Report

5.3 - Presentations: TPB, MWAQC, CEEPC & COG Board [September 2015]

6.1 - Technical Memorandum on Goals & Targets

6.2 - Presentation to MSWG [September 25, 2015]

7.1 - Draft Final Technical Report

7.2 - Final Technical Report

7.3 - Presentations: TPB, MWAQC, CEEPC & COG Board [December 2015; January 2016]

In-Person Meetings

1 - Task 2 Sector Subgroup Strategy Selection Meetings []

2 - Task 3 MSWG Meeting [May 8, 2015]

3 - Task 5 Interim Technical Report Presentation to MSWG [July 31, 2015]

4 - Task 5 Interim Technical Report Presentations to TPB, MWAQC, CEEPC & COG Board [September, 2015]

5 - Task 6 Presentation to MSWG [September 25, 2015]

6 - Task 7 Final Technical Report Presentations [December 2015; January 2016]

Chapter 4. References

References for CCS Team members are provided below. Note that the references overlap for several team members, since most have been common team members across many projects.

CCS references:

- South Coast Association of Governments: Frank Wen, Planning Manager, 213-236-1854.
- Diane Duff, Executive Director; Southern Governor's Association, Washington D.C.
- John Quigley, Secretary, Pennsylvania DEP, Harrisburg, PA
- South Jersey Transportation Planning Organization: David Heller, Sr. Transportation Planner, 856-794-1941.

CS references:

- Georgetown Climate Center: Kathryn Zyla, Deputy Director, 202-661-6558
- Maryland Department of Transportation: Mike Haley, Strategic Planning Manager, 410-865-1011. *For work conducted on the Maryland DOT Climate Action Plan.*
- Oregon Department of Transportation: Amanda Pietz, Planning Unit Manager, 503-986-4227. *For work conducted on the Oregon Sustainable Transportation Strategy.*

David von Hippel references:

- WA Dept. of Ecology, Bill Drumheller, Climate & Energy Specialist, 360-407-7657. *For work conducted on the Oregon Cost Curves Project.*
- Institute for Sustainable Communities, Steve Adams, Sr. Program Director, 802-229-2900 (HQ office). *For work conducted on the Florida Energy & Climate Action Plan.*
- South Coast Association of Governments: Frank Wen, Planning Manager, 213-236-1854.

KBE references:

- Florida Department of Transportation, Robin Rhinesmith, Environmental Manager, 813-975-6496.
- Port Authority of NY/NJ, Ed Knossel, Environmental Specialist, 212-435-3747.
- FAA Office of Environment and Energy, Chris Sequeira, Environmental Specialist, 202-267-7821.

Johnson Consulting references:

- Arkansas Public Service Commission, Matthew Klucher, Director, Rates and Demand Resources, 50-682-5661.
- Missouri Public Service Commission, John Rogers, President & Owner, Innovologie, 573-751-7524.
- New York State Energy Research and Development Authority and the New York State Evaluation Advisory Group, Dr. Patricia Gonzalez, Program Manager, 518-862-1090.

Sage Energy references:

- Maryland Energy Administration, Fred Hoover, Energy Programs Director, 410-260-7544.
- Montgomery County Sustainability Working Group/Montgomery County Department of Environmental Protection, Eric Coffman, Senior Energy Planner, 240-777-7754
- U.S. Green Building Council, Rick Fedrizzi, President, CEO and Founding Chairman, 202-828-7422.

Attachment A. Standard Terms and Conditions

I. Energy Conservation – 42 U.S.C. 6321 et seq.
The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

II. Clean Water Requirements – 33 U.S.C. 1251 et seq.
1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended. The Contractor agrees to report each violation to COG and understands and agrees that COG will, in turn; report each violation as required to assure notification to appropriate federal agencies including the appropriate EPA Regional Office.
2. The Contractor also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance.

III. Lobbying – 31 U.S.C. 1352 et seq.
(*To be submitted with each bid or offer exceeding $100,000)*
The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal Loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of and Federal contract, grant, loan, or cooperative agreement.
2. If any funds or than Federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form—LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions [as amended by "Government wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/19/96). Note: Language in paragraph (2) herein as been modified in accordance with Section 10 of the Lobbying Disclosure Act of 1995 (P.L. 104-65, to be codified at 2 U.S.C. 1601, *et.seq.*)]
3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction by 31, U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

[Note: Pursuant to 31 U.S.C. § 1352(c)(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such expenditure or failure.]

The Contractor, _____, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. A 3801, *et seq*., apply to this certification and disclosure, if any.

_____Signature of Contractor's Authorized Official

_____Name and Title of Contractor's Authorized Official

_____Date

IV. Access to Records and Reports – 49 U.S.C. 5325

1. The Contractor agrees to provide COG, and if applicable the state or federal funding agency, the Comptroller General of the United States or any of their authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts and transactions.
2. The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.
3. The Contractor agrees to maintain all books, records, accounts and reports required under this contract for a period of not less than three years after the date of termination or expiration of this contract, except in the event of litigation or settlement of claims arising from the performance of this contract, in which case Contractor agrees to maintain same until COG, the applicable state or federal funding agency, the Comptroller General, or any of the their duly authorized representatives, have disposed of all such litigation, appeals, claims or exceptions related thereto.

V. Funding Agency Changes

Contractor shall at all times comply with all applicable state and federal agency regulations, policies, procedures and directives, including without limitation those listed directly or by reference in the funding agreement between such agency and COG, as they may be amended or promulgated from time to time during the term of this contract. Contractor's failure to comply shall constitute a material breach of this contract.

VI. Clean Air – 42 U.S.C. 7401 et seq

The Clean Air requirements apply to all contracts exceeding $100,000, including indefinite quantities where the amount is expected to exceed $100,000 in any year.

1. The Contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. §§ 7401 et seq. The Contractor agrees to report each violation to COG and understands and agrees that COG will, in turn; report each violation as required to assure notification to the funding federal agency, if any, and the appropriate EPA regional office.
2. The Contractor also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance.

VII. Recycled Products – 42 U.S.C. 6962

The Recycled Products requirements apply to all contracts for items designated by the EPA, when COG or the contractor procures $10,000 or more of one of these items during the fiscal year, or has procured $10,000 or more of such items in the previous fiscal year, using federal funds.

The Contractor agrees to comply with all requirements of Section 6002 of the Resource Conservation and Recovery Act (RCRA), as amended (42 U.S.C. 6962), including but not limited to regulatory provisions of 40 CFR Part 247, and Executive Order 12873, as they apply to the procurement of the items designated in Subpart B of 40 CFR Part 247.

VIII. No Government Obligation to Third Parties

1. The Contractor acknowledges and agrees that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this contract and shall not be subject to any obligations or liabilities of COG, the Contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.
2. The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

IX. Program Fraud and False or Fraudulent Statements and Related Acts – 31 U.S.C. 3801 et seq.

1. The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801 et. seq. and all appropriate federal agency regulations apply to its actions pertaining to this Project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract of the Federally assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or caused to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor or to the extent the Federal Government deems appropriate.
2. The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance, the Federal Government reserves the right to impose the penalties of 18 U.S.C. § 1001 and 49 U.S.C. § 5307(n) (1) on the Contractor, to the extent the Federal Government deems appropriate.
3. The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to the provisions.

X. Termination – 49 U.S.C. Part 18

Applicable to all contracts in excess of $10,000

a. **Termination for Convenience** – COG, by written notice, may terminate this contract, in whole or in part, at any time by written notice to the Contractor when it is in COG's best interest. If this contract is terminated, COG shall be liable only for payment under the payment provisions of this contract for services rendered before the effective date of termination.

b. **Termination for Default [Breach or Cause]** – If the Contractor fails to perform in the manner called for in this contract, or if the Contractor fails to comply with any other provisions of the contract, COG may terminate this contract for default. Termination shall be effected by serving a notice of termination on the Contractor setting forth the manner in which the Contract is in default. The Contractor will only be paid the contract price for services performed in accordance with the manner of performance set forth in the contract. If it is later determined by COG that the Contractor had an excusable reason for not performing, such as strike, fire, or flood, events which are beyond the control of the Contractor, COG, after setting up a new delivery of performance schedule, may allow the Contractor to continue work, or treat the termination as a termination for convenience.

C . COG in its sole discretion may, in the case of termination for breach or default, allow the Contractor ten (10) working days in which to cure the defect. In such case, the notice of termination will state the time

period in which cure is permitted and other appropriate conditions. If the Contractor fails to remedy to COG's satisfaction the breach or default of any of the terms, covenants, or conditions of this Contract within the 10 working days after receipt by Contractor of written notice from COG setting forth the nature of said breach or default, COG shall have the right to terminate the Contract without further obligation to Contractor. Any such termination for default shall not in any way operate to preclude COG from also pursuing all available remedies against Contractor and its sureties for said breach or default.

d. In the event COG elects to waive its remedies for any breach by Contractor of any covenant, term or condition of this Contract, such waiver by COG shall not limit COG's remedies for any succeeding breach of that or any other term, covenant, or condition of this Contract.

XI. Civil Rights Requirements – 29 U.S.C. § 62, 42 U.S.C. § 2000, 42 U.S.C. § 602, 42 U.S.C. § 12112, 42 U.S.C. § 12132, 49 U.S.C. § 5332

1. **Nondiscrimination** – In accordance with Title VI of the Civil Rights Act, as amended, 42 U.S.C. § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 U.S.C. § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 U.S.C. § 12132, and all other provisions of Federal law, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age, or disability. In addition, the Contractor agrees to comply with applicable Federal implementing regulations.

2. **Equal Employment Opportunity** – The following equal employment opportunity requirements apply to the underlying contract:

a. **Race, Color, Creed, National Origin, Sex** – In accordance with Title VII of the Civil Rights Act, as amended, 42 U.S.C. § 2000e, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 CFR Parts 60 et seq., (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 U.S.C. § 2000e note), and with any applicable Federal Statutes, executive orders, regulations, and Federal policies that may in the future affect activities undertaken in the course of this Project. The Contractor agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination;
rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements the funding federal agency may issue.

b. **Age** – In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 U.S.C. § § 623 and other applicable law, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements the funding federal agency may issue.

c. **Disabilities** – In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 U.S.C. § 12112, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 CFR Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements the funding federal agency my issue.

3. The Contractor also agrees to include these requirements in each subcontract financed in whole or in part with Federal Assistance, modified only if necessary to identify the affected parties.

XII. Breaches and Dispute Resolution

Disputes – Disputes arising in the performance of this Contract which are not resolved by agreement of the parties shall be decided in writing by the COG Executive Director or his/her designee. This decision shall be final and conclusive unless within ten (10) working days from the date of receipt of its copy, the Contractor mails or otherwise furnishes a written appeal to the Executive Director or his/her designee. In connection with any such appeal, the Contractor shall be

afforded an opportunity to be heard and to offer evidence in support of its position. The decision of the Executive Director or his/her designee shall be binding upon the Contractor and the Contractor shall abide the decision.

Performance During Dispute – Unless otherwise directed by COG, Contractor shall continue performance under this Contract while matters in dispute are being resolved.

Claim for Damages – Should either party to the Contract suffer injury or damage to person or property because of any act or omission of the party or of any of its employees, agents or others for acts it is legally liable, a claim for damages therefore shall be made in writing to such other party within a reasonable time after the first observance of such injury or damage.

Remedies – Unless this contract provides otherwise, all claims, counterclaims, disputes and other matters in question between COG and the Contractor arising out of or relating to this agreement or its breach will be decided by arbitration if the parties mutually agree, or in a court of competent jurisdiction within the District of Columbia.

Rights and Remedies – The duties and obligations imposed by the Contract and the rights and remedies available there under shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by COG or the Contractor shall constitute a waiver or any right or duty afforded to them under the Contract, not shall any such action or failure to act constitute an approval of or acquiescence in any breach there under, except as may be specifically agreed in writing.

XIII.
Patent and Rights in Data

A. Rights in Data - The following requirements apply to each contract involving experimental, developmental or research work:

(1) The term "subject data" used in this clause means recorded information, whether or not copyrighted, that is delivered or specified to be delivered under the contract. The term includes graphic or pictorial delineation in media such as drawings or photographs; text in specifications or related performance or design-type documents; machine forms such as punched cards, magnetic tape, or computer memory printouts; and information retained in computer memory. Examples include, but are not limited to: computer software, engineering drawings and associated lists, specifications, standards, process sheets, manuals, technical reports, catalog item identifications, and related information. The term "subject data" does not include financial reports, cost analyses, and similar information incidental to contract administration.

(2) The following restrictions apply to all subject data first produced in the performance of the contract to which this Attachment has been added:

(a) Except for its own internal use, the Purchaser or Contractor may not publish or reproduce subject data in whole or in part, or in any manner or form, nor may the Purchaser or Contractor authorize others to do so, without the written consent of the Federal Government, until such time as the Federal Government may have either released or approved the release of such data to the public; this restriction on publication, however, does not apply to any contract with an academic institution.

(b) In accordance with 49 C.F.R. § 18.34 and 49 C.F.R. § 19.36, the Federal Government reserves a royalty-free, non-exclusive and irrevocable license to reproduce, publish, or otherwise use, and to authorize others to use, for "Federal Government purposes," any subject data or copyright described in subsections (2)(b)1 and (2)(b)2 of this clause below. As used in the previous sentence, "for Federal Government purposes," means use only for the direct purposes of the Federal Government. Without the copyright owner's consent, the Federal Government may not extend its Federal license to any other party.

1. Any subject data developed under that contract, whether or not a copyright has been obtained; and

2. Any rights of copyright purchased by the Purchaser or Contractor using Federal assistance.

(c) For FTA Assisted Contracts - When FTA awards Federal assistance for experimental, developmental, or research work, it is FTA's general intention to increase transportation knowledge available to the public, rather than to restrict the benefits resulting from the work to participants in that work. Therefore, unless FTA determines otherwise, the Purchaser and the Contractor performing experimental, developmental, or research work required by the underlying contract to which this Attachment is added agrees to permit FTA to make available to the public, either FTA's license in the copyright to any subject data developed in the course of that contract, or a copy of the subject data first produced under the contract for which a copyright has not been obtained. If the experimental, developmental, or research work, which is the subject of the underlying contract, is not completed for any reason whatsoever, all data developed under that contract shall become subject data as defined in subsection (a) of this clause and shall be delivered as the Federal Government may direct. This subsection (c), however, does not apply to adaptations of automatic data processing equipment or programs for the Purchaser or Contractor's use whose costs are financed in whole or in part with Federal assistance provided by FTA for transportation capital projects.

(d) Unless prohibited by state law, upon request by the Federal Government, the Purchaser and the Contractor agree to indemnify, save, and hold harmless the Federal Government, its officers, agents, and employees acting within the scope of their official duties against any liability, including costs and expenses, resulting from any willful or intentional violation by the Purchaser or Contractor of proprietary rights, copyrights, or right of privacy, arising out of the publication, translation, reproduction, delivery, use, or disposition of any data furnished under that contract. Neither the Purchaser nor the Contractor shall be required to indemnify the Federal Government for any such liability arising out of the wrongful act of any employee, official, or agents of the Federal Government.

(e) Nothing contained in this clause on rights in data shall imply a license to the Federal Government under any patent or be construed as affecting the scope of any license or other right otherwise granted to the Federal Government under any patent.

(f) Data developed by the Purchaser or Contractor and financed entirely without using Federal assistance provided by the Federal Government that has been incorporated into work required by the underlying contract to which this Attachment has been added is exempt from the requirements of subsections (b), (c), and (d) of this clause, provided that the Purchaser or Contractor identifies that data in writing at the time of delivery of the contract work.

(g) Unless the federal funding agency determines otherwise, the Contractor agrees to include these requirements in each subcontract for experimental, developmental, or research work financed in whole or in part with Federal assistance.

(3) Unless the Federal Government later makes a contrary determination in writing, irrespective of the Contractor's status (i.e., a large business, small business, state government or state instrumentality, local government, nonprofit organization, institution of higher education, individual, etc.), the Purchaser and the Contractor agree to take the necessary actions to provide, through the federal funding agency, those rights in that invention due the Federal Government as described in

U.S. Department of Commerce regulations, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms under Government Grants, Contracts and Cooperative Agreements," 37 C.F.R. Part 401.

(4) The Contractor also agrees to include these requirements in each subcontract for experimental, developmental, or research work financed in whole or in part with Federal assistance provided by FTA.

B. **Patent Rights** - The following requirements apply to each contract involving experimental, developmental, or research work:

(1) General - If any invention, improvement, or discovery is conceived or first actually reduced to practice in the course of or under the contract to which this Attachment has been added, and that invention, improvement, or discovery is patentable under the laws of the United States of America or any foreign country, the Purchaser and Contractor agree to

take actions necessary to provide immediate notice and a detailed report to the party at a higher tier until the Federal funding agency is ultimately notified.

(2) Unless the Federal Government later makes a contrary determination in writing, irrespective of the Contractor's status (a large business, small business, state government or state instrumentality, local government, nonprofit organization, institution of higher education, individual), the Purchaser and the Contractor agree to take the necessary actions to provide, through the Federal funding agency, those rights in that invention due the Federal Government as described in U.S. Department of Commerce regulations, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," 37 C.F.R. Part 401.

(3) The Contractor also agrees to include the requirements of this clause in each subcontract for experimental, developmental, or research work financed in whole or in part with Federal assistance.

XIV. Interest of Members of Congress

No member of or delegates to the Congress of the United States shall be admitted to a share or part of this Contract or to any benefit arising there from.

XV. Interest of Employees of COG

No employee of COG who exercises any functions or responsibilities in review or approval of the undertaking or carrying out the Project during his or her tenure or one year thereafter shall have any personal interest, direct or indirect, apart from his or her official duties, in this Contract or the proceeds thereof.

XVI. Interest of the Contractor

The Contractor covenants that it has presently no financial interest, shall not acquire any financial interest, direct or indirect, which would conflict in any manner or degree with the performance of services required to be performed under this Contract. The Contractor further covenants that, in the performance of this Contract, no person having any such interest shall be employed.

XVII. Allowable Costs

Only those costs which are consistent with Title 48 Part 31 of the Code of Federal Regulations shall be reimbursed under this Contract.

XVIII. Covenant Against Contingent Fees

The Contractor warrants that it has not employed any person to solicit or secure this Contract upon any agreement for a commission, percentage, brokerage or contingent fee. Breach of warranty shall give the Contracts Officer the right to terminate this Contract or, in his discretion, to deduct from the Contract price or consideration the amount of such commission, percentage, brokerage or contingent fees. This warranty shall not apply to commissions' payable by the Contractor upon contracts or sales secured or made through a bona fide established commercial or selling agency maintained by the Contractor for the purpose of securing business.

XIX. Indemnification

The Contractor, acting as an independent contractor, shall hold COG harmless from and shall be solely responsible, where found liable, for the payment of any and all claims for loss, personal injury, death, property damage, or otherwise, arising out of any act of omission or negligence of its employees or agents in connection with the performance of this work.

XX. Severability

It is understood and agreed by the parties that if any of these provisions shall contravene, or be invalid under, the laws of the particular state, county or jurisdiction where used, such contravention or invalidity shall not invalidate the whole agreement, but the Contract shall be construed as if not containing the particular provision or provisions held to be invalid in the said particular state, county or jurisdiction and the rights and obligations of the parties shall be construed and enforced accordingly.

XXI. Assignments

This Contract shall not be assigned, sublet or transferred in whole or in part by the Contractor, except with the previous written consent of the COG Contracting Officer or his designee.

XXII. Entire Agreement

This Contract sets forth the entire understanding of the parties and supersedes all previous agreements, whether oral or in writing, relating to the subject matter hereof. This Contract may only be altered, amended or modified in accordance with Changes Clause of this Contract.

XXIII Confidential or Personal Data

a. COG respects the privacy or business interests involved in confidential or personal data. It is COG's policy to obtain confidential or personal data or store or allow storage of such data only 1) when necessary to fulfill COG's information-gathering and data collection responsibilities, or 2) in conjunction with COG projects. COG intends to minimize risk of disclosure of such confidential or personal data.

b. Whenever feasible and the requirements of a project allow, the names of survey participants or users of a website or other data collection method shall not be accepted, recorded, stored or retained.

c. When COG engages in a project, which involves the collection or storage of confidential or personal information by or through use of surveys, websites or by other data collection, the following conditions shall be met:

1) The survey, website or other collection method shall contain a set of conditions for use and a disclaimer of any COG liability for use, in language approved by COG in writing.

2) The party(ies) working with COG shall demonstrate adherence to a federal or applicable state standard for protecting confidential or personal information.

3) The confidential or personal information collected or stored by or through the survey, website or other data collection shall be kept confidential. All necessary steps shall be taken to protect the privacy of the users of the website or other data collection. Any confidential or personal information provided by users of the website or other data collection, including but not limited to their names and addresses, shall be protected.

4) COG shall retain control over and ownership of all surveys, WebPages, control files and scripts, database schema, and database contents, in addition to all content which is published on or stored by the website or other data collection, unless COG specifically agrees in writing otherwise.

5) No release of any announcements intended for public dissemination concerning the collection or storage of such information by or through the survey, website or other data collection shall occur until COG has given prior written authorization, unless COG specifically agrees in writing otherwise.

6) In the event that information collected or stored by or through the survey, website or other data collection shall be stolen or handled incorrectly, the party(ies) working with COG on the project shall be responsible for any required notification to persons who have entered personal information in that system and all costs related thereto.
7) The project documents shall provide that other parties working with COG on the survey, website or other data collection or storage shall indemnify COG with at least the following commitment:

The [CONTRACTOR or other party] shall indemnify and hold COG harmless
from and shall be solely responsible, for the payment of any and all claims for loss, personal injury, death, property damage, infringement or misappropriation of any third party's intellectual property rights, violation of privacy, confidentiality or otherwise, arising out of any act of omission or negligence of its employees or agents in connection with the performance of the work under this [agreement or memorandum of understanding].
8) At the end of the project or contract, any personal or confidential information shall be given to COG or destroyed and a certification of destruction provided to COG by the contractor or other party.

XXIV. COG's Policies and Procedures
When federal law, or any grant conditions, certifications or assurances require COG to utilize competitive procurement procedures for selection of a contractor, COG's policies and procedures shall govern every aspect of the contractor selection process, e.g., the solicitation, evaluation, award, and post-award process (including, without limitation, any protest of an award, and the terms and conditions under which a contract may be approved, executed and administered). Any contractor and potential contractor will be provided with a copy of such policies and procedures, on request.

XXV. Additional Requirements
In addition to the terms and conditions expressly referenced in this CONTRACT, the SUBGRANTEE acknowledges and agrees that the terms and conditions of any federal or state grant that provides funding for this CONTRACT, in whole or in part, shall apply to and shall govern the parties' rights and obligations under this CONTRACT and shall be deemed additional terms, conditions and requirements of this CONTRACT.

XXVI. Priority of Requirements
In the event of a conflict between or among any of the terms, conditions and requirements applicable to this CONTRACT, the conflict shall be resolved by assigning the following priorities, in the order as stated below:
1) Terms and conditions of any grant that provides funding for this CONTRACT, in whole or in part;
2) Terms and conditions set forth or referenced within Attachment A to this CONTRACT;
3) Terms and conditions set forth or referenced within Parts I and II of this CONTRACT;
4) Terms, conditions, specifications, and requirements set forth within any solicitation (e.g., RFP or IFB) pursuant to which this CONTRACT was awarded.

Attachment B. Certification Regarding Debarment, Suspension, and Other Responsibility Matters

The prospective vendor certifies to the best of its knowledge and belief that it and its principals:

- Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any department or agency of the District of Columbia, State of Maryland or the Commonwealth of Virginia or any of the 22 jurisdictions comprising the membership of the Metropolitan Washington Council of Governments (COG);
- Have not within a three year period preceding this date been convicted of or had a civil judgment rendered against them for commission of fraud or criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State or local) with commission of any of the offenses enumerated above of this certification; and
- Have not within a three-year period preceding this date had one or more public transactions (Federal, State or local) terminated for cause or default.

Vendor understands that a false statement on this certification may be grounds for rejection of any submitted proposal or quotation or termination of any award. In addition, under 18 USC Sec. 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to 5 years, or both if federal funds are being used to support the procurement.

Typed Name of Vendor

Typed Name & Title of Authorized Representative

Signature of Authorized Representative Date

Attachment C. Contact Information Sheet

RFP/RFQ No.: _____ Federal Tax ID No.: _____

Name of Offeror: _____

Address of Offeror: _____

Telephone No: _____ Fax No.: _____ Website: _____

Name of Authorized Representative: _____

Mailing Address (If different from Above): _____

Telephone No.: _____ Mobile No.: _____ Other: _____

Email Address: _____

Name of Contact Person for this RFP/RFQ: _____

Title of Contact Person: _____

Telephone No.: _____ Mobile No.: _____ Other: _____

Email Address: _____

Attachment D. Resumes of Key Staff

Thomas D. Peterson

Professional Background

2004-Present	Founder, President & CEO, The Center for Climate Strategies (CCS), Washington, DC
2009-Present	Adjunct Professor/Teaching Fellow, Johns Hopkins University Center for Advanced Governmental Studies, Global Security Center, Washington, DC
2012-Present	Adjunct Professor/Teaching Fellow, Johns Hopkins University Department of Earth and Planetary Sciences, Energy and Climate Program, Washington, DC
2010-2011	Adjunct Professor, George Mason University Institute for Conflict Analysis & Resolution, Arlington, VA,
2005-2008	Adjunct Professor, Penn State-Dickinson School of Law, Carlisle, PA
2001-2004	Domestic Policy Director, Center For Clean Air Policy, Washington, DC
1990-2001	Economist, US Environmental Protection Agency (EPA): Offices of Policy Planning and Evaluation/Policy Analysis/Transportation & Air Quality, Washington, DC
1997-1998	Senior Advisor, White House Climate Change Task Force, Washington, DC (concurrent as Economist with US EPA)
1995-1996	Brookings Legislative Fellow, Environment & Natural Resources, US EPA Fellow, Senator Joe Lieberman, Washington, DC (concurrent as Economist with US EPA), Washington, DC
1990	Vice President, Marketing and Management, DSL Capital Corp, Washington, DC
1988-1989	Marketing Specialist, Law Offices of Brown Maroney & Oaks Hartline, Austin, TX
1983-1987	Chief, Information & Education, Arkansas Game and Fish Commission, Little Rock, AR
1982-1983	Assistant Director, Arkansas Nature Conservancy, Little Rock, AR
1980-1982	Economics Research Assistant, Duke University – USDA/Forest Service and Duke University, Washington, DC

Academic Background

University of Texas at Austin Graduate School of Business, Master of Business Administration, Finance/Marketing (1988)

Duke University School of Forestry and Environmental Studies, Master of Environmental Management, Economics/Policy (1982)

College of William and Mary, Biology/Economics, Bachelor of Science (1980)

Professional Activities

Founder, President and CEO, Member Board of Directors, CCS (2004-Present)

- Developed and implemented US and International programs for comprehensive policies and mechanisms to advance climate change mitigation and adaptation, and to integrate economic, energy and environmental security opportunities
- Developed expert teams and private and public resources for institutional capacity and program implementation

Project Director and Facilitator, US State and Local Comprehensive Climate Action Plans, including: Alaska, Arkansas, Arizona, Connecticut, Colorado, Florida, Iowa, Kentucky, Michigan, Minnesota, Montana, New Mexico, New York, North Carolina, Kansas, Pennsylvania, Southern California, South Carolina, Vermont; Foundation Funders and State Governors Offices and Cabinet Agencies, CCS (2004-Present)

Adjunct Professor/Teaching Fellow, Johns Hopkins University Center for Advanced Governmental Studies, Global Security Center (2009-Present)

- Energy and Environmental Security (graduate core course)
- Climate Change Science and Policy; Climate Change Economics; Climate and Energy Security; Integrative Climate Energy and Economic Security Planning (graduate electives, developed by instructor)

Adjunct Professor/Teaching Fellow, Johns Hopkins University Department of Earth and Planetary Sciences (2012-Present)

- Climate Change Adaptation (graduate elective, developed by instructor)

Adjunct Professor, George Mason University Institute for Conflict Analysis & Resolution (2010-2011)

- Climate Change Consensus Building (graduate elective, developed by instructor)

Adjunct Professor, Penn State Dickinson School of Law (2005-2008)

- Climate Change Law and Policy (graduate elective, co-developed by instructor and law partner)

Project Director, Minnesota Climate Strategies and Economic Opportunities (CSEO) project; Rockefeller Brothers Fund, McKnight Foundation, and Energy Foundation In Cooperation with the Minnesota Department of Commerce and Minnesota Pollution Control Agency, CCS (2014)

Project Director and Facilitator, Transatlantic Dialog, Overlapping Climate, Economic and Energy Agenda and Cooperative Mechanisms; the European Delegation to the US, CCS (2014-2015)

Project Director, US Clean Air Act Section 111d, Lessons Learned from State Climate Action Plans; Merck Family Fund, CCS (2014)

Project Director, Development of the China Low Carbon Development Planning and Analysis Toolkit In Cooperation with the Chinese Academy of Sciences Institute for Policy Management; Rockefeller Brothers Fund, Blue Moon Foundation, Energy Foundation, and Oak Foundation, CCS (2009-2015)

Planning, Analysis, and Training Consultant, Ukraine Enhancing Capacity Low Emissions Development Program; Engility Corporation/US Agency for International Development (AID), CCS (2014-2016)

Project Director, Puerto Rico Greenhouse Gas Inventory and Forecast and Goal Setting; Puerto Rico Energy Affairs Administration, Pursuant to Governor's 2013 executive orders, CCS (2014)

Program Advisor, Puerto Rico Department of Environmental Conservation, Energy Affairs Administration, and Environmental Quality Board for Implementation of the Governor's Five Climate Change Executive Orders of 2013; Rockefeller Brothers Fund, CCS (2013-Present)

Project Director and Energy Supply Technical Work Group Leader, Coahuila, Mexico, Phase Two Climate Action Planning Process for the Mexico Low Emissions Development Program; Border Environment Cooperation Commission and World Wildlife Fund/US AID, CCS (2014)

Project Director and Energy Supply Technical Work Group Leader, Baja California, Mexico, Phase Two Climate Action Planning Process for the Mexico Low Emissions Development Program; Border Environment Cooperation Commission and World Wildlife Fund/US AID, CCS (2013-2014)

Project Director, State Energy Plan Foundational Modeling Updates; Oregon Department of Energy, CCS (2013-2014)

Contributing Author, Green Growth Best Practices Report, Planning and Coordination Chapter; National Renewable Energy Laboratory (NREL) and the Global Green Growth Initiative, CCS (2013)

Project Director, Financing Mechanisms for States, Tribes, and Localities for Implementation of Energy Efficiency and Renewable Energy for the American Recovery and Reinvestment Act; US Department of Energy (DOE) Energy Efficiency and Renewable Energy Office, CCS (2009-2014)

Project Director and Facilitator, Maryland Greenhouse Gas Reduction Act, Enhancement of Power and Transportation Sector Programs and Policies; Town Creek Foundation in Cooperation with the Maryland Department of Environment, Maryland Energy Office, Maryland Department of Transportation, CCS (2012-2013)

Project Director and Facilitator, Climate and Economic Development Project of Southern California; Southern California Association of Governments, CCS (2012)

Project Director, CCS Security and Investment Project and International Energy Agency Workshop Paper "Developing Integrated Climate, Energy, and Economic Security Options for the US; "Rockefeller Brothers Fund, New York Community Trust, Energy Foundation, CCS (2012)

Project Director and Facilitator, Climate and Energy Plan and Analysis for New York; New York State Energy Research and Development Authority, CCS (2009-2012)

Project Director and Facilitator, National Biological Sequestration Assessment; US Geological Survey, CCS (2011)

Study Director, Assessment report and action plan for the Pacific Coast Collaborative, including "The West Coast Clean Economy: Opportunities to Accelerate Investment and Job Creation" report; Rockefeller Brothers Fund in Cooperation with the California, Oregon, and Washington Governors' Offices and Office of the Premiere of British Columbia, CCS (2011-2012)

Facilitator, North American Greenhouse Gas Inventory and Forecast Comparison; North American Commission for Environmental Cooperation, CCS (2010)

Study Director, "Impacts of Comprehensive Climate and Energy Policy on the US Economy"; In Cooperation with Johns Hopkins University, Center for Advanced Governmental Studies, Global Security Center, CCS (2010)

Project Director and Facilitator, State Climate Adaptation Action Plan Development Guidance; Rockefeller Foundation and New York Community Trust, CCS (2010)

Project Director, Climate Action Policy Development Using Existing Agency Authorities and State Climate Action Plans; US DOE Policy and International Office, CCS (2010)

Project Director, Governor Tim Kaine's Climate Change Initiative; Rockefeller Brothers Fund, Merck Family Fund, and Energy Foundation In Cooperation with the Southern Governors' Association, CCS (2009)

Project Director, Mexico Border State Climate Action Plans, Including Six Northern States of Mexico; Foundations and the Border Environment Cooperation Commission, CCS (2008-Present)

Facilitator and Policy Advisor, Startup and Goal Setting, Western Climate Initiative; Rockefeller Brothers Fund and Energy Foundation In Cooperation with state agencies and governors offices, CCS (2008-2009)

Project Director, Western States Greenhouse Gas Emissions Inventories and Forecasts; Western Regional Air Partnership, CCS (2007)

Policy Consultant, Work Group Facilitator and Lead Analyst for Agriculture and Forestry Sectors, Puget Sound Climate Action Plan (2004)

Policy Consultant, Work Group Facilitator and Lead Analyst for Agriculture and Forestry Sectors, Maine Climate Action Plan (2004)

Policy Consultant, Development of Energy Efficiency and Conservation Standards for the Pennsylvania Advanced Energy Portfolio Standard, Pennsylvania Department of Environmental Protection (2004)

Policy Consultant, Development of A Pennsylvania Climate Change Roadmap, Pennsylvania Environmental Council (2004)

White House Congressional Liaison and Lead Contact, Agriculture and Forestry Sectors, White House Climate Change Task Force (1997-1999)

Legislative Design, Analysis, and Outreach, Brookings Legislative Fellow, US Senator Joe Lieberman (1995-1996)

- Climate Change Treaty and Law Issues, Representative to UNFCCC Negotiations
- National Debate on Regulatory Reform, Unfunded Mandates, 5th Amendment Takings
- State Conservation and Natural Resources Legislation and Appropriations

Policy Analysis and Interagency Coordination, US EPA (1990-2001)

- Domestic climate change policy development
- Transportation and land use climate change mitigation policy development
- US Coastal Zone Management Act implementation
- US western water trading and sustainable agriculture
- Northern Spotted Owl; Endangered Species Committee, Pacific Northwest Forest Conference
- Enhancing Capacity for Environmental Management, Former Soviet Union and Eastern Europe, Bulgaria and Poland, US AID

Manager, Credit Enhancement and Blended Debt-Equity Mechanisms, DSL Capital Corp. (1990)

Chief, Information and Education, Arkansas Game and Fish Commission (1983-87)

- Information Director and Liaison for Media and News Service, Magazine and Publications, Hearings and Events
- Co-Producer, Public Television Feature Documentary Series "Natural, Wild, and Free" and Educational Series "Best in the Field" with the Arkansas Game & Fish Commission and Arkansas Educational Television Network
- Education Director for Project Wild (K-12), Hunter Education, Boating Education
- Public Liaison, Deer Conservation Management Program
- Agency Communications Director, 1984 Conservation Sales Tax Campaign (passed in 1996)

Technical Lead, Landowner Outreach and Conservation Agreement Design, Arkansas Nature Conservancy (1982-1983)

Remote Sensing Analyst, US Southern Pine Reforestation Survey, USDA/Forest Service and Duke University (1981-82)

Selected Publications

Delaquil, P., Goldstein, G., Nelson, H., Peterson, T., Roe, S., Rose, A., Wei, D., & Wennberg, J. (2014). Developing and Assessing Investment Options for Economic, Energy, and Climate Security Gains in the United States. *Low Carbon Economy, Scientific Research, 5(1)*

Peterson, T.D. (2013). US Progress on Climate Change. *EM Magazine,* 10 (2013), 14-16

Delaquil, P., Goldstein, G., Nelson, H., Peterson, T., Roe, S., Rose, A., Wei, D., & Wennberg, J. (2012). Developing and Assessing Investment Options for Economic, Energy, and Climate Security Gains in the US, 2012 International

Energy Workshop Paper, *Center for Climate Strategies, DecisionWare Group, Claremont Graduate University, Johns Hopkins University, the University of Southern California*

Peterson, T. D., Rose, A., & Wei, D. (2010). Impacts of Comprehensive Climate and Energy Policy Options on the US Economy. *Center for Climate Strategies & John Hopkins University*

Dernbach, J. C., McKinstry, R. B., & Peterson, T. D. (2010). Making the States Full Partners In a National Climate Change Effort: A Necessary Element for Sustainable Economic Development. *Environmental Law Reporter, 10*(08)

Rose, A. Z., Wei, D., Peterson, T. D., & Wennberg, J. (2009). Climate Change Policy Integration In Minnesota: The Case For Integrated Regional Policies. *The Economics of Climate Change Policy: International, National and Regional Mitigation Strategies*

McKinstry, R. B., Peterson, T. D., Rose, A. Z., & Wei, D. (2009). The New Climate World: Achieving Economic Efficiency In a Federal System for Greenhouse Gas Control Through State Planning Combined with Federal Programs. North Carolina *Journal of International Law & Commercial Regulation*, *34* (102)

Peterson, T. D., McKinstry, R. B., & Dernbach, J. C. (2008). Developing a Comprehensive Approach to Climate Change Policy In the United States that Fully Integrates Levels of Government and Economic Sectors. *Virginia Environmental Law Journal, 26*(219)

McKinstry, R. B., Dernbach, J. C., & Peterson, T. D. (2008). Federal Climate Change Legislation as if the States Matter. *Natural Resources & Environment*, *22*(3), Winter, 3

McKinstry, R. B., & Peterson, T. D. (2007). The Implications of The New "Old" Federalism In Climate-Change Legislation: How to Function In a Global Marketplace When States Take the Lead. *McGeorge Global Business & Development Law Journal, 20*(61)

Peterson, T. D., & Rose, A. Z. (2006). Reducing Conflicts Between Climate Policy and Energy Policy In the US, the Important Role of the States. *Center for Integrated Regional Assessment, the Pennsylvania State University. Energy Policy*, 34619-34631

Rose, A. Z., Peterson, T. D., & Zhang, Z. (2006). Regional Carbon Dioxide Permit Trading in the United States: Coalition choices for Pennsylvania. *Penn State Environmental Law Review*, *14*(2), 203-229

Peterson, Thomas D. (2004). The Evolution of State Climate Change Policy In the United States: Lessons Learned and New Directions. *The Widener Law Review*. University Park, PA. March 25, 2004

Peterson, T.D. (2003). Impacts of US State And Regional Actions On National Climate Policy. In Approaches, Challenges, and Potentials: Renewable Energy And Climate Change Policies In US States And Germany – Opportunities For Transatlantic Cooperation And Beyond. *The Heinrich Boll Foundation*. Pages 25-40

Peterson, T, and Branagan M. (2000). "Analysis of Land Consumption Rates and Impacts, *The State Of The Cities 2000*," Fourth Annual 2000. US HUD, The White House and US Department of Housing and Urban Development. Washington, DC, pp. 93-94. June 22, 2000

Peterson, T, and Branagan M. (1999). "Findings from the American Housing Survey: The Impact of Lot Size On Land Development in the US." *The Lincoln Land Institute*. Cambridge, MA, December 3, 1999

Selected Papers and Reports

Peterson, Thomas D. Peterson, Robert B. McKinstry, Jr. (2014). *Clean Air Act Section 111(d) Implementation: Lessons Learned from State Climate Action Plans (forthcoming)*

Globe Advisors & the Center for Climate Strategies (2012). *The West Coast Clean Economy, Opportunities for Investment & Accelerated Job Creation (Co-Author, CCS and GLOBE Team)*

National Association of Counties and The Center for Climate Strategies (2010). *Energy Implications of National Climate Change Legislation*. Washington, DC. Peterson, T.D.

The Center for Climate Strategies (2010*). Prospering in a Carbon-Constrained Economy," Climate Change and America's Energy Coast.* Mobile, Alabama: Peterson, T.D.

Center for Climate Strategies (2009). Commissioned by the Southern Governors' Association. *A Regional Economic Assessment of Climate Change Actions in the South*. Washington, DC *(Co-Author)*

Center for Climate Strategies (2009). Commissioned by the Southern Governors' Association. *A Meta Analysis of Climate Mitigation Economic Impact Studies*. Washington, DC *(Co-Author)*

Center for Climate Strategies (2009). *A Comprehensive Template for Climate Strategy and Policy Development*. Washington, DC: Peterson, T.D.

Center for Climate Strategies Special Session (2009). *The Role of Collaborative Process for Climate Change Policy Development, Association for Conflict Resolution Annual Conference "Climate Action Planning, Process and Results*." Denver, CO: Peterson, T.D.

Center for Climate Strategies (2009). Commission for Environmental Cooperation, Joint Policy Action Committee, & Conference for North American Policy Coherence. *The North American Policy Landscape for Climate Change*. Peterson, T.D.

Peterson, Thomas D. Peterson, Robert B. McKinstry, Jr. (2008). Comments By The Center for Climate Strategies On the Advance Notice of Proposed Rule-Making To Regulate Emissions of Greenhouse Gases Under the Federal Clean Air Act Before the United States Environmental Protection Agency, Docket No. EPA-HQ-OAR-2008-0318, The Center for Climate Strategies, November 26, 2008

The Center for Climate Strategies (2008). White Paper for Discussion, *Economic Stimulus, Recovery, and Climate Mitigation: Policy and Program Opportunities from the States (Co-Author)*

The Center for Climate Strategies (2008). White Paper for Discussion (2008) *Climate Change Policy as Economic Stimulus: Evidence and Opportunities from the States (Co-Author)*

Yale University School of the Environment, 100th Anniversary Commemoration (2008). *Integrating State and Federal Action in National Climate Policy: A Case for Partnership.* Peterson, T.D.

Pennsylvania Department of Environmental Protection (2005). *Climate Change Mitigation: Process and Policy Options for State Greenhouse Gas Plans*. Harrisburg, PA: Peterson, T.D.

Awards and Distinctions

Sea Studios Foundation

- Feature interviews and commentary, "Ahead of the Curve 2" (2008)

Krieger Publishing Company

- Feature professional, Intelligent Courage: Natural Resource Careers that Make a Difference, Michael Fraidenburg (2007)

Public Broadcast System

- Feature interviews, "The God Squad," Emily Hart Films (2003)

US Environmental Protection Agency

- Gold Medal For Exceptional Service, US EPA, Northern Spotted Owl/Endangered Species Committee (1992)
- Gold Medal For Exceptional Service, US EPA, The President's 1993 Northwest Forestry Plan (1993)

University of Texas at Austin, Graduate School of Business

- Coca Cola Foods Graduate Marketing Fellowship Award (1988)

Arkansas Game & Fish Commission

- National Committee On Agro-Forestry, Winrock International Institute for Agricultural Development, Morrilton, AR (1986-1987)
- Vice President, Information Section, Southeastern Association of Fish and Wildlife Agencies (1986-1987)
- Member, Outdoor Writers Association of America (1985-1988)
- Bronze Medal, New York Film and Television Festival, Feature Documentary "Natural, Wild, and Free"(1985)
- Ohio State Journalism Award, Conservation Television "Natural, Wild, and Free" (1985)
- Conservation Educator of the Year, Sears Corporation/Arkansas Wildlife Federation (1985)
- Outdoor Writers Association of America and Association Awards for Conservation Educators (1984-1987)
    - Best News Article (multiple) (Editor)
    - Best TV Series, "Best in the Field" (Co-Producer)
    - Best TV Documentary, "Natural, Wild, and Free" (Co-Producer)
    - Best News Feature (multiple) (Editor)
    - Best Magazine, "Arkansas Game and Fish Magazine" (Publisher)

Duke University School of Forestry & Environmental Studies

- Union Camp Industry Fellowship Award (1982)

Volunteer Activities

Fairfax County Virginia, Deer Conservation Program (2012-Present)

Northern Virginia Swim League, Stroke and Turn Judge (2010-Present)

Seminar Leader, "Stewardship Of The Environment: Biblical Foundations and Modern Challenges," Emmanuel Lutheran Church, Vienna, VA (2003-2004)

Tutor, Men's NCAA Program, University of Texas at Austin (1988)

On Camera Host, Arkansas Educational Television Network Annual Telethons (1984-1986)

President of the Fellowship of Christian Athletes, College of William and Mary (1979-1980)

Stephen M. Roe

Professional Background

2011-Present	Technical Program Manager, Center for Climate Strategies
1993-2011	Team Leader, Climate Change Services, TranSystems|Pechan
1993	Air Quality Project Manager, EMCON Corporation
1988-1993	Air Quality Project Manager, Dynamac Corporation
1986-1988	Process Engineering Technician, Xidex Corporation
1985-1986	Quality Control Technician, Mearl Corporation

Summary of Relevant Professional Experience

Mr. Roe has 29 years of experience in air quality and climate change consulting, environmental management, and process engineering. His areas of expertise include the development of emission inventories for greenhouse gases (GHGs)/aerosols, toxic and criteria air pollutants, as well as mitigation/control programs covering all of these pollutants. Mr. Roe also served as an accredited greenhouse gas inventory verifier for California's mandatory reporting program (covering all reporting sectors) and the Climate Action Reserve (CAR; landfill and livestock projects) and has conducted entity and project-level GHG verifications under CAR, the California Climate Action Registry, The Climate Registry, and California AB32 programs. He has supported numerous organizations and government agencies in the development of energy/GHG/air pollutant inventories and has provided facilitation and support of action plans in these areas for over 40 local jurisdictions and states/provinces in North America, Mexico, China, and the Philippines. This includes GHG baselines developed for the North Jersey Transportation Planning Authority and the South Jersey Transportation Planning Organization. He is also developing GHG mitigation training tools (Excel workbooks, presentations, documentation) for use in low emissions development planning in China, Mexico, Ukraine, and other developing countries and is supporting CCS' climate action planning curriculum development. He also served as a technical workgroup member on a project with the World Resources Institute to develop protocols for GHG mitigation planning (the "Policies & Actions Standard").

Verification of Local Government Unit GHG Inventories – Philippines. Recently, managed a project to verify the GHG inventories prepared by six local government units (LGUs) that are serving as the starting points for local mitigation planning by each of these areas as required by the national climate change program. The LGUs are: Aurora Province, Batangas City, Makati City, Pasig City, Santa Rosa City, and Kalayaan municipality.

Clean Energy Planning Capacity Building in China. Currently, supporting CCS' partners in the Chinese federal and provincial governments in developing sub-national (provincial and municipal) clean energy plans. Work has included development and presentation of software tools and workshops on GHG inventory and forecast development in all sectors, and clean energy and GHG mitigation policy development and analysis in the agriculture, forestry and waste management sectors. Led CCS' efforts in the development of a set of GHG inventory and forecast tools for use in sub-national planning efforts. Currently providing assistance on provincial and municipal baseline energy and emissions development which will be followed by microeconomic assessment of GHG mitigation policy implementation in the agriculture, forestry, and waste management sectors.

North Jersey Transportation Planning Authority Regional GHG Inventory & Forecast. Managed a contractor team that developed a 2006 regional GHG inventory and forecast (I&F) of emissions out to 2050. Emissions covered all source sectors and sinks. Detailed down to the municipal level to allow for use by 13 counties and over 350 municipalities in developing their own climate action plans. Included novel methods for I&F development and display, including both

direct and consumption-based accounting methods and inclusion of full energy-cycle emissions. A web tool was also developed to allow for data exploration and download by the region's local stakeholders.

Mexico GHG Inventories and Forecasts, Center for Climate Strategies. Provided senior level technical support and review on CCS projects to develop 1990-2020 GHG inventories and forecasts for the six border states of Mexico (Sonora, Baja California, Chihuahua, Nuevo Leon, Tamaulipas, and Coahuila). Work is now ongoing in the five border states on climate change mitigation planning. Assisted in the development of training materials on inventory and forecast development and mitigation analysis in the agriculture, forestry, and waste management sectors.

South Coast Association of Governments Regional Climate Action Planning Support. Provided technical support in GHG I&F development for this region of six counties in southern California. Also provided technical support in the microeconomic analysis of GHG mitigation options developed for the agriculture, forestry, and waste management sectors.

Greenhouse Gas (GHG) Verification

California AB 32 Program, All sectors. Lead verifier for AB32 reports submitted by 3 California co-generation facilities, a biomass electric power provider, and a stationary combustion reporter. Senior reviewer for 2 municipal power providers with generating plants and electricity transactions California Climate Action Registry, the Climate Registry, and Climate Action Reserve Programs. Since 2004, has acted as either the lead verifier or senior reviewer for 30 clients reporting entity-level emissions or project reductions under these programs. Climate Action Reserve. Acted as lead verifier and senior internal reviewer for a landfill methane reduction project in Virginia.

GHG Inventory Technical Review and Guidance on GHG Management

Port Authority of New York & New Jersey (PANYNJ). This inventory covers all Scope I and II GHG sources for PANYNJ (direct and indirect emissions) in addition to many Scope III GHG sources (e.g., emissions associated with operations at facilities on leased properties). Currently, managing work on a new project to evaluate GHG reduction and offset projects to assist PANYNJ achieve carbon neutrality by reviewing offset projects, and providing assistance on renewable energy credit purchases and energy efficiency crediting programs.

Energy & Climate Change Mitigation Planning in Over 25 States/Provinces. Work has included energy and GHG inventory and forecast (I&F) development in each state (includes support in US, Mexico, and China). Also included the development of a 2002 base year and 2018 forecast inventories for black carbon [both mass and carbon dioxide (CO_2)-equivalent emissions] for 10 of these states; stakeholder support in each state through facilitation of the agriculture, forestry, and waste management (AFW) technical work groups which are responsible for finalizing the GHG I&F and developing GHG mitigation options to support the reports to the governors/legislature in each state. Policy options in each of these states include measures to increase the production and use of biofuels (biodiesel, ethanol); energy efficiency; methane utilization at concentrated animal operations; landfill gas utilization; waste reduction/recycling/organics management; nutrient management; and measures enhance carbon sequestration on forested and agricultural lands. Lead developer of CCS' Low Carbon Development Planning System which assists state and local planners develop energy and emissions baselines, assess applicable GHG mitigation actions, develop future year targets, conduct micro-economic assessments of policy actions, and compile/summarize the results of an energy and climate action plan.

GHG Management Program Policy & Procedures Document, Roseville Electric, California. Work included a "practice CA AB32 verification" covering power plant emissions, electricity transactions, and other sources, followed by development of a detailed document providing information on Roseville Electric's GHG sources, metering systems, data management, reporting procedures and record-keeping needed to achieve compliance with AB32 reporting requirements.

Development of Multi-pollutant Inventory, U.S. Environmental Protection Agency (EPA). Managed a pilot project to develop a multi-pollutant inventory of emissions of GHGs, criteria pollutants, and toxic air pollutants for the State of Iowa using EPA's common National Inventory Format.

Regional Haze Modeling Emission Inventory, Mid-Atlantic - Northeast Visibility Union (MANE-VU) Regional Planning Organization (RPO). Assisted in the development of the MANE-VU RPO's regional haze modeling emission inventory. This inventory covered all particulate matter (PM) and precursor emissions for the RPO, the mid-western United States, and eastern Canadian Provinces.

Academic Background

California State University, Environmental Chemistry and Toxicology, M.S 1993.

Florida State University, Biology, B.S., 1984.

Selected Publications and Presentations

Roe, S.M., R. Strait, B. Strode, J. Wilson, H. Lindquist, M. Mullen, J. Schreiber, H. Hammer, J. Matic, T. Lin, and J. Perlman, "Development of a Regional Greenhouse Gas Inventory and Forecast Including Direct and Consumption-Based/Energy Cycle Emissions, Paper 2011-A-159-AWMA, presented at the 2011 AWMA Annual Conference, Orlando, FL, June 2011.

Roe, S.M., "Carbon Foot-Printing 101", organizational and supply chain carbon foot-printing, presented at the Material Handling and Logistics Conference, Park City, UT, September, 2010.

Roe, S.M., A. Bollman, M. Mullen, M. Salhotra, M. Stein, L. Chappell, "Development of a Multi-pollutant Emission Inventory for the State of Iowa," presented at the 18th Annual EPA Emissions Inventory Conference, Baltimore, MD, April 2009.

Roe, S.M., R. Strait, H. Lindquist, A. Bailie, A. Jamison, T. Peterson, "Greenhouse Gas Emission Inventories and Forecasts for Nine Western States", presented at the 16th Annual EPA Emissions Inventory Conference, Research Triangle Park, NC, May 2007.

Roe, S.M., R. Strait, H. Lindquist, A. Bailie, A. Jamison, T. Peterson, "1990 – 2020 Greenhouse Gas Inventory & Forecast for the State of Alaska" presented at the 2007 Alaska Forum on the Environment, Anchorage, AK, February 2007.

Roe, S.M. and T. Peterson, "Greenhouse Gas Mitigation Measures Implemented or Planned by U.S. States," presented at the 2007 Alaska Forum on the Environment, Anchorage, AK, February 2007.

Roe, S.M., M. Mullen, R. Strait, H. Lindquist, M. Lazarus, A. Bailie, T. Peterson, K. Colburn, "Emissions Inventory Considerations for Supporting the Development of State & Local Climate Change Mitigation Plans", presented at the 15th Annual EPA Emissions Inventory Conference, New Orleans, LA, May 2006.

Roe, S.M., M.A. Mullen, (Pechan); R.P. Strait, T. Peterson, K. Hausker, and K. Colburn (Center for Climate Strategies); M. Lazarus (Stockholm Environment Institute); and A. Bailie (Pembina Institute); "Progress in Climate Change Mitigation Action Plan Development for Several U.S. States", presented at Air & Waste Management Conference, "Planning for the Future: Climate Change, Greenhouse Gas Inventories & Clean Energy Linkages", March 7-9, 2006, San Francisco, CA.

Roe, S.M., "Black Carbon Emissions for the State of Arizona," presented to the State of Arizona Climate Change Advisory Group, July 2005.

Hsu, Y., S.M. Roe, F. Divita Jr., and D. Holoman, "New Upgrades to EPA's SPECIATE Database," presented at 14th Annual International Emission Inventory Conference entitled Transforming Emission Inventories - Meeting Future Challenges Today, Las Vegas, NV, April 2005.

Strait, R.P. and S.M. Roe, "Regional Haze Modeling Inventories for the MANE-VU and CENRAP Regions," a poster session presented to the 14th Annual International Emission Inventory Conference, "Transforming Emission Inventories - Meeting Future Challenges Today," April 12, 2005.

Roe, S.M., R.P. Strait, D.W. Holoman, M.A. Mullen, K. Thesing, Y.K. Hsu, H.C. Lindquist, P.M. Hemmer, M.D. Spivey, D.F. Fees, and J.L. Outten, "Delaware Statewide Toxic and Criteria Air Pollutant Emissions Inventories for 2002 and Projected Toxic Air Pollutant Emissions Inventory for 2003", presented at the 13th Annual Emission Inventory Conference, "Working for Clean Air in Clearwater," Clearwater Florida, June 2004.

Roe, S.M., M. Spivey, H. Lindquist, R. Huntley, "National Emissions Inventory for the Commercial Cooking Sector," presented at EPA's Annual Emission Inventory Conference, Clearwater, FL, June 2004.

Roe, S.M., H.C. Lindquist, M.D. Spivey, K.B. Thesing, R.P. Strait, and R. Huntley, "Emissions Inventory Guidance for Anthropogenic Non-Agricultural Ammonia Sources", presented at the 13th Annual Emission Inventory Conference, "Working for Clean Air in Clearwater," Clearwater Florida, June 2004.

Roe, S.M., J. Hearne, T. Summers, R. Sedlacek, D. Jenkins, "Use of Remotely-Sensed Data in the Development and Improvement of Emission Inventories," presented at the Annual EPA Emission Inventory Conference in San Diego, CA, April 2003.

Baumann, A., S.M. Roe, and K. Thesing, "Gathering Open Burning Activity Information and the Limitations of EIIP Methodologies," presented at the Annual EPA Emission Inventory Conference in San Diego, CA, April 2003.

Roe, S.M., H. Chelf, M. Caldwell, R.P. Strait, M. Torres and K. Smith-Hardison, "Development of Revised Emission Estimates for Important VOC Area Sources in Texas," presented at the 11th Annual Emission Inventory Conference, "Emission Inventories - Partnering for the Future," Atlanta, GA, April 16-18, 2002.

McCubbin, D.R., B.J. Apelberg, S.M. Roe, and F. Divita Jr., "Livestock Ammonia Management and Particulate-Related Health Benefits," *Environmental Science & Technology*, pp. 1141-1146, vol. 36, no. 6, 2002.

Mansell, G.E. and S.M. Roe, "Development of a Gridded Ammonia Emission Inventory for the San Joaquin Valley of California," presented at the Annual EPA Emission Inventory Conference in Atlanta, GA, April 2002.

Scott T. Williamson

Professional Background

2014-Present	Program Manager, Center for Climate Strategies
2013-2014	Program Director, BRT Initiatives, Communities For Transit, and Transportation Consultant to Center for Climate Strategies
2009-2013	Research Analyst/Sr. Project Director, Jack Faucett Associates, consulting on transportation to Center for Climate Strategies
2008-2009	Graduate Policy Intern, USAID Latin-America/Caribbean Bureau and Environmental & Energy Study Institute
2006-2008	Executive Committee Member, D.C. Sierra Club

Summary of Relevant Professional Experience

Mr. Williamson has nine years of experience in environmental and climate change policy and analysis. His areas of expertise include macroeconomic modeling of policy impacts on GDP, employment and incomes; development and quantification of greenhouse gas (GHG) emissions inventories, forecasts, and impacts from a wide range of emissions-reduction policy designs; public and political communication and outreach around legislative initiatives and policy implementation; and transportation planning and management issues, including public-private partnerships, pension management, infrastructure finance, and the integration of smart growth with long-range transportation planning efforts. Mr. Williamson has analyzed the emissions reduction impact of dozens of policy proposals for emissions reduction for local, state and international jurisdictions as part of several climate action plans. He has completed macroeconomic modeling and analysis of the changes to statewide and national economies for major environmental policies such as climate action plans, CAFE standards, and low-carbon fuel standards. He developed the data on the 2014 FHWA model estimating emissions from infrastructure construction projects, and has prepared reports and guidebooks on a range of pension and finance issues. He has contributed to the development of training tools for, and carried out training in support of provincial-level climate action plans in China and Mexico.

Selected Projects:

Minnesota Climate Solutions and Economic Opportunities (CSEO) Project Macroeconomic Analysis. In Spring 2015, acting as CCS Project Manager and also completing full macroeconomic analysis of all emissions-reduction policies identified and analyzed as part of the CSEO project's analysis of policy impacts. Working with analysts and state agency staff to refine scenario policy impacts, and designing inputs to REMI PI+ model to estimate changes to major economic indicators, as well as to identify the most-affected sectors of the economy. Developing graphics, summary tables and final report chapter on economic impacts results and analysis methodology.

Estimation of Macroeconomic Impacts Associated with Low-Carbon Fuel Standard Pathways in Washington. In 2011 and again in 2014, reviewed VISION model analyses of fuel expenditures and vehicle expenditures from nine different scenarios representing different approaches to achieving low-carbon transportation fuel supply for the state of Washington. Developed additional expenditure estimates from associated infrastructure, such as provision of charging facilities for electric vehicles and pumping facilities for biofuels, as well as estimates for costs associated with new fuel production capacity and distribution infrastructure. Produced inputs to macroeconomic models to complete macroeconomic analyses of statewide impacts. Prepared presentations to department staff and to legislative committees.

China Low Carbon Development Program Training Manager. Acting as program manager for CCS on a multi-year work plan. Coordinating development of a curriculum to support training and capacity-building efforts to technical institutes throughout China as they develop greenhouse gas modeling and policy analysis techniques. Writing curriculum for various topics, including macroeconomic analysis, policy selection, and exercises in policy impact quantification. Working with Chinese partner entities to recruit trainees, establish a training center, identify trainers, and schedule in-person training efforts by CCS staff and consultants, as CCS pursues its goal of establishing a broad base of capacity that can support significant climate planning in 30 Chinese provinces and cities.

Macroeconomic Impact Analysis of Environmental Benefits Within Long-Range Transportation Plan for Southern California Association of Governments. Used REMI Transight model to perform macroeconomic analysis of over a dozen initiatives, while also estimating GHG-reduction impacts along with changes to regional employment, income levels, and gross product. Produced estimates for individual policies, multiple policies in concert, and all measures together. Led preparation of reports and presentations, and presented results to agency leadership.

Research into Post-Recession Public Pension Burdens and Management Practices by Transit Agencies. Researched current best practices as well as policy positions regarding the selection of discount rates and projected growth rates used for pension fund assets, both those assets held specifically for transit agency employees and unions and those held by other government agencies such as city and state pension plans. Wrote write papers regarding discount rates, transit-specific pension issues, and specific agency case studies. Carried out all calculations, wrote and produced final deliverables, and led presentations to agency leadership.

Review and Revision of Capital Cost Requirements for BRT Network Construction. Fact-checked consultant assumptions and estimates for numerous components of capital-spending requirements to construct an alternative estimate for discussion by local government steering committees and government officials. Key revisions focused on overbroad application of overrun-contingency assumptions, and double-counting of portions of each route.

Analysis and Visualization of Minimum BRT Road Space Requirements, and Resulting Property Impacts. In response to highway agency assumptions indicating intensive private-property losses along future BRT routes in Montgomery County, MD, utilized county roadway design standards to develop appropriate space requirements on a block-by-block basis for over 20 miles of planned route. Developed visualizations of roadway appearance with Google Earth and Google Maps with BRT infrastructure and reduced property takings as a result of county road standards application. Presented these alternatives to community groups, county agencies and elected officials.

Employment Impacts Analysis of Policies Displacing Petroleum with Natural Gas. Developed employment-impacts analysis methodology for three different scenarios envisioning a displacement of either gasoline or diesel with natural gas. Utilized macroeconomic employment multipliers drawn from the REMI PI+ model in order to estimate employment impacts of changes in imported fuel, domestic fuel and other expenditures that would likely change as a result of fuel consumption changes. Wrote summary of results for technical and non-technical audiences.

Estimation of Macroeconomic Impacts Associated with Low-Carbon Fuel Standard Pathways in Oregon. Reviewed Vision model analyses of fuel expenditures and vehicle expenditures from nine-different scenarios representing different approaches to achieve low-carbon transportation fuel supply for the state of Oregon. Developed additional expenditure estimates from associated infrastructure, such as provision of charging facilities for electric vehicles and pumping facilities for biofuels, as well as estimates for costs associated with new fuel production capacity and distribution infrastructure. Produced inputs to macroeconomic models to complete macroeconomic analyses of statewide impacts. Prepared presentations to department staff and to legislative committees.

Research and Drafting of Report on Public-Private Partnerships in Public Infrastructure Procurement. Researched several aspects of PPP contracts, including a). the state of current practice in the United States, Australia, Canada and Spain, b). comparative approaches to assessing value for money (VFM) in PPP decisions, and c).utilization of contracting forms to allocate risk between public-sector and private sector players both during construction and in

future. Drafted majority of several reports on related topics as part of a larger project for the Federal Highway Administration.

Analysis of Funding and Financing for Virginia's Transportation System. Analyzed long-term impacts of different funding scenarios on overall performance of transportation system, using highway economics requirement modeling tools and data from a variety of state and federal transportation agencies. Drafted report summarizing analysis for submission to Virginia Department of Transportation.

Economic Impact Analyses of Rural Interstate Infrastructure. Managed process of updating old economic-impact studies of nine separate rural highway corridors after completion of their respective roadways. Supervised collection of qualitative socioeconomic data and anecdotal reports regarding post-construction changes to communities and economies in the corridor, and produced final case-study reports. Managed and coordinated efforts with subcontractor.

Review of TIGER Grant Program. Worked on team to develop program-review based and metrics, and led development of a data collection tool to standardize the approach and results resulting from staff review of related documents. Coordinated with the client (US Department of Transportation) and with four other consulting firms on a large contracting team to execute both trail and full runs of document-review process. Developed schedule of tasks for all firms and the client in response to concerns about project schedule.

Greenhouse Gas Analysis Training Project for Officials in Guangdong, China. Developed workshop materials to train officials in Guangdong, China on methods to estimate the greenhouse gas impacts of transit systems. The training guidance also included information on how to perform benefit-cost analysis related to transit related greenhouse gas reduction measures. Built emissions estimation and forecasting tool against which policy analyses could be measured, and completed policy analyses. Traveled to Beijing to carry out in-person training.

Development of Model for Energy and GHG Emissions from Construction and Maintenance of Transportation Infrastructure. For Federal Highway Administration (FHWA), developed a set of emissions factors for a range of most-common construction projects on various infrastructure types (such as interstates, local roads, bike lanes and BRT routes), in order to develop and populate a GHG modeling tool for use by transportation planners. Tasks included reviewing prior research, identifying infrastructure types and construction activities for inclusion in the model, developing fuel-use, materials-use, and emissions factors, constructing the spreadsheet-based modeling tool, and preparing supporting materials and final report.

Review and Revision of Maryland Greenhouse Gas Reduction Act Policy. Reviewed transportation-sector greenhouse gas reduction strategies selected by Maryland state agencies for opportunities to improve policy design and reassess policy effectiveness through improved analysis. Also indentified additional policies and developed estimates of emissions-reduction potential. Worked directly with agency staff and other consultants.

Greenhouse Gas Analysis Training Project for Officials in Mexican Border States. Assisted with the development of workshop materials to train officials in Mexico's northern Border States on methods to estimate the greenhouse gas impacts of climate policies in the transportation sector. Traveled to Mexicali and presented training in Spanish.

Greenhouse Gas Policy Analysis and Macroeconomic Impact Analysis for Southern California Association of Governments. Completed analysis of GHG reduction potential and associated costs and savings for vehicle-technology

policies as part of local MPO's Climate and Economic Development Program. Developed individual-policy impacts and integrated impacts from multiple policies in concert, as those policies were implemented over different affected actors and different time frames. Produced reports and results summaries for the client and for agency staff.

Cost-Curve Development for Transportation-Related GHG Mitigation Strategies in Oregon. Leveraged prior work developing an economic impact analysis of Oregon's Low Carbon Fuel Standard to develop emissions-reduction and cost-effectiveness estimates for a wide range of fuels and vehicle technologies. Graphed estimates as cost curves for easy comparative assessment by policymakers. Produced draft and final reports to client.

Greenhouse Gas Policy Analysis for New York State. Completed an integration analysis, measuring the combined reductions and cost impacts of ten transportation emissions-reduction strategies under a simultaneous-implementation scenario as part of New York's Climate Action Plan process. Worked directly with government stakeholders and other consultants to establish analytical methodology and format for reporting results. Quantified the projected overall GHG-reduction and cost-effectiveness of GHG-reduction results.

Greenhouse Gas Policy Analysis for Kentucky. Completed quantitative policy analyses of five different policies in the transportation sector and two in the electricity-supply sector for Kentucky's Climate Action Plan process. Quantified both emissions reduction projections and microeconomic impacts to the public, to industry and to government entities. Worked with government stakeholders to clarify policy definitions and assumptions, and presented final results and methodologies.

Analysis of Impacts of Greenhouse Gas Reduction Policies for 50 US States. Established baseline projections for greenhouse gas emissions from nationwide on-road transportation over the 2010-2020 time period. Analyzed the benefits and costs of greenhouse several gas reduction measures for the light-duty vehicle sectors or the combined light- and heavy-duty vehicle sectors. Used data from Argonne National Laboratories and the Department of Energy to develop baselines for costs, emissions and consumption for vehicles and fuel, as well as to develop projections for business-as-usual and policy scenarios.

Analysis of Trucking Efficiency Measures in Wisconsin. Estimated costs and emissions reduction impacts from implementation scenario involving anti-idling measures across Wisconsin. Measured comparative costs and impacts of truck-stop electrification and installation of electric refrigeration capacity at loading/unloading points.

Low-Carbon Advanced-Technology Scenario Emissions Impact Analysis for New Jersey. Estimated emissions reduction potentials and economic costs of several alternative policy scenarios involving the implementation of renewable electricity and electric vehicles in New Jersey. Compared emissions-reduction impact of electric vehicles against impact of hybrid vehicles, and measured importance of renewable electricity to emissions reduction from electric vehicles.

Academic Background

Georgetown University, McCourt School of Public Policy, M.P.P., 2009
University of Illinois College of Law, J.D., 2000
University of Chicago, B.A., 1997

Selected Publications and Presentations

Williamson, S. and Lawrence, M., "Scenarios Modeling Macroeconomic Impacts of a California-Style Low-Carbon Fuel Standard in Washington and Oregon." Presented at the Air & Waste Management Association's Conference. "Greenhouse Gas Strategies in a Changing Climate," November 2011, and at the Transportation Research Board Annual Meeting in Washington, D.C., January 2012.

Williamson, S., "Analysis of Transportation-Sector Policy Selection and Policy Preference Expressed in State Climate Action Planning Processes." Presented at the Air & Waste Management Association's Conference, "Greenhouse Gas Strategies in a Changing Climate," November 2011, and at the Transportation Research Board Annual Meeting in Washington, D.C., January 2012.

Williamson, S. and Lawrence, M., "Best Principles in Managing Retirement System Benefit Obligations to Retired Transit Employees." Final report presentation to Associate Administrator and other Federal Transit Administration staff in Washington, D.C, in December 2011.

Williamson, S., "Cuantificación de las Opciones de Política Pública: El Sector de Transporte y Desarollo Urbano." Training presentation provided to officials from Mexican state governments and the Border Environment Cooperation Commission in Mexicali, Baja California, June 2011.

Williamson, S., "Economic Impacts of Climate Change Mitigation Policies for the Transportation Sector: Comparing Cost-Effectiveness of Efficiency and Alternative-Fuel Strategies." Presented at the 57th Annual North American Regional Science Council Annual Conference in Denver, November 2010.

Williamson, S., "Analysis of Transportation-Sector Policy Selection and Policy Preference Expressed in State Climate Action Planning Processes." Presented at the 58th Annual North American Regional Science Council Annual Conference in Miami, November 2011.

Williamson, S. and Lawrence, M., and Mueller, J., "Public-Private Partnerships and the Importance of Value for Money Analysis: Overview of Current International State of Practice." Presented at the Transportation Research Board Annual Meeting in Washington, D.C., January 2011.

Hauck, D., and Williamson, S., "A Rapid Transit System For Montgomery County."' Presented at several open houses and civic-association meetings in the communities of Rockville, Glenmont, Wheaton and Silver Spring, Maryland, on multiple dates in 2014.

Holly C. Lindquist

Professional Background

2014-Present	Policy Analyst, Center for Climate Strategies
2010-2013	Environmental Scientist, TranSystems|Pechan
2001-2010	Environmental Scientist, E.H. Pechan & Associates

Summary of Relevant Professional Experience

Ms. Lindquist has 13 years of experience in emission inventory development, verification, and policy analysis. Her emission inventory experience includes development of emission estimates, estimation methodologies, and emission factors, for criteria air pollutants (CAP), greenhouse gases (GHG), and hazardous air pollutants (HAP). Ms. Lindquist has developed inventories for many source sectors, including transportation; residential, commercial, and industrial (RCI) fuel use; industrial processes; fossil fuel industry; agriculture; forestry and other land use (FOLU); and waste management sectors. She has supported climate change stakeholder projects in both US and Mexican states by conducting research to support baseline and policy development, estimating costs and benefits for proposed mitigation policies, and supporting technical workgroup facilitation. Ms. Lindquist has also supported GHG inventory verification projects for 9 corporate reporters to North American emissions registries.

China Low Carbon Development Project: Developing training exercises to support training and capacity building curriculum materials, including exercises to illustrate baseline inventory and forecast development, policy development, and microeconomic and macroeconomic analysis of policies.

Minnesota Climate Solutions & Economic Opportunities (CSEO) Project: Assisted in the construction of a revised energy and emissions baseline for the State. This included a major revision to the FOLU sector net carbon sequestration data addressing forests, peat lands, and rangelands, and supporting policy design and microeconomic analysis of policies developed for the FOLU sector.

South Jersey Transportation Planning Organization GHG Inventory. Developed a regional 2010 GHG inventory for the FOLU (net carbon sequestration, plus GHG sources) and agricultural sectors for this four county region.

North Jersey Transportation Planning Authority GHG Inventory and Forecast. Supported development of GHG inventory and forecast for the NJTPA by developing municipal-level emission estimates for the agriculture, forestry, and wastewater treatment sectors, including direct, consumption-based, and energy-cycle emissions.

Mexico GHG Inventories and Forecasts. Assisted in development of GHG inventories for the Mexican States of Baja California, Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas, including agriculture, forestry, and industrial processes sectors.

Central States Air Resource Agencies (CenSARA) Agricultural Pesticide Emission Inventory. Provided primary technical work for a project for CenSARA to develop an inventory of VOC and HAP emissions from agricultural pesticide application and develop a database tool for making future updates to the inventory.

Climate Change Action Plan Stakeholder Projects. Assisted in climate change stakeholder support projects in AK, AZ, FL, MI, NC, NM, and NY by conducting research to support policy development and estimating costs and benefits of proposed policies.

Review of Inventory Methods for Urban Sources of Ammonia, San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD). Developed recommendations for improving methods to quantify urban sources of ammonia emissions for the SJVUAPCD.

South Coast Association of Governments Regional Climate Action Planning Support. Developed transportation sector GHG emission inventory and forecast for six counties in Southern California.

Development of Multi-pollutant Inventory, U.S. Environmental Protection Agency (EPA). Supported a pilot project to develop a multi-pollutant inventory of emissions of GHGs, criteria pollutants, and toxic air pollutants for the State of Iowa using EPA's common National Inventory Format.

Port Authority of New York & New Jersey (PANYNJ). Developed a bus idling survey plan for the PANYNJ for studying baseline bus idling activity at the PATH Journal Square Transportation Center.

Greenhouse Gas (GHG) Verification, California Climate Action Registry. Supported verification of GHG inventories for Sacramento Metropolitan Utility District, Sacramento Air Quality Management District, California State Teacher's Retirement System, Trust for Public Land, El Dorado Irrigation District, Santa Clara Valley Water District, San Lorenzo Valley Water District, and Mojave Desert Air Quality Management District submitted to the California Climate Action Registry.

Western Regional Air Partnership (WRAP) GHG Inventory and Forecast. Assisted in development of greenhouse gas emissions inventories for the 13 states in the WRAP by estimating emissions for the transportation sector.

Criteria Air Pollutant (CAP) and Hazardous Air Pollutant (HAP) Inventory and Forecasts. Supported many projects to develop CAP and HAP inventories, including CAP/HAP area source inventory for Delaware; CAP/HAP residential wood and ammonia inventories for the Mid-Atlantic/Northeast Visibility Union (MANE-VU); inventory of particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) from area sources for Yuma, AZ nonattainment area; area source ozone precursor inventory for Sedgwick County, Kansas; and CAP/HAP area source inventory for Texas.

Academic Background

University of North Carolina at Chapel Hill, Environmental Science, M.S 2001.

University of North Carolina at Chapel Hill, Chemistry, M.S 1998.

Transylvania University, Chemistry, B.A., 1996.

Selected Publications and Presentations

Maldonado, J.A., H. Lindquist, C. Wu, T. Pella, "Pesticide Application Emissions Inventory Enhancement Project", presented at Air & Waste Management Association 106th Conference, Chicago, IL, June, 2013.

Roe, S.M., B. Strode, J. Wilson, H. Lindquist, M. Mullen, J. Schreiber, H. Hammer, J. Matic, T. Lin, and J. Perlman, "Development of a Regional Greenhouse Gas Inventory and Forecast Including Direct and Consumption-Based/Energy Cycle Emissions, Paper 2011-A-159-AWMA, presented at the 2011 AWMA Annual Conference, Orlando, FL, June 2011.

Lindquist, H.C., S. Roe, J. Wilson, M. Mullen, B. Strode, J. Schreiber, H. Hammer, J. Matic, T. Lin, J. Perlman, "Development of a Regional Greenhouse Gas Inventory and Forecast Including Direct and Consumption-Based/Energy-Cycle Emissions", presented at the EPA's Annual Emission Inventory Conference, San Antonio, TX, September, 2010.

Lindquist, H.C., S. Roe, A. Bollman, M. Salholtra, E.H. Pechan; L, Tooly, USEPA; and M. Stein, IA DNR, "Development of an Integrated Criteria/Toxic Air Pollutant and Greenhouse Gas Inventory for Iowa", presented at the A&WMA's Conference on Greenhouse Gas Assessment and Reporting, Baltimore, MD, September 2009.

Roe, S.M., R. Strait, H. Lindquist, A. Bailie, A. Jamison, T. Peterson, "Greenhouse Gas Emission Inventories and Forecasts for Nine Western States", presented at the 16th Annual EPA Emissions Inventory Conference, Research Triangle Park, NC, May 2007.

Roe, S.M., R. Strait, H. Lindquist, A. Bailie, A. Jamison, T. Peterson, "1990 – 2020 Greenhouse Gas Inventory & Forecast for the State of Alaska" presented at the 2007 Alaska Forum on the Environment, Anchorage, AK, February 2007.

Roe, S.M., M. Mullen, R. Strait, H. Lindquist, M. Lazarus, A. Bailie, T. Peterson, K. Colburn, "Emissions Inventory Considerations for Supporting the Development of State & Local Climate Change Mitigation Plans", presented at the 15th Annual EPA Emissions Inventory Conference, New Orleans, LA, May 2006.

Roe, S.M., M.A. Mullen, (Pechan); R.P. Strait, T. Peterson, K. Hausker, and K. Colburn (Center for Climate Strategies); M. Lazarus (Stockholm Environment Institute); and A. Bailie (Pembina Institute); "Progress in Climate Change Mitigation Action Plan Development for Several U.S. States", presented at Air & Waste Management Conference, "Planning for the Future: Climate Change, Greenhouse Gas Inventories & Clean Energy Linkages", March 7-9, 2006, San Francisco, CA.

Peterson, T., K. Hausker, and E. Williams (Center for Climate Strategies) and R. Strait, S. Roe, H. Lindquist, M. Ma, Y. Hsu, M. Mullen, "Draft North Carolina Greenhouse Gas Inventory and Reference Case Projections 1990-2020," prepared for the North Carolina Department of Environment and Natural Resources, Raleigh, NC, October 2005.

Suseel D. Indrakanti, AICP
Associate
Cambridge Systematics, Inc.

PROFESSIONAL EXPERIENCE

Transport Emissions Evaluation Models for Projects (TEEMP) Transportation Greenhouse Gas Appraisal Tools – For the Institute for Transportation & Development Policy (ITDP), Cambridge Systematics assisted in the development of sketch-level transportation greenhouse gases (GHG) appraisal tools for the Asian Development Bank (ADB) and the Global Environment Facility (GEF). Mr. Indrakanti assisted ITDP in developing a GHG evaluation model by recommending the structure and parameters to include in the model for certain Transportation Demand Management (TDM) related GHG reduction strategies including parking pricing, pay-as-you-drive insurance, employer-based commute strategies, and eco-driving. He was instrumental in developing the basic structure that is being used in the TDM models, the set of key parameters that were needed, and in providing a model template for these components.

Los Angeles MTA Congestion Mitigation Fee (CMP) Program – Greenhouse Gas Emissions Impact Tool. For Los Angeles MTA (LA MTA), Mr. Indrakanti developed a GHG emissions reduction sketch planning tool as an enhancement to the CS developed CMP Fee Revenue and Growth Forecast Calculator. The objective of this additional functionality within the LA MTA CMP toolset was to provide the resource necessary for individual sub-regions and cities within the region to estimate the greenhouse gas (GHG) impacts of the candidate projects they specify in their prototype fee programs. The sketch planning tool includes 10 project types including capacity expansion, intersection and interchange improvements, park-and-ride, system management and operations including corridor signal synchronization, bike and pedestrian improvements, transit expansion and managed lanes.

Metroplan Orlando Freight Related Air Quality Assessment and Strategies –As part of the Central Florida Regional Freight Study, Mr. Indrakanti supported an air quality analysis to provide an inventory of freight related emissions and explore strategies to reduce freight related emissions. He developed emissions inventories for freight modes including truck, rail, and ports for particulate matter and greenhouse gases. Technology-based emission reduction strategies estimated include retrofits to existing vehicles and switching from diesel fuel to more efficient alternative fuels, such as compressed natural gas (CNG) or electricity. Operational and system management

EDUCATION

M.S., Civil Engineering, Boise State University, 2006

B.E., Civil Engineering, S.R.K.R. Engineering College, Andhra University, 2002

AREAS OF EXPERTISE

Environmental Analysis
Air Quality and Emissions Modeling
Climate Change Mitigation and Adaptation
Transportation and Land Use
Transportation Planning and Analysis
Travel Demand Modeling
Geographic Information Systems (GIS)

strategies involve streamlining or increasing efficiency by reducing travel activity and operating conditions, like creating freight villages and idle reduction strategies.

SJTPO Regional Greenhouse Gas Emissions Inventory - For the South Jersey Transportation Planning Organization (SJTPO), Mr. Indrakanti supported the development of a greenhouse gas (GHG) emissions inventory at the region, county, and municipality scale for the on-road passenger and freight vehicles, passenger rail; freight rail; and commercial marine sectors. The on-road sector inventory was developed using EPA MOVES 2010b and the South Jersey Travel Demand Model. Passenger rail, freight rail, and commercial marine inventories were supported through consultation with the New Jersey Department of Transportation (DOT), New Jersey Transit, and the New Jersey Department of Environmental Protection (DEP). Mr. Indrakanti also developed a GHG emissions forecasting protocol to support SJTPO in developing estimates of GHG emissions through 2040.

Oregon DOT Greenhouse Gas Reduction Toolkit for Bill 1059 – For the Oregon Department of Transportation (DOT) and its partners, Cambridge Systematics developed a Greenhouse Gas (GHG) Toolkit to assist Oregon's local governments in developing and executing actions and programs to reduce GHG emissions from light (cars) motor vehicles, defining strategies and programs that can be used to test and identify the potential GHG emission reductions by mode, system, and geographic region. Mr. Indrakanti led the development of the GHG Toolkit to includes a database with query capabilities that provide a comprehensive listing of actions and programs that Oregon, the State's MPOs, and local governments can implement on the local and regional level to reduce transportation-related GHG emissions.

NJTPA Regional GHG Emissions Mitigation Plan. Mr. Indrakanti was involved in development of the Regional Greenhouse Gas (GHG) Emissions Mitigation Plan for the NJTPA. He developed the generation of alternative baseline emissions forecasts, an analysis of the effectiveness of a variety of transportation strategies in mitigating on-road emissions, and development of a toolkit to facilitate the integration of mitigation strategies into local transportation and land use plans. The plan included developing a GHG emissions baseline for transportation sources for all counties and municipalities in the region, and developing a GHG mitigations strategies toolkit to inform regional and local comprehensive planning decisions

ARC Regional Transportation Planning Services - For the Atlanta Regional Commission (ARC), Mr. Indrakanti led the development of a Congestion Mitigation and Air Quality (CMAQ) emissions calculator to estimate individual emissions benefits of projects, as well as co-benefits across projects in an effort to help standardize best practice in evaluating CMAQ projects. The tool calculates benefits for 16 types of strategies including transit enhancements, system operations strategies, alternative fuels, demand management strategies, and bicycle and pedestrian investments. The calculator has been calibrated for the Atlanta region, but can be customized and adopted for other regions throughout the country.

Moving Cooler – Mr. Indrakanti supported the evaluation of strategies to reduce greenhouse gas emissions from transportation sources focusing on systemic transportation planning and policy by providing a comprehensive evaluation of more than 50 strategies to reduce greenhouse gas (GHG) emissions and fuel consumption from transportation by providing comprehensive and credible analysis of the cost-effectiveness and equity effects of the coordinated implementation of transportation measures. Mr. Indrakanti conducted research and development of techniques to quantify the GHG reduction benefits of each strategy.

Maryland Climate Action Plan – Implementation Plan. Mr. Indrakanti is serving as the CS team Deputy Project Manager developing technical and policy information and analysis and leading development of the Maryland Department of Transportation (DOT) Climate Action Plan – Implementation Plan. As part of this process, Mr. Indrakanti has lead technical analysis to estimate GHG reductions and from MDOT's Consolidated Transportation Program (CTP), developed a cost effectiveness estimate for different investment strategies, and developed multiple public reports on MDOTs process, goals, and strategic direction as it applies to climate change.

PROFESSIONAL AFFILIATIONS

American Institute of Certified Planners (AICP), Certified Planner

David N. Kall, E.I.T
Associate
Cambridge Systematics, Inc.

Professional Experience

CHCNGA TPO Conformity Determination Reports. For the Chattanooga-Hamilton County/North Georgia Transportation Planning Organization (CHCNGA TPO), Mr. Kall supported the transition from a MOBILE6-based air quality postprocessor to a MOVES based one. As part of this effort he prepared all local data inputs for the County Data Manager within MOVES, coordinated the inputs with interagency partners, and wrote portions of the conformity determination report for the 2035 Regional Transportation Plan (RTP) Amendment. As part of the MOVES transition, the CHCNGA TPO is including green-house gases (GHG) in the MOVES runs and air quality postprocessor. Mr. Kall is currently managing a team of air quality modelers and travel demand modelers to update the MOVES runs and air quality postprocessor for the 2040 RTP and the corresponding conformity determination report.

NCHRP Project 25-38 Input Guidelines for Motor Vehicle Emissions Simulator (MOVES) Model. For the National Cooperative Highway Research Program (NCHRP), Mr. Kall is serving as the Deputy Project Manager and as key technical staff for this project on MOVES data inputs. The objective of the project is to provide guidance on methods and procedures for obtaining and preparing data, as required for MOVES regional- and project-level local inputs; and to provide default datasets that could potentially be used in the absence of local data. Mr. Kall led the literature review to gather relevant past research and the assessment of past MOVES-related surveys of metropolitan planning organizations (MPO) and state department of transportation (DOT). He is currently leading the sensitivity analysis task and will be supporting research on new data sources and methods for creating MOVES inputs.

Travel and Emissions Impacts of Highway Operations Strategies. For the Federal Highway Administration (FHWA), Cambridge Systematics is examining the induced demand and emissions impacts of implementing operations strategies. Highway operations have the potential to smooth traffic flow, reducing acceleration and deceleration events and resulting in more efficient vehicle operation. At the same time, strategies that improve travel conditions may also affect traveler decisions that may or may not have an impact on VMT. Mr. Kall will be supporting the emissions analysis, which will predict the production of both criteria pollutants and GHGs over a 40-year

EDUCATION

M.S., Civil Engineering (Transportation Systems),
Georgia Institute of Technology, 2008

M.C.R.P., City and Regional Planning,
Georgia Institute of Technology, 2008

B.S., Civil Engineering,
University of Dayton, 2004

AREAS OF EXPERTISE

GHG Analysis
Air Quality Analysis
Regional and Urban Transportation Planning

PROFESSIONAL REGISTRATIONS

Engineer-in-Training (EIT), Ohio

time horizon for project-level operational strategies. Emissions impacts are being estimated with the U.S. EPA's MOVES model and the Comprehensive Model Emissions Model (CMEM) developed for the NCHRP.

Indianapolis MPO Air Quality Emissions Submodel for the Indianapolis Travel Demand Model. For the Indianapolis MPO, Mr. Kall is providing support for the MPO's transition to the U.S. Environmental Protection Agency's (EPA) new air quality modeling software, MOVES, from MOBILE6.2 and updating the regional travel demand model to include a MOVES compliant air quality emissions submodel. He also supported coordination efforts with the MPO, state, and Federal partners on input data required for MOVES. Mr. Kall conducted all of the MOVES runs required for the emissions submodel and incorporated the emissions results from the submodel into a gap test to compare against the area's MOBILE6 based motor vehicle emissions budgets. In addition, he conducted a training workshop for the MPO staff to train them on the use of MOVES for regional conformity, project level conformity, and Congestion Mitigation and Air Quality Improvement (CMAQ) applications.

NJTPA GHG Mitigation Plan. For the North Jersey Transportation Planning Authority (NJTPA) GHG Mitigation Plan, Mr. Kall led the first task, which is to create a MOVES-based GHG inventory. For this effort he designed a series of batch MOVES runs using local input data. The resulting emission rates were then combined with vehicle activity data to estimate on-road GHG emissions.

Hillsborough MPO GHG Analysis. For the Hillsborough County, Florida MPO, Mr. Kall analyzed the GHG impacts of implementing two future year cost affordable scenarios from the long-range transportation plan and compared them to a base year and existing plus committed scenario. To do this he estimated GHG emissions for highways and transit by using vehicle miles of travel (VMT) and speed outputs from the Tampa Bay Regional Planning Model in combination with GHG emissions factors from MOVES.

ARC Planning Support. Mr. Kall provided support on the air quality task to assist the Atlanta Regional Commission (ARC) in transitioning to a MOVES-based air quality postprocessor in anticipation of the upcoming requirement to use MOVES for transportation conformity analyses. Specifically, he provided training and support on setting up MOVES runs, new data requirements for MOVES inputs, and methods to interface MOVES with an air quality postprocessor to the travel demand model. As part of the MOVES transition ARC is including GHGs in the MOVES runs and air quality postprocessor.

Florida Air Quality Post-Processor. For the Florida Department of Transportation (DOT), Mr. Kall supported the development of an air-quality postprocessor to be incorporated into the Florida Standard Urban Transportation Model Structure (FSUTMS)/Voyager. This tool will assist the Florida DOT in running conformity analyses for the anticipated new ozone standards and provide estimates of GHG emissions. As part of this effort, Mr. Kall has investigated the feasibility of using the MOVES emissions model; followed technical modifications to the MOVES model, including the release of MOVES2010, the official version of the model for use in conformity analysis; ran the MOVES model to provide emission rates for use in the postprocessor; and advised the Florida DOT on local input data requirements of the MOVES model.

TCRP Project H-41 – Assessing and Comparing Environmental Performance of Major Transit Investments. For the Transit Cooperative Research Program (TCRP), Cambridge Systematics is evaluating criteria, metrics, and methods for assessing and comparing the environmental performance of major transit investments, including Federal Transit Administration (FTA) 5309 New Starts and Small Starts projects. As part of this effort, Mr. Kall is creating a spreadsheet tool to calculate the air quality, energy, and GHG related metrics for several pilot transit projects. He is designing a series of MOVES runs to provide emission factors for all criteria pollutants, air toxics, and GHGs. These emission rates will be fed into a postprocessor to estimate exposure and health benefit indices at the zonal level.

Stacy Cook, AICP
Transportation Planner, (Associate)
Cambridge Systematics, Inc.

Professional Experience

For VIA Metropolitan Transit (San Antonio, TX) Ms. Cook. Cook has recently completed work on a number of projects, including supporting the development of transit supportive land use (TSLU) policy toolkit and guidebook, supporting a BRT corridor analysis, and leading the development of a Strategic Housing Toolkit for High Capacity Transit Corridors - that documents best practices for preserving and producing affordable housing in transit communities. Currently, Ms. Cook is supporting implementation of the TSLU toolkit and is leading efforts to implement strategies in the housing toolkit, as well as supporting the coordination of a new VIA and San Antonio Housing Authority (SAHA) interagency committee that resulted from the housing toolkit development process.

For the Federal Transit Administration - Ms. Cook has supported the FTA in the review of Small Start grant applications, focusing on the relationship of land use, affordable housing, and transit.

Maryland DOT Attainment Report (AR) and Managing for Results (MFR). For the Maryland DOT, Ms. Cook lead the development of the 2016 MFR and supported development of the 2015 AR. This is her fifth year of involvement with the development of Maryland's annual performance reports on the implementation of the Maryland Transportation Plan and the Consolidated Transportation Program.

For the International Development Bank (IDB) Ms. Cook is supporting efforts to develop a handbook for ministries of transport in Mesoamerica and the Dominican Republic on climate change adaptation. For each of the involved countries, Ms. Cook is assisting with the development of profiles that identify climate change trends, vulnerabilities, climatic projections, and adaptation strategies.

For the Metropolitan Transportation Commission (San Francisco, California) Ms. Cook is supporting the development of a survey to gain information about vulnerabilities of select transportation facilities in the San Francisco Metropolitan area. This information, along with other analyses, will be used to develop climate change adaptation strategies for regional

EDUCATION

M.S., Urban and Regional Planning, University of Wisconsin – Madison, 2009

Certificate, Transportation Management and Policy, University of Wisconsin – Madison, 2009

B.A., Spanish and International Relations, University of Wisconsin – Madison, 1997

Certificate: National Transit Institute Transit and Land Use Course.

AREAS OF EXPERTISE

Regional and Urban Transportation Planning
Transportation Analysis
Environmental Analysis
Transit Planning

transportation infrastructure.

Louisiana Department of Transportation and Development (DOTD) Regional Strategic Highway Safety Plan. For the DOTD, Ms. Cook is leading the development of the New Orleans region Strategic Highway Safety Plan (SHSP). This plan includes the development of multimodal emphasis area plans that will target the reduction of fatalities and injuries in the New Orleans region.

Manassas National Battlefield Park Transportation Study. For the Manassas National Battlefield Park Ms. Cook lead a study to identify strategies to improve visitor experience in the park, including transit, traffic calming, multimodal/trails improvements, parking utilization improvements, and technological enhancement for communications, way finding, and trip planning.

Federal Highway Administration - Performance-Based Management of Federal-Aid Highway Programs Phase II. For the FHWA, Ms. Cook reviewed the approach to transportation system performance measurement developed by the United Kingdom. Ms. Cook assisted in development of a report which demonstrated the possible application of this approach, and its performance measures, for use in the United States.

Maryland DOT Development of the Aberdeen TOD Master Plan. For the Maryland DOT Ms. Cook managed the development of the Aberdeen, MD Transit Oriented Development (TOD) Master Plan.

San Francisco Municipal Transportation Agency Transportation Nexus Studies. Ms. Cook helped to build upon work conducted in the Automobile Trip Mitigation Fee (ATMF) Study by selecting, describing, and justifying the inclusion of projects in the ATMF Mitigation Package.

Virginia DOT I-66 Multimodal Study. For the VDOT I-66 Multimodal study, Ms. Cook provided technical support for analysis of Mobility Option Packages to ease congestion on I-66 inside the beltway, and is assisting with project coordination.

Texas DOT - High Speed and Intercity Rail Visioning Sessions. For the Texas Department of Transportation (TxDOT), Ms. Cook assisted with facilitation of visioning sessions and workshops for public officials and key stakeholders which addressed the vision of passenger rail in Texas, investing in rail, and how to prioritize rail investments in Texas. These efforts supported the Texas Rail Plan and Statewide Long Range Transportation Plan.

Maryland Public-Private Partnership (P3) Identification and Screening. For the Maryland DOT, Ms. Cook assisted with the development of criteria for the identification and screening of potential P3 projects. Ms. Cook is also assisted with facilitation of Task Steering Group meetings, conduct of interviews, and the development of a process to integrate P3 identification and screening into existing planning activities at Maryland's multimodal transportation agencies.

NCHRP 20- 24 (80) Transportation and the Economy Workshop and Research Agenda Ms. Cook assisted with the production of a workshop at which public officials and transportation industry leaders from across the nation discussed what gaps exist in the body of knowledge about transportation and the economy, and what research might address those gaps and be beneficial to decision makers. Ms. Cook developed presentation information for the workshop, assisted with meeting facilitation, and was a key contributor to the development of the workshop report and research agenda.

SELECTED PUBLICATIONS AND PAPERS

Develop an Asset Management Tool for Collecting and Tracking Commitments on Selected Environmental Mitigation Features, paper presented as a poster session at the 2010 TRB Annual Conference, January, 2010

David L. Jackson, AICP
Senior Associate
Cambridge Systematics, Inc.

Professional Experience

NJTPA Greenhouse Gas Mitigation Plan. For NJTPA, Mr. Jackson served as the team Project Manager developing a regional GHG mitigation plan for 13 counties in Northern New Jersey. The plan revised the GHG emissions inventory and baseline forecast for on-road transportation sources for all counties and municipalities in the region using the most recent version of the EPA MOVES model. The study resulted in a GHG mitigation strategy effectiveness plan and toolkit designed to help inform regional and local comprehensive planning decisions. The study included an extensive research process of identifying a universe of possible transportation sector GHG reduction strategies applicable to the North Jersey region, and a screening process to constrain the list of strategies to a priority list based on measures of feasibility, consistency with regional goals, political and institutional support, and effectiveness.

Oregon Department of Transportation – Statewide Transportation Strategy. For the Oregon Department of Transportation (DOT) and its partners, Department of Environmental Quality (DEQ), Oregon Department of Energy (DOE), and the State's Metropolitan Planning Organizations (MPOs), Cambridge Systematics is developing a statewide transportation strategy to achieve future targets of Greenhouse Gas (GHG) emissions for light (cars), heavy-duty (trucks), and long-distance vehicles. Mr. Jackson is assisting the DOT in identifying GHG reduction targets for the transportation sector; defining a vision for the transportation system to accomplish the adopted targets; identifying key problems and associated risks that need to be addressed to achieve the vision; developing methodologies to assess the long-term GHG reduction benefit of statewide transportation and land use strategies; and determining the critical actions required to meet the State's vision.

Maryland Climate Action Plan – Implementation Plan. For the Maryland Department of Transportation (DOT), Mr. Jackson is serving as Project Manager developing the Climate Action Plan – Maryland DOT Implementation Plan. Cambridge Systematics is leading the development of land use, transit, bike and pedestrian, pricing and technology strategies across eight transportation and land use working groups. These strategies are being developed and analyzed against baseline statewide transportation sector GHG emission forecasts, accounting for demographic growth trends and existing transportation investment trends through 2020. The work has included coordination with the Baltimore Metropolitan Council on use of EERPAT, as well as transitioning from MOVES2010b to MOVES2014.

EDUCATION

M.S., Civil Engineering,
Georgia Institute of Technology, 2005

M.C.R.P, City and Regional Planning,
Georgia Institute of Technology, 2005

B.S., Civil Engineering,
Georgia Institute of Technology, 2000

Maryland Carbon Neutral Corridor. For the Maryland Department of Transportation (DOT), Mr. Jackson served as the Deputy Project Manager developing the U.S. 40 Carbon Neutral Corridor. The objective of the project is the development of an action plan for reducing transportation carbon emissions in the corridor and the remainder offset to the point where over the long term, the net carbon emissions from the corridor approach zero. Technical approaches include use of U.S. EPAs

MOVES model and other available GHG inventory models. Strategies include transportation measures/technologies, carbon sequestration off-sets from afforestation and reforestation, working with local businesses on workforce patterns, and implementing educational programs on sustainable land use and energy efficient business practices

District Department of Transportation (DDOT) – Right Size Parking Study. Mr. Jackson is serving as the team project manager leading development of a webtool for DDOT and Office of Planning (OP) that estimate residential parking supply and demand based on an analysis of local built environment, transportation, and socioeconomic variables and observed multifamily residential property parking utilization.

Metro Congestion Mitigation Fee Program – Greenhouse Gas Emissions Impact Tool. For Los Angeles County Metropolitan Transportation Authority (Metro), Mr. Jackson served as the task manager developing a GHG emissions reduction sketch planning tool as an enhancement to the CS developed *CMP Fee Revenue and Growth Forecast Calculator*. The objective of this additional functionality within the LA MTA CMP toolset is to provide the resource necessary for individual sub-regions and cities within the region to estimate the greenhouse gas (GHG) impacts of the candidate projects they specify in their prototype fee programs. The tool includes 12 project types representing a portfolio of mobile source GHG reduction strategies. A summary of tool development and application was published in Transportation Research Record: Journal of the Transportation Research Board, Volume 2303 / 2012 Travel Demand Forecasting 2012.

Gateway Cities COG Consultant Support in Developing a Subregional Sustainable Communities Strategy. For the Gateway Cities Council of Governments (CA), Cambridge Systematics prepared the first sub-regional Sustainable Communities Strategy (SCS) under the landmark California legislation requiring a statewide reduction in greenhouse gas (GHG) emissions from transportation. Mr. Jackson served in a technical leadership role supporting the evaluation of over 50 land use and transportation strategies. This analysis included development of analytical methods to measure the interactions between bundles of strategies implemented at the municipal, sub-regional, county, regional, state and Federal levels.

Fairfax County Bicycle Master Plan. For Fairfax County Virginia, Mr. Jackson served as the team Project Manager developing a Countywide Bike Plan. The project objective is to develop a plan that will make bicycle transportation a more significant piece of the overall transportation component of Fairfax County, while expanding logical bicycling opportunities for Fairfax County. Phase 1 of the Plan focused on the Greater Tysons Corner Area and Phase 2 addressed bicycle access throughout Fairfax County through identifying specific improvements that are needed to accommodate and encourage bicycling throughout Fairfax County.

Moving Cooler. Mr. Jackson served as a technical lead for a study by Cambridge Systematics focusing on systemic transportation planning and policy by providing a comprehensive evaluation of more than 50 strategies to reduce greenhouse gas emissions and fuel consumption from transportation. The intent of the study is to inform transportation investment and policy decisions by providing comprehensive and credible analysis of the cost-effectiveness and equity effects of the coordinated implementation of transportation measures. Mr. Jackson led research and development of techniques to quantify the greenhouse gas reduction benefits of each strategy as well as individual and bundled strategy cost-effectiveness.

Atlanta Regional Commission. Prior to joining Cambridge Systematics, Mr. Jackson served as a planner with the Atlanta Regional Commission (ARC) for three years. As Model Applications Group Manager, he was responsible for overseeing an annual work program including regional transportation and land use scenario testing, air quality planning and conformity analysis, performance measure development and analysis, congestion management process criteria measurement, Congestion Mitigation and Air Quality program management and project analysis, and project evaluation criteria review.

Christopher D. Porter
Principal
Cambridge Systematics, Inc.

Professional Experience

Christopher D. Porter is a Principal of Cambridge Systematics with 18 years of experience in transportation and land use, air quality and greenhouse gas (GHG) analysis, travel demand management (TDM), and performance measurement. **He has led or served as a primary contributor to a variety of national efforts** to synthesize information on the effects of a wide range of transportation strategies on traffic congestion, travel reduction, air quality, and GHG emissions. He has supported state and regional GHG inventories and reduction plans in Florida, Maryland, Massachusetts, New Jersey, and Oregon.

SHRP Project C09 – Incorporating Greenhouse Gas Emissions into the Collaborative Decision-Making Process. For the Strategic Highway Research Program (SHRP), Mr. Porter led Cambridge Systematics' role in work to develop a strategy for addressing GHG emissions at relevant key transportation planning decision points and prepare a Practitioner's Handbook describing strategies for addressing GHG emissions. Mr. Porter's role included developing guidance on where and how to incorporate GHG considerations at four levels of planning – long-range planning, programming, corridor planning, and project development – as well as technical resources for practitioners.

National Renewable Energy Laboratory Transportation Energy Futures Study. For the National Renewable Energy Laboratory, Mr. Porter supported the Transportation Energy Futures study by developing issue papers on 1) the influence of the built environment on travel, and 2) the effects of travel reduction and efficient driving strategies. Mr. Porter also led the development of a national-level sketch-planning tool for addressing the potential for built environment strategies to influence energy use for transportation, considering factors such as density, mix of uses, and availability of modes.

Massachusetts Global Warming Solutions Act Implementation Support. Mr. Porter led Cambridge Systematics' role in providing strategic and analytical support for the implementation of the Massachusetts Global Warming Solutions Act, which establishes statewide GHG reduction targets for 2020 and 2050. Activities included GHG inventory development, strategy development, and modeling of GHG reductions, costs and benefits, and economic impacts for transportation and land use strategies.

Education

M.S., Transportation, University of California at Berkeley, 1995

M.C.P., City Planning, University of California at Berkeley, 1995

B.C.E., Civil Engineering, University of Minnesota, 1993

Areas Of Expertise

Transportation and Land Use
Air Quality and Greenhouse Gas Analysis
Travel Demand Management
Performance Measurement

Oregon Department of Energy GHG Marginal Abatement Cost Curves. For the Oregon Department of Energy, Mr. Porter developed inputs to marginal abatement cost curves for transportation fuels and vehicle technology strategies. He estimated the potential GHG benefits and cost-effectiveness in the State of each strategy through the year 2035 under various

deployment scenarios. The analysis examined roughly a dozen strategies, including various types of biofuels, natural gas, electric vehicles, and advanced technology internal combustion engine vehicles for both the passenger and freight sectors.

NCHRP 25-25 (Task 59) - Evaluate the Interactions between Transportation-Related Particulate Matter, Ozone, Air Toxics, Climate Change, and Other Air Pollutant Control Strategies. For the NCHRP, Mr. Porter led research to identify which types of control strategies will have beneficial effects on reducing all pollutants, including ozone precursors, particulate matter (PM), air toxins, and GHG; as well as which ones may reduce some pollutants while increasing others, and the specific tradeoffs involved. The research also identified how transportation and air quality agencies have evaluated cost-effectiveness, considering multiple pollutants, and made tradeoffs among these pollutants.

U.S. DOT Report to Congress on Transportation's Impact on Climate Change and Solutions. For the United States DOT, Mr. Porter supported the preparation of a Report to Congress studying the potential fuel savings and air pollution reductions of transportation climate change mitigation strategies. He was the lead author of chapters focusing on system efficiency and travel activity strategies and oversaw the development of chapters on vehicle efficiency and low-carbon fuels.

Connecticut DEEP Development of a Strategic Plan for Reducing Emissions Associated with Freight Movement in Connecticut. Mr. Porter supported the Connecticut Department of Energy and Environmental Protection (DEEP) with the development of a strategic plan for reducing emissions associated with freight movement in Connecticut, including criteria pollutants, air toxics, and GHG emissions. The strategic plan includes options for multi-pollutant emissions reductions from drayage and other heavy-duty diesel trucks, locomotives, marine engines, and port operations.

California Energy Commission – Update of the Energy Aware Planning Guide. For the California Energy Commission, Mr. Porter managed a project to update the Energy Aware Planning Guide for California. The Guide focuses on methods that local and regional governments can use to develop, implement, and quantify the benefits of relevant strategies and policies to promote sustainable, energy-efficient communities. Mr. Porter oversaw Cambridge Systematics' work to develop new sections to the Guide that address how local and regional governments can incorporate climate change considerations in their plans, and to prepare a comprehensive update of all sections of the guide.

LACMTA Active Transportation Model. Mr. Porter is supporting the Los Angeles County Metropolitan Transportation Authority (LACMTA) in developing bicycle travel forecasting models to support the County's Congestion Mitigation Fee program. Mr. Porter led the development of a sketch-level "Track 1" model, which forecasts increased bicycle travel because of new or improved on-road facilities as well as other bicycle improvements. The model also estimates a variety of benefits, including GHG emissions savings and health benefits.

SELECTED PUBLICATIONS AND PAPERS

Greenhouse Gas Benefits of Land Use Strategies. Presented and published at the Transportation Land-Use, Planning, and Air Quality Conference, Denver, Colorado, July 2009.

These Agencies Get It: When it Comes to Integrating Transportation and Land use, the Winners are… Planning Magazine, American Planning Association, May 2005.

John (Jay) Evans, P.E., AICP
Principal
Cambridge Systematics, Inc.

Professional Experience

MWCOG/TPB Travel Demand Model Development and Assistance. Mr. Evans served as the Program Manager, leading Cambridge Systematics' work program under this contract to provide travel demand model development, advice, and assistance to the Metropolitan Washington Council of Governments (MWCOG)/TPB. Among the recent task reports developed under his direction were "Fuel Prices in Travel Models," "Recommended Approach to Near-Term Model Enhancements," "Improving the Model's Sensitivity to Land Use Policies and Nonmotorized Travel," and "Recommendations on Feedback Convergence Methods." Cambridge Systematics and Mr. Evans recently were selected to perform these services during the most recent three-year contract award.

Virginia DOT I-66 Multimodal Study. For the Virginia Department of Transportation (DOT), Mr. Evans served as the Project Manager for this comprehensive study of multimodal mobility option packages that could be used to address congestion and improve travel conditions in the I-66 corridor inside the Beltway, including U.S. 29 and U.S. 50. Mobility option elements considered for the corridor included highway, high-occupancy vehicle (HOV), congestion pricing, bus rapid transit, rail transit, transportation demand management (TDM), bicycle, and integrated corridor management strategies. Evaluation techniques included use of the National Capital Region Transportation Planning Board (TPB) Version 2.3 travel demand forecasting model. Mr. Evans served as the lead author for the study reports and oversaw all aspects of the work program, involving six subconsultants and including conceptual engineering efforts.

Fairfax County Consulting Services: Transportation and Urban Planning, Design, and Engineering. For Fairfax County, Virginia, Mr. Evans has served as the Program Manager leading Cambridge Systematics in providing a wide range of general transportation and urban planning skills to conduct areawide, subarea, and corridor-level analysis of transportation alternatives of all modes of transportation and to support planning initiatives and urban planning design needs. Mr. Evans has served as the Project Manager or Principal-in-Charge on several tasks under the on-call contract, including updating the subarea model; preparing a transportation and urban design analysis to support comprehensive plan revisions for the Tysons Corner area; leading an effort to reinvent the Springfield area in terms of both urban design and local multimodal connectivity; and conducting a study into how TDM techniques can increase the effectiveness and efficiency of obtaining proffer commitments from developers and further reduce vehicle trips in the county. The Fairfax County subarea model has been

EDUCATION

M.B.A., Darden Graduate School of Business, University of Virginia, 2000

B.S., Civil and Environmental Engineering, Cornell University, 1992

AREAS OF EXPERTISE

Transportation and Transit Planning and Analysis
Travel Demand Forecasting Model Development and Application

PROFESSIONAL REGISTRATIONS

Professional Engineer
Maryland No. 22411
Certified Planner, American Institute of Certified Planners

PROFESSIONAL ASSOCIATIONS

Member, Public Transportation Planning and Development Committee, Transportation Research Board

developed to use the MWCOG/TPB model to generate regional travel forecasts and then use a detailed, county-level highway network and zone system to perform a more refined trip assignment. The subarea model's improved validation and finer level of detail permits the County to use it to successfully perform a wider range of analyses.

Virginia DRPT I-66 Transit/TDM Study and I-95/395 Transit/TDM Study. For the Virginia Department of Rail and Public Transportation (DRPT), Mr. Evans served as the Project Manager for two separate corridor-focused studies, providing recommendations on a comprehensive approach to the future provision of transit and TDM services and programs in each corridor. For the I-95/I-395 project, Cambridge Systematics worked with the Virginia DRPT and a Transit/TDM Advisory Committee (TAC) to develop a comprehensive alternative transportation plan to reduce congestion through the increased use of enhanced transit and TDM services in the corridor with the introduction of high-occupancy toll (HOT) Lanes. The study required demand forecasting, traffic analysis, analysis of park-and-ride facilities, and consideration of intermodal transfer facilities. Recommended tiered transit service and TDM improvements as well as the associated capital and operating costs were developed. For the I-66 project, the work also proceeded under the direction of a TAC. Version 2.2 of the TPB model was used in conjunction with the Washington Metropolitan Area Transit Authority (WMATA) nested-logit mode choice postprocessor to develop multimodal travel forecasts for the transit alternatives studied. The project included conceptual engineering of potential BRT-related enhancements designed to permit later extension of heavy rail transit.

Triangle Transit Program Management Services. Mr. Evans has served as the Project Manager for Cambridge Systematics' role of developing financial plans, preparing New Starts submissions, and performing travel demand forecasting. The Triangle Regional Transit Program consists of three separate Alternatives Analysis and New Starts project studies. The work has included preparing and validating the existing regional model for use for New Starts travel forecasting procedures, meeting regularly with representatives of the Federal Transit Administration (FTA), preparing model documentation, and preparing forecasts. Current work is focused on completing a Draft Environmental Impact Statement for a light rail project connecting the City of Durham with the Town of Chapel Hill.

WMATA Planning Architectural and Engineering Services for New Starts Projects. Cambridge Systematics, led by Mr. Evans, performed travel demand forecasting to support projects under the FTA New Starts program and other planning projects on a task order basis. Under one task order, Cambridge Systematics evaluated current ridership trends, determined the factors that are affecting ridership growth, and developed short- and long-term ridership projections. Cambridge Systematics also recommended and developed new econometric tools and procedures that can be used to improve the quality of short-term ridership forecasts and analysis prepared by the Authority.

NCHRP Travel Demand Forecasting: Parameters and Techniques (Report 716). Mr. Evans served as the Principal-in-Charge for this comprehensive update and expansion of the Report 365, Travel Estimation Techniques for Urban Planning. He participated in key workshops, reviewing and preparing selected materials, and overseeing adherence to project and client objectives. The revised report is intended to reflect current travel characteristics and provide guidance on travel demand forecasting procedures and their application for solving common problems. A range of credible approaches is presented to allow different users to select modeling and analysis techniques most appropriate to their situations (e.g., in terms of level of detail and sophistication). It is intended to be sufficiently broad, yet detailed enough, to allow practitioners to use it to address a range of issues (e.g., air quality, freight, multimodal, and other critical concerns).

TCRP Report 95 – Traveler Response to Transportation System Changes Handbook. For the Transit Cooperative Research Program (TCRP), Mr. Evans served as a Co-Principal Investigator on this engagement focused on synthesizing available findings on travel behavior changes that have been observed as a result of various transportation and land use strategies. The project addressed findings for all public transportation modes and illuminated results from best practices across the United States. Mr. Evans reviewed reports and journal articles and made contact with individual agencies through interviews and surveys. He served as Lead Author or Contributing Author for nine printed chapter volumes, including "Bicycle and Pedestrian Facilities," "Transit Scheduling and Frequency," "Transit Routing and Coverage," "Park-and-Ride/ Pool," "Transit-Oriented Development (TOD)," and "Road Value Pricing."

David F. Von Hippel

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Electronic Mail: dvonhip@igc.org

Citizenship: United States of America

Education:

Ph.D.: Energy and Resources, University of California at Berkeley. 1987.

M.S.: Energy and Resources, University of California at Berkeley. 1983.

M.A.: Biology, University of Oregon. 1981.

B.A.: Mathematics and General Science, University of Oregon. 1980.

Skills and Aptitudes

Broad knowledge in and familiarity with a variety of topics in the domestic and international energy and environmental science fields, including extensive background in the physical, biological, and social sciences. Strong mathematical, analytical and research skills, good writer, speaker and teacher, aptitude for design, ability to learn and to assess problems quickly. Extensive experience in training/teaching and in group facilitation. Thorough knowledge of Windows microcomputers and software, including energy sector modeling with the Long-range Energy Alternatives Planning (LEAP) software tool, programming experience in Excel, and in designing and building extensive Excel analytical tools (in the context of dozens of projects). Conversational-level knowledge of French and German, reading knowledge of Spanish.

Experience

1991 - Present: Independent Energy/Environmental Consultant and Analyst. Current and recent work includes coordinating the Asian Energy Security/East Asia Science and Security and related projects for Nautilus Institute, which have over time involving working groups from up to nine nations from the East Asia and Pacific region investigating nuclear energy, climate change, and energy security issues, working with the Stockholm Environment Institute-United States for the Global Green Growth Institute on a national green growth planning project in Mongolia, as well as on a Guidebook for Green Growth Planning, work on an Asian Development Bank greenhouse gas mitigation planning project in Vietnam, acting as a trainer in an integrated resource planning workshop for non-governmental agencies in Vietnam, in ongoing analysis of energy use and energy sector redevelopment in North Korea, work as a trainer, analyst, and facilitator on a greenhouse gas emissions reduction plan development project in China, with the Center for Climate Strategies (CCS), preparation of a series of articles and Working Papers for the Energy, Governance, and Security Center of Hanyang University, Republic of Korea.

Other recent domestic (United States) work has included:

- Working with a team from the Center for Climate Strategies to help update a Climate Action Plan for the state of Minnesota.

- Preparation of a screening curve and database of emissions reduction options in the residential, commercial, and industrial sectors in the State of Oregon (with the Center for Climate Strategies).
- Contributing to an evaluation of the factors driving the differences between US Department of Energy Annual Energy Outlook forecasts of greenhouse gas emissions in recent years (with the Center for Climate Strategies).
- Evaluating greenhouse gas emissions reduction options for the Southern California Association of Governments (with the Center for Climate Strategies).
- Work on a national study of the potential of climate mitigation actions to reduce greenhouse gas emissions, and the employment and economic impacts of those actions (with the Center for Climate Strategies).
- Preparation of a review of potential nationally appropriate climate mitigation actions for U.S. Environmental Protection Agency, International Capacity Building Branch (working with the Stockholm Environment Institute—United States).
- Preparing an analysis of climate change mitigation potential for the Southern US states for the Southern Governors' Association (with the Center for Climate Strategies).
- Assisting Climate Change Advisory Groups in the Midwest (for the Midwestern Governors' Association) and the State of Washington (with the Stockholm Environment Institute—United States and the Center for Climate Strategies).
- Reviewing similar work in Iowa, Michigan, Minnesota, and Arkansas, and in related work for the Southern Governors Association, working with the Center for Climate Strategies.
- Assisting Climate Change Advisory Groups in Washington, North Carolina, Montana, Florida, Arizona and New Mexico to develop policies to reduce greenhouse gas emissions in their states.
- Providing input to evaluation of Gas DSM possibilities in Nevada, working with Synapse Energy Economics.
- Providing review and analysis of the impacts of a Renewable Portfolio Standard in New Jersey.
- Preparation of studies of achievable and/or technical energy efficiency potential in Utah, the Western US, the Pacific Northwest, and Oregon, and reviewing and commenting on integrated resource planning and demand-side management (IRP and DSM) issues in Utah.
- Evaluation of current and future sources of oil pollutant emissions to the San Francisco Bay.
- Assisting a US gas utility in preparing and defending an Integrated Resource Plan filing, a Demand-side management filing, and in providing commentary (for the gas utility) on electric utility Integrated Resource Plans and DSM plans in the same jurisdiction.

Other recent international work has included:

- Helping to train North Korean specialists in building energy efficiency methods and technologies as a part of Nautilus Institutes' "DPRK Building Energy Efficiency" project.
- Serving on an "Energy Experts Advisory Council" for the United Nations Development Programme's Greater Tumen Initiative.
- Analysis of the energy sector in North Korea, and assessment of energy efficiency and other options for international engagement with North Korea through energy sector cooperation in a series of projects (1994 to present).

- Preparation of an "Energy Independent Village Scoping Study" proposing a set of energy engagement activities in North Korea to be pursued by the Republic of Korea and other international partners.
- Reviews of numerous articles on energy security, energy planning, nuclear energy development, and climate change issues for *Energy Policy* and other journals.
- Training and working with a group of Asian energy researchers from a number of countries to develop and evaluate the energy security implications of different energy and nuclear energy paths for the countries of that region (2000 to present).
- Working with a group of Asian researchers to develop and evaluate scenarios of regional nuclear fuel cycle cooperation in East Asia, including evaluating the relative radiological risks of different spent fuel management approaches in the major nuclear energy-using countries of the region (2006 to present).
- Work for the Stockholm Environment Institute on analytical activities in support of the activities of the ClimateWorks Foundation.
- Preparation of a report for the US Environmental Protection Agency on Nationally Appropriate Mitigation Actions (with Stockholm Environment Institute)
- Reviewing regional consultant reports for the National Energy Efficiency Program of Saudi Arabia as a contractor to the United Nations Department of Economic and Social Affairs.
- Evaluation of a United National Development Programme/Global Environment Facility project on energy-efficient refrigeration in China.
- Preparation of a document on multi-disciplinary costs and benefits associated with international electricity grid interconnections.
- Evaluation of emerging DSM technologies for Enbridge Gas Distribution company of Ontario.
- Work with a group of in-country engineers on a United Nations Development Programme project to prepare an energy efficiency assessment for the country of Syria.
- Assembly of a regional workshop and report on the environmental impacts of power grid integration in Northeast Asia.
- Assisting Egyptian electric sector authorities in developing a framework for DSM and IRP in Egypt.
- Development of "low-carbon" scenarios of electricity sector development in Japan,
- Preparation of a database of the technical, economic and environmental attributes of energy technologies.
- Assisting government organizations in Saudi Arabia with electricity IRP for the United Nations Development program.
- Updating and expanding an energy/environmental planning software tool.
- Evaluation of set of six United Nations Development Programme air pollution control projects in China/
- Preparation of a manual for assembling inventories of trans-boundary air pollutants for use in Northeast Asia.
- Establishing a rural renewable electrification pilot system and directing and synthesizing the results of a rural energy survey in North Korea (for Nautilus Institute).
- Assisting government organizations in Syria with electricity Integrated Resource Planning (for UNDP).

- Delivering a USAID-sponsored course on IRP and acting as a Resource Person in a related UN-sponsored course.
- Preparation of a study on IRP for the United Nations.
- Preparation of an environmental manual to accompany a database of emission coefficients.
- Provision of training in energy and environmental planning for the governments of Namibia and Bangladesh (funded by UNDP)
- Preparation of an assessment of the technical alternatives for reducing acid gas emissions in Northeast Asia and an evaluation of the global dimensions of growth in energy use Northeast Asia.
- Preparation of a summary of industrial demand-side management options for developing countries.
- Review of a document on forestry and agricultural-sector greenhouse gas mitigation options.
- Preparation of a review document on the technical, economic, environmental, and social considerations in selecting between alternative approaches for rural electrification.
- Preparation of an analytical framework for reviewing the basis for energy security choices in Japan.
- Analysis to estimate current and future inputs of oily pollutants to the Sea of Japan.
- Provision of technical assistance on a greenhouse gas mitigation assessment study in Ecuador (for the United Nations Environment Programme).
- Preparation of a framework for evaluation of the greenhouse gas emissions from proposed energy facilities involved in Global Environment Fund projects (for the World Bank)
- Training of staff from Philippine Non-Governmental Organizations in the use of DSM Planning tools and techniques.
- Preparation of informational materials on climate change for an United Nations agency (the Information Unit on Climate Change).
- Providing training programs for energy/environment resource planning in the Philippines (three workshops that included trainees from Thailand and other south-east Asian nations), Malaysia (for a Regional UN Agency) Costa Rica, Italy, and other nations in energy/environment scenario modeling.
- Preparation of guidelines for the assessment of measures for reducing greenhouse gas emissions.
- Assisting the government of Nigeria in preparing a national greenhouse gas inventory.
- Preparation of a synthesis document on sea level rise and climate change (including impacts, vulnerability assessments, and policy responses) for the UN-ESCAP (Asia) program.

1987 - 1991: Tellus Institute (formerly ESRG). Research Associate. Involved in projects in international resource and development planning, including performing training in and applying energy/environment planning software in Central and South America (Ecuador, Costa Rica). Responsible for assembling a database system to account for and project anthropogenic greenhouse gas emissions. Also involved in programming and compiling an international Environmental Database of pollutant emission factors. Worked on projects in domestic (US) electric utility planning cases in Maine, Vermont, Ohio, the District of Columbia, and the Carolinas on topics that included elements of electricity demand forecasting, demand-side management for utilities, and the environmental impacts of electricity generation.

1984 - 1986: Research Assistant with The Western Consortium for the Health Professions on U.S. Environmental Protection Agency contract to investigate and develop methods for economic valuation of aquatic ecosystems.

1984 - 1985: Research Associate with Future Resources Associates, Inc. Berkeley, CA, on U.S. Department of Energy Contract to research on the conversion of microalgal biomass to ethanol.

1984 - 1987: Researcher at the Sanitary Engineering and Environmental Health Research Laboratory (SEEHRL), University of California/Berkeley, on a project to design, build, and test a device for capturing methane evolved from facultative (algal-bacterial) waste-treatment ponds, and on investigation of a system for producing fuel ethanol from algae.

1983: Senior Teaching Assistant, U.C./Berkeley, for Energy and Resources 100: Energy and Society.

1982 - 1983: Research Assistant on a U.S. Forest Service contract to develop a program to train Forest Service personnel in the use of forest residues for energy purposes.

1982: Summer Intern with the New and Renewable Energy Division of the World Bank, Washington, D.C. Worked on studies of wood-fueled electricity generation and mini-hydroelectric facilities for developing countries.

1981 - 1982: Research Assistant on a California Energy Commission contract to develop a computer-based profit-maximizing "biomass utilization model" for California.

1979 - 1981 Worked with Dr. William Sistrom at the University of Oregon on a microbiology project investigating hydrogen production from cellulose using a dual culture of anaerobic photosynthetic and cellulose-degrading bacteria.

Recent Energy/Environmental Research (Sole author, principal author, or major co-author, except as noted)

January, 2015 "What Could an "Asian Super-grid" Mean for Northeast Asia?", article for Hanyang University Energy Security and Governance (EGS) Center's Monthly Online *Monitor* (forthcoming).

December, 2014 "The DPRK as a Participant in Northeast Asia Regional Energy Cooperation: Benefits and Challenges", article for Hanyang University Energy Security and Governance (EGS) Center's Monthly Online *Monitor* (Volume 2, #10).

December, 2014 *Rapid Relief and Reconstruction in a DPRK Humanitarian Energy Crisis,* Nautilus Institute NAPSnet Special Report.

November, 2014 "Private Purchases of Solar Photovoltaic Panels in the DPRK: Signs of Green Growth on the Way?", article for Hanyang University Energy Security and Governance (EGS) Center's Monthly Online *Monitor* (Volume 2, #9).

August, 2014 *Technical Working Paper on GHG Emissions, Scenarios and Mitigation Potentials in the Energy and Transport Sectors* (Viet Nam). Prepared for the Asian Development Bank (forthcoming).

June, 2014 — *Green Growth Energy Planning: A Guidebook for Green Energy Planning and Mitigation Assessment*, prepared for the Global Green Growth Institute (GGGI) (forthcoming).

May, 2014 — *Illustrative Assessment of the Risk of Radiological Release from an Accident at the DPRK LWR at Yongbyon*, Nautilus Institute NAPSnet Special Report.

May, 2014 — *Energy Needs in the DPRK, and Opportunities for Collaboration on Energy Sector Engagement and Redevelopment*, prepared as a Working Paper for the Energy, Governance and Security Center of Hanyang University, Republic of Korea (EGS Working Paper 2014-05).

May, 2014 — *Supplying Energy Needs for the DPRK's Special Economic Zones and Special Administrative Regions: Electricity Infrastructure Requirements*, prepared as a Working Paper for the Energy, Governance and Security Center of Hanyang University, Republic of Korea (EGS Working Paper 2014-04).

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October 1988: *Toward a Conservation/Load Management Power Plant for the Centerior Energy Corporation Service Area*. Report to the Ohio Office of Consumer's Council, Dockets No. 88-170, 88-171. ESRG Study No. 88-038D. Co-author.

April 1988: *An Analysis of the Employment and Environmental Effects of Central Maine Power Company's Proposed Purchase of Power from Hydro-Quebec*. Report to Maine Off. of the Public Advocate, Docket No. 87-268. ESRG Study No. 87-030. Co-author.

April 1988: *An Evaluation of Central Maine Power Company's Proposed Purchase of Power from Hydro-Quebec*. Report to the Maine Public Utilities Commission Staff, Docket No. 87-268. ESRG Study No. 87-030. Co-author.

Other Energy/Environment-Related Publications

February 1989: Von Hippel, D.F., and W.J. Oswald (1988), *The Effect of Crib Heating on Gas Production in a Facultative Waste-Treatment Pond.* Report to the University-wide Energy Research Group of the University of California.

November 1987: *An Analysis of an Ethanol-Producing Solar Bioconversion System Using the Microalga Dunaliella as the Biomass Crop* (Doctoral Dissertation).

October 1986: Horne, A., J. Harte, and D.F. Von Hippel, "The Hysteresis Effect in the Recovery of Damaged Aquatic Ecosystems: an Ecological Phenomenon with Policy Implications", and Harte, J., A. Horne, and D.F. Von Hippel, "Ecotoxicology and Benefit-Cost Analysis: The Role of Error Propagation". Both in *Economic Valuation of Aquatic Ecosystems Final Report to the U.S. EPA.*

May 1985: Von Hippel, D.F., G.P. Morris, and W.J. Oswald, *Production of Ethanol From Microalgal Biomass: Fermentation of Glycerol from Dunaliella.* Report to the Small Business Innovation Research Program, United States Department of Energy. 85 pp.

1985: Von Hippel, D.F., and W.J. Oswald, *Collection of Methane from Facultative Waste-Treatment Ponds.* Report to the Univ. of Cal. Appropriate Tech. Program

June 1983: *Soil Quality Impacts of Intensive Biomass Utilization* (Master's Thesis).

June 1982: Morris, G., D. Von Hippel, and S. Maves, *CALBUM: The California Biomass Utilization Model.* Report to the California Energy Commission.

June 1981: *Investigations into the Bioconversion of Cellulose* (Master's Thesis).

June 1980: *Microbial Energy Conversion: Processes, Problems, and Prospects* (Senior Thesis).

Testimony and Research Support for Tellus/ESRG Testimony

Agency	Case or Docket No.	Date	Topic
The Gas Company of Hawaii	Not Established (Tellus 93-271)	1996 and 1997	Demand-Side Management Programs
The Gas Company of Hawaii	94-0011, -0206 (Tellus 94-145)	Jan. 1995	Electric Utility Demand-Side Management
The Gas Company of Hawaii	7258, 7259 (Tellus 94-020)	Sept./Oct. 1994	Electric Utility Integrated Resource Planning: Supply, Integration, Externalities, DSM Issues
The Gas Company of Hawaii and BHP-Petroleum Americas 93-170)	7257 (Tellus 93-144, 94,070)	January 1994	Electric Utility Integrated Resource Planning: Supply, Integration, Externalities Issues
The Gas Company of Hawaii	7261 (Tellus 92-181)	May 1993	Integrated Resource Planning
District of Columbia Office of People's Council	877 (ESRG 88-128)	February 1989	Demand-Side Management
Ohio Office of Consumers Council	88-170, 88-171 (ESRG 88-38)	October 1988	Electricity Demand Forecasts, Demand-Side Management
Vermont Department of Public Service	5270 (ESRG 88-18)	July 1988	Demand-Side Management
Maine Public Utilities Commission	87-268 (ESRG 87-30)	April 1988	Electricity and Wood Demand Forecasts
Maine Office of the Public Advocate	87-268 (ESRG 87-68)	April 1988	Environmental Impacts of Electricity Supply Options

Honors and Awards

Dean's List (1979-1981), Phi Beta Kappa (1981), Earle C. Anthony Fellowship (1981-1982), University of California Regent's Fellowship (1982-1983).

Memberships

Association of Energy Engineers
American Association for the Advancement of Science

Katherine Johnson
1033 Lindfield Drive, Frederick, MD 21702
301.461.4865, kjohnson@johnsonconsults.com

SUMMARY

Dr. Katherine Johnson is President of Johnson Consulting Group, a certified woman-owned consulting firm specializing in the energy efficiency field. For 23 years, Dr. Johnson has directed complex, large-scale market research studies on energy efficiency evaluation and has completed more than 200 program evaluations for energy efficiency programs targeting all customer sectors.

EXPERIENCE

President, Johnson Consulting Group, Frederick, MD: 2008 -: A woman-owned strategic consulting headquartered in Suburban Washington D.C. that is a Certified Women's Business Enterprise.

- **Arkansas Public Service Commission: Independent Evaluation Monitor (IEM):** For the past four years, Dr. Johnson has been working with the Parties Working Collaboratively (PWC) to help Arkansas inform, direct, and work towards consensus in achieving consistent reporting standards that conform to EM&V "Best Practices" for both the EM&V Protocols and the Technical Reference Manual (TRM). She also has supervised the annual updating of Arkansas Technical Reference Manual, developed the current EM&V Protocols incorporated into Arkansas TRM V.3. Her responsibilities include reviewing the third-party implementation plans and reports, and preparing an Annual Report to the Arkansas Public Service Commission each June. She has testified before the Arkansas Public Service Commission as an expert in EM&V issues.
- **Arkansas Public Service Commission: Weatherization Collaborative Facilitation:** Dr. Johnson is leading the facilitation and development a new unified statewide approach to weatherization programs at the request of the Arkansas Public Service Commission.
- **Missouri Public Service Commission: EM&V Auditor:** Dr. Johnson is leading the team of EM&V Auditors to review EM&V plans and reports prepared by third-party evaluation firms to ensure that these reports reflect industry best practices and are consistent with industry approved protocols such as the IPMVP.
- **New York State Energy Research and Development Authority (NYSERDA):** Dr. Johnson conducted extensive research on current "Best Practices" in EM&V activities nationwide which led to the development of the first set of EM&V Protocols for the Arkansas Public Service Commission and the first ever set of Process Evaluation Protocols for New York State.
- **City Utilities of Springfield (MO):** Dr. Johnson led the first program portfolio evaluation of this municipal utility's residential and commercial program offerings. She led the process evaluations for all seven programs, including completing a non-participant baseline survey in which she compared customer attitudes regarding energy efficiency to similar surveys conducted for several other program evaluations. This provided an opportunity for utility benchmarking and comparison going forward. Dr. Johnson also directed the benchmarking of the municipal utility on key performance metrics to all of the other municipal utilities throughout the US. She directed the cost-benefit analysis for the program evaluation, supervised the impact evaluation, and developed case studies based on a desk review and program analysis for several C&I lighting installations.
- **Colorado Partners in Energy Savings Program:** Dr. Johnson has been leading the statewide evaluation of four gas utilities' coordinated energy efficiency portfolio named Partners in Energy Savings (PIES). In addition to supervising the overall program evaluation, she also led the process evaluations for each program year, including conducting a review of program materials, interviews with program staff, contractors and implementers and customer surveys.
- **Central Hudson Gas & Electric:** Led the process evaluations for both the Residential and Small Business Efficiency Programs, marketed under the SavingsCentral Brand. As a subcontractor to Applied Energy Group, Dr. Johnson is leading process evaluation activities which include identifying ways to help Central Hudson launch a successful trade-

ally program targeting both residential and commercial customers. She is also advising them on developing a geothermal heat pump component for its residential HVAC program.

- **Columbia Gas of Virginia:** Directing the development and execution of the utility's EM&V plans for its $8 million energy efficiency program portfolio. Dr. Johnson will be involved in supervising all aspects of the process and impact evaluation activities for this multi-year suite of programs.
- **Colorado Governor's Office:** Developed the market and technical potential for the Governor's Office to determine the feasibility of a statewide program for geothermal heat pumps. Also developed four stand-alone case studies featuring GHP installations costs, savings, and benefits for installations in four locations throughout Colorado.
- **Consumers Energy:** Developed the business case for a Hybrid Heat Pump Program as a way to help contractors compete more effectively in this challenging residential market.
- **Efficiency Maine's PACE Program:** As a subcontractor to Opinion Dynamics, Dr. Johnson completed an extensive literature review of financing program best practices to help guide the direction of the new PACE program. This literature review, supplemented by in-depth interviews with key program staff operating energy efficiency financing programs, provided additional insights to the program staff to ensure that this program would leverage industry best practices. This literature review included the key findings and recommendations from several of Dr. Johnson's previous program design and evaluation work in this field.
- **EmPower Maryland:** As part of the EmPower Program Evaluation team, Dr. Johnson conducted in-depth interviews with trade allies participating in EmPower's statewide Commercial & Industrial programs. She also completed in-depth interviews with program staff.
- **Energy Trust of Oregon:** Conducted in-depth interviews with key program vendors and customers in support of a process evaluation of its Production Efficiency Program. As a sub-contractor to Summit Blue, she also contributed the developing key findings and recommendations to enhance program delivery to hard-to-reach commercial and industrial customers in the Pacific Northwest.
- **Energy Trust of Oregon:** Conducted process evaluation of the ETO's Home Performance Program focusing on gathering feedback from staff, third-party implementers, contractors and customers regarding ways to enhance and streamline the overall program.
- **Energy Trust of Oregon:** Conducted a comprehensive process evaluation of Clean Energy Works Oregon (CEWO), one of the largest statewide energy efficiency financing programs initially funded by ARRA grants. The process evaluation by Dr. Johnson included conducting and analyzing seven separate customer surveys designed to gauge customer attitudes and experiences at each key decision-point throughout the program. She also conducted in-depth interviews with participating contractors, key stakeholders, lenders and program staff.
- **Hawaiian Electric Company:** Completed two program evaluations of HECO's innovative Solar Saver Program, a tarriffed on-bill-financing program modeled after the PAYS concept. She completed interviews with program staff, contractors, and customers as well as developed program process flows. She conducted a final program evaluation in 2010 for conclusion in the pilot program.
- **Home Performance with Energy Star:** Developed comprehensive compendium of current home performance programs including documenting marketing materials, metrics, and contractor outreach plans. Details are available at www.johnsonconsults.com/HPWEScompendium2008.html.
- **Idaho Power Company:** Conducted two comprehensive process evaluations of Idaho Power's two weatherization programs: Weatherization Assistance for Qualifying Customers Program which delivers services via CAP agencies, and Weatherization Solutions Program which provides services to customers who do not qualify for low-income assistance. She will be completing two additional process evaluations for Idaho Power's Shade Tree and Home Energy Audit Programs in 2014.
- **Local Government Partnership Initiative:** As a subcontractor to Summit Blue, Dr. Johnson completed in-depth executive level interviews with key decision makers on California Community College Campuses as part of the Net to Gross Assessment of Free Ridership. She also prepared 10 case studies on the participating campuses and identified the barriers to installing energy efficiency measures as part of this project.
- **MASS Save:** Completed an independent review and analysis of the major HP software packages currently being used or under consideration in Massachusetts for its MASS Save program. Provided recommendations on the best ways the

state could develop a common software approach which would both meet the needs of the Program Administrators (PAs) and the HP contractors looking to expand their business opportunities.

- **Northern California Municipal Power Authority:** Led the process evaluation activities for 12 municipal utilities in Northern California. As part of the Summit Blue team, Dr. Johnson developed the process evaluation plans and completed evaluations to document program operations and areas for improvement in residential, commercial, and institutional offerings. Her clients ranged from small municipal utilities such as Lompoc to Silicon Valley Power.
- **Ontario Hydro:** Completed two process evaluations and program logic models for Ontario Hydro's award-winning "Double Return" Program. Dr. Johnson completed in-depth process evaluations of both program years, talking with program staff, contractors, and industrial decision-makers as part of her subcontract with Summit Blue.
- **PECO:** Conducted process and impact evaluations of PECO's Low-Income Energy Assistance Program (LEEP) that relies on delivering services via both private contractors and CAP agencies to meet specific utility goals. Led the process evaluations from 2011-2013. She also led the process and impact evaluations of PECO's Smart Home Rebate Program, which was one of the largest appliance rebate programs in the country. She led these activities as a subcontractor to Navigant Consulting.
- **Touchstone Energy:** Dr. Johnson is an instructor for Touchstone Energy's MSR PRO Class. This one-day class focused on teaching electricity basics to CSRs and other cooperative member staff. She conducted workshops for co-ops in Arizona, Alabama, Michigan, and Pennsylvania (2009).
- **Washington Gas Light:** Developed the three year EM&V Plans for their energy efficiency program portfolio, which includes a Home Performance Program. Will be leading the process and impact evaluations for the utility for the next three years.
- **Western Area Power Administration:** Johnson Consulting Group continues to support Western Area Power Administration and its members in providing technically-oriented workshops designed to educate utility staff. During 2009, JCG completed workshops on heat pump technologies and motors and conducted additional workshops on water heating technologies in 2010.

Principal, KJ Consulting, Frederick, MD (1997-2006): A woman-owned marketing and management firm headquartered in Metropolitan Washington, D.C.

- **Consortium for Energy Efficiency:** As lead contractor, Dr. Johnson provided assistance in refining and deploying EPA's Energy Star Purchasing Tool Kit targeting state and local government procurement officials. She also wrote case studies highlighting effective strategies used by municipal governments to adopt energy efficient equipment.
- **Colorado Springs Utilities:** Completed an economic, market, and technical potential study for this municipal utility to determine the feasibility of developing a geothermal heat pump incentive program targeting residential and commercial customers. This work included conducting economic tests to quantify the benefits to the customer and the utility from offering this program, as well as to determine the current competitive market conditions.
- **Delta-Montrose Electric Association:** Completed a comprehensive market assessment and literature review of lighting trends in the residential market. Project included developing a financial analysis of energy efficient lighting for residential applications that expanded to small commercial applications in 2006.
- **Department of Energy:** Assisted in a comprehensive analysis of the Commercial Building Sector, identifying key trends in market development, consumer attitudes and behaviors that will influence how commercial buildings operate. This groundbreaking study identified likely effects that improvements in communications, technology, and materials will on how various commercial segments use commercial building space.
- **Edison Electric Institute**: Provided EEI with strategies for new product and service development. She developed affinity-marketing program for vendors specializing in residential and small commercial markets and led development of their marketing plan.
- **PG&E Motors and Food Service Programs:** Conducted two separate market research studies focusing on the barriers to market transformation in these critical commercial markets. Her work included conducting both primary and secondary research and conducting a number of in-depth interviews with key stakeholders, customers, and decision-makers serving these markets.

Marketing and Finance Manager, **Geothermal Heat Pump Consortium, Inc., Washington, D.C. (1995-1996)**

- Managed marketing and financing initiatives for a $100 million six-year industry/government collaborative to increase installations of an alternative energy technology.
- Worked with 120 member utilities to develop innovative marketing and financing strategies to promote geothermal systems. Directed $3.2 million in marketing and financing projects at member utilities, including a $750,000 national awareness campaign.
- Identified and promoted alternative financing options to utilities, lenders, governmental agencies, and trade associations; facilitated development of partnerships between utilities and national financing organizations.

Associate, Barakat & Chamberlin, Washington D.C. (1993-1995)

Katherine was Team Leader for consulting engagements for investor-owned utilities and provided strategic recommendations for program improvement, assisted in new product development, market potential, and competitive assessment studies. She was Project Manager for engagements targeting the residential and commercial totaling more than $1 million. Projects included the following:

- **Consolidated Edison:** Led the evaluation activities of this comprehensive, three-year program analysis of Consolidated Edison's Low-Income Energy Efficiency Program. Her work included conducting focus groups with landlords, building owners, and supervising the implementation of tenant questionnaires. Her analysis identified new ways to deliver effective customer education and increase measure persistence among participating customers.
- **Delmarva Power:** Was on-site project manager for eight program evaluations and responsible for questionnaire development, design and analysis for commercial, industrial and residential energy conservation programs. She prepared summary reports and provided recommendations to company management.
- **New England Electric System:** Was project manager and key researcher on projects regarding adoption rates and trends for energy efficient motors among commercial and industrial customers. Responsibilities included conducting key interviews, program evaluation, interview design and analysis.
- **Potomac Edison Electric Corporation:** Areas of responsibilities included questionnaire development and analysis of success rates of various residential energy conservation programs; also identified key barriers to technology adoption, determined measure persistence and recommended strategies for future program design, including an analysis of the most effective technologies to include in future programs.

Research Director, The Corps Group, St. Louis, MO. (1992-1993)

- Co-authored a white paper describing the key issues facing the telecommunications and electric utility industries after deregulation.
- Conducted focus groups with customers and staff members to determine the appropriate strategies to install customer-friendly automated voice-response systems. Designed customer satisfaction surveys and tracked long-term performance of this voice-response system. Succeeded in increasing customer satisfaction 95% in just three months.
- Developed and implemented complex sampling designs and determined appropriate segmentation studies for utility marketing programs in Northern California.

Project Manager, Aragon Consulting Group, St. Louis, MO. (1991-1992)

- Improved customer satisfaction at a major utility as part of a $3 million research study.
- Performed in-depth analysis of energy efficiency products and services for a major utility company. Identified market potential and sales revenue projections for residential, commercial, and industrial products and services.
- Supervised ongoing marketing tracking studies, mystery shopping, and consumer panels for Fortune 500 firms specializing in the residential market.

EDUCATION

Doctor of Business Administration (July 2010)
University of Southern Queensland, Toowoomba, Australia

Masters of Business Administration (Dean's List: 1990)
Rollins College, Roy E. Crummer Graduate School of Business, Winter Park, FL

Bachelor of Science in Business and Journalism (Dean's List: 1983)
Indiana University School of Business, Bloomington, IN

Selected Conference Papers and Proceedings

Johnson, K. 2014. *A Modern Twist on an Old Classic: New Program Designs for Low and Middle Income Residential Weatherization Programs*, ACEEE Summer Study in Buildings, Asilomar, CA August, Forthcoming

Johnson, K, & Klucher, M. 2014. *All Together Now! How Collaboration Works in Arkansas*, IEPPEC Conference, September, Berlin, Germany, Forthcoming

Johnson, K., Spector, M. Griffin, C. & Smith, P. 2011, *Getting out of the Starting Blocks: Challenges with PY1 Portfolio Evaluations*, IEPEC, Boston.

Johnson, K., *Archer*, B. & Griffin, C. 2011. Soup to Nuts: Building *EM&V into Program Design*, Interactive Conference Session with Griffin, C & Archer, B. 21st Association of Energy Services

Johnson, K. 2010. *Geo Heat Pumps: Leading Energy Utility Marketing Programs. Fifth Edition*, Johnson Consulting Group, Frederick, MD.

Johnson, K., Willoughby, G., Shimoda, W. & Volker, 2010. *Lessons Learned from the Field: Key Strategies for Implementing Successful On-the-bill Financing Programs*, IEPEC Conference, Paris, France. June.

Johnson, K., Hendershot, D., Naleway, R., Pope, M., Willoughby, G. & Webster, E. 2010. ***Staying Out of Hot Water,*** ACEEE Summer Study, Pacific Grove, CA

Reynolds, D., Johnson, K. & Cullen, G. 2009. *E, M &V Best Practices: Lessons Learned from California Municipal Utilities*, Association of Energy Services Professionals Annual Conference, San Diego, CA. 2009

Reed, J. & Johnson, K. 2004, *"Who Plays and Who Decides: The Structure and Operation of the Commercial Building Market*, A Report Prepared for the U. S. Department of Energy, Office of Building Technology, State and Community Programs, Washington, D.C. March

White Papers

Geothermal Heat Pumps: The "Killer Utility App" for the 21st Century, *2012:* www.johnsonconsults.com/presentations/GHP White Paper 2012.pdf

Strategies and Initiatives to Proactively Respond to a New Customer Demographic. *plus referenced utility snapshots for At-Risk Customers:* www.johnsonconsults.com/presentations/White Paper Strategies at Risk Customer EEI 4-22-2009.pdf

- DTE: www.johnsonconsults.com/presentations/Snapshot DTEEnergy2009.pdf
- We Energies: www.johnsonconsults.com/presentations/Snapshot WEEnergies2009.pdf
- Integrys: www.johnsonconsults.com/presentations/Snapshot Integrys2009.pdf
- KCP&L: www.johnsonconsults.com/presentations/Snapshot KCPL2009.pdf

Breaking Down the Barriers to Efficiency Improvements in the Rental Housing Market: One Utility's Approach, given at the 2008 ACEEE Summer Study on Energy Efficiency in Buildings: www.johnsonconsults.com/Breaking Down Barriers ACEEE 2008.pdf

Best Practices and Lessons Learned from EPA/DOE's Home Performance with ENERGY STAR Program, given at the 2008 ACEEE Summer Study on Energy Efficiency in Buildings: www.johnsonconsults.com/case_Best Practices ACEEE 2008.pdf

*Teaching Customers to Value Energy Efficiency: A Comparison of CFL Fund Raisers***,** given at the 2008 ACEEE Summer Study on Energy Efficiency in Buildings: www.johnsonconsults.com/case_Teaching Customers.pdf

The Future of Residential Electric Water Heating is Off-Peak: www.johnsonconsults.com/case_Future.pdf

Fundamentals of Linking Demand Side Management Strategies with Program Implementation Tactics: www.johnsonconsults.com/case_fundamentals.pdf

Light Bulb Fund Raiser Leverages Community Groups in Energy Efficiency and Peak Shaving Initiative: www.johnsonconsults.com/case_eceee.pdf

Geri Nicholson

Selected Experience

Ms. Nicholson is founder and president of Sage Energy Consulting, LLC (Sage Energy) – an energy efficiency and renewable energy firm specializing in solutions that substantially improve the environment and the bottom line for its clients. She has twenty years of comprehensive experience in the fields of energy efficiency, renewable energy, resource economics, global climate change, and sustainability. Since 1998, she has advised Maryland Governors, legislators, department secretaries and energy office directors on energy, sustainability and climate change technical and policy issues.

Energy Efficiency/ Green Building

Manage preliminary energy and water audits, investment grade analyses, development of audit reports with energy conservation measures (ECMs), incentives and financing mechanisms for plan implementation, project timelines and budgets. Responsible for client development, proposal drafting, project timelines and budget development. Handle the client relationship from sales through assessment and project implementation to marketing of green successes.

Established the Maryland Energy Administration (MEA) as the lead state agency in commercial high-performance, energy efficient, green building development. Oversaw Maryland's Commercial Green Buildings Tax Credit and HERS Programs. Managed Maryland's Energy Star Program. Represented MEA on the Green Buildings Task Force and chaired the Task Force Energy Committee. Participated in drafting Executive Orders on green building and energy efficiency.

Oversaw Maryland's industrial, commercial, residential and state government efficiency programs. Co-chaired the Governor's Energy Efficiency Task Force of representatives from the state legislature, industry, utilities and energy-related nonprofits. Managed scoping and development of the task force report consisting of development of a Maryland energy baseline, recommendations for program design, and a budget for energy efficiency. Provided programmatic content and analysis.

Renewable Energy

Assist commercial clients in navigating the available federal, state and local grants, tax credits, other incentive programs and financing mechanisms to reduce upfront and ongoing project costs. Advise clients on project financing models, and government programs and policies to promote clients' project goals.

Managed Maryland's renewable energy programs. Expanded the programmatic base of MEA into wind and landfill gas-to-energy sectors. Developed an innovative package of policies and incentives to achieve the construction of permitted wind farms in western Maryland, and promote the wind industry and green power markets in Maryland generally. Worked closely with generators, suppliers, and the renewable energy industry to produce an educational booklet and marketing material for renewable energy in Maryland. Established state policy on cost-effective distributed electricity generation project development.

Utilities Procurement

As part of a comprehensive energy and water conservation plan, provide cost-effective procurement of utilities, from bill analysis and utility rate analysis through competitive procurement. Assisted the State of Maryland in their reverse auction for the procurement of electricity supply, overseeing the reconciliation of thousands of accounts and performing rate/tariff verification.

Actively participated in the Maryland state electricity procurement process, especially as it related to the competitive acquisition of electricity generated from renewable resources – both commodity electricity and RECs. Advised state and municipal governments on implementing innovative procurement mechanisms for cost-effective wind energy purchases and to promote the development of wind energy projects.

Climate Change Policy and Technical Analysis

Developed various aspects of a "GreenMap" to provide guidance to Montgomery County in the implementation of the Climate Protection Plan. Provided technical and policy analysis on proposed County actions to reduce greenhouse gas emissions in the areas of energy use (renewables, residential, commercial, and transportation) and other sectors. This analysis included implementation recommendations to enhance program and overall policy goals.
Worked with the Maryland State government to calculate an environmental footprint (including, GHG inventory, and water usage baseline and recommended "next steps") for all State agencies and the university system. Assisted Montgomery County, Maryland in the development of their climate action plan implementation.

Consultant to the U.S. Green Building Council (USGBC) on its greenhouse gas inventory development. Advised USGBC as it developed its climate change/climate offset program. Provided technical and outreach support to the U.S. Environmental Protection Agency for domestic and global climate change in the areas of green building, renewable energy, energy efficiency and energy management.

Established Maryland's climate change program and institutionalized the Maryland Energy Administration as the State's lead agency on voluntary greenhouse gas emissions reduction policy issues. Coordinated State greenhouse gas emissions reduction efforts, management of an impacts analysis, a climate change action plan of cost-effective, no-regrets actions and a Cabinet-level and staff-level working group.

Provided technical expertise on the feasibility and benefits of carbon sequestration in Maryland. Analyzed carbon pools and fluxes associated with the U.S. forest products sector. Forecast the effects of various recycling scenarios on future carbon sequestration. Developed a comprehensive model to estimate current, and project future, stocks and flows of carbon in U.S. forest products. This methodology is currently being used in the California Climate Action Registry Protocols.

Energy Policy Development And Analysis

Provided policy and technical consulting to the Maryland Energy Administration (MEA), including research, analysis and advising on: electricity market structures; competitive green power and REC markets; renewable portfolio standard eligible facility definitions; renewable energy zones and offshore wind; and, offshore wind incentive policies. Technical

and policy analyses enabled the MEA to respond to requests from the legislature in a timely and thorough manner, as well as provide guidance on the policy and market implications of proposed legislation.

Analyzed the implications of Renewable Portfolio Standard (RPS) legislation in Maryland, Pennsylvania and the District of Columbia. Drafted Maryland RPS legislation. Assisted in the drafting and analysis of RPS legislation in Pennsylvania, Virginia and the District of Columbia. Assisted the DC Energy Office in drafting RPS regulations. Drafted Maryland renewable energy legislation such as net-metering and a production tax credit.

Advised the Maryland Governor and the Legislature on energy issues, including: economic and policy implications of a RPS in Maryland; a commercial green buildings tax credit; a green standard for State buildings; and a public benefits fund for energy efficiency projects. Also advised the Governor and Legislature on the state-level implications of federal legislation and energy market trends. Collaboratively drafted the National Governors' Association Climate Change Policy and Energy Policy.

Managed a state energy office of twenty employees and a budget of over $14 million, with an energy project fund of over $10 million. Represented Maryland's state energy office in budget hearings, and wrote testimony and testified on behalf of the Governor's Office before the Maryland General Assembly on energy-related matters. Negotiated passage of agency and administration energy efficiency and renewable energy legislation. Prepared testimony for State legislators and remarks for the Governor on renewable energy, green building, deregulation, and energy efficiency issues.

Process and Performance Evaluation

Currently evaluate public and private sector energy conservation and renewable energy programs and projects to ensure cost-effective program implementation and identify process improvements for streamlined delivery and improved results.

Led the design and implementation of a process and market awareness assessment of MEA's EmPOWER Maryland renewable energy, commercial, and energy finances programs. Provided actionable evaluation recommendations based on in-depth analysis at the project-level that led to greater efficiency and more effective delivery of programs. Recommendations were also made to improve program delivery to better meet EmPOWER Maryland goals including: increased energy efficiency savings and renewable energy production, more efficient economic development, and additional green jobs in the State, as well as improvements in the marketing and outreach aspects of the programs.

Evaluate existing efforts, and oversee the development of media, public, and government relations strategies and collateral material relating to: greening of corporate portfolios; reducing carbon footprints; renewable energy projects; and government energy program outreach.

Selected Publications and Reports

Maryland Offshore Wind Report: An Economic Analysis of Adding Offshore Wind Energy to Maryland's Generation Mix, prepared for The National Wildlife Federation, March, 2011 (with La Capra Associates).

Next Generation Technologies Barriers and Industry Recommendations for Commercial Buildings, prepared for The Zero Energy Commercial Buildings Consortium, March, 2011 (with Lee DeBaillie, Energy Center of Wisconsin).

Montgomery County Maryland Green Map: Implementation Plan for the Climate Protection Plan, prepared in support of the Montgomery County Sustainability Working Group, March, 2010 (with SAIC).

Greenhouse Gas Reduction Strategies in Maryland, Volumes I and II, prepared for the U.S. Environmental Protection Agency, March 2004 (with Christina Mudd).

Maryland Energy Conservation and Efficiency Baseline: Report of the Governor's Task Force on Energy Conservation and Efficiency, December 2001 (with Christina Mudd, Steve Estomin and Michael Lee of Exeter Associates).

The Feasibility of a Renewable Portfolio Standard in Maryland, January 2000 (with Steve Estomin, Exeter Associates).

Nicholson, Geraldine. P.D. Mountain and H. Wattenbach. (2000). *Educating the Consumer About Green Power: Maryland's Efforts to Evaluate Renewable Energy for the Public.* Presented at the AWMA's 93rd Annual Conference June 18-22, Salt Lake City, Utah. Annapolis, MD: Maryland Department of Natural Resources, Power Plant Research Program.

Chronology

Sage Energy Consulting, LLC, President, present
Maryland Energy Administration, Deputy Director, Director, 2000-2004
Maryland Department of Natural Resources, Administrator of Economic Studies, Power Plant **Siting Division, 1998-2000**
National Oceanic and Atmospheric Administration, Coastal Services Center, Consultant, 1997-1998
University of Wisconsin -- Madison, Department of Botany, Fellow, 1996-1998
USDA Forest Service, Forest Product Laboratory, Economist, 1995-1996
University of Wisconsin – Madison, Department of Forestry, Research Assistant, 1993-1995
Institute for Policy Reform, Economist, 1992 and 1993

Education

Master of Science, Conservation Biology and Sustainable Development, Institute for Environmental Studies; University of Wisconsin, Madison, Wisconsin.

Bachelor of Arts, Economics/Biology (minor), The College of William and Mary, Williamsburg, Virginia. Dean's List student.

Gretchen Dolan
Research Analyst

Selected Experience

Gretchen Dolan, Research Analyst with Sage Energy, possesses 18 years of experience in energy and telecom research, market analysis, and project management, with a concentration in Maryland markets. Her work with Sage Energy also includes research on renewable energy and climate change initiatives, financing mechanisms for various municipal and state government projects, and market sector research in energy efficiency management and initiatives, especially with regard to the Maryland EmPOWER Programs.

Gretchen currently manages projects involving qualitative analysis and data collection. With expertise in competitive benchmarking research and analysis, her research and project management skills are invaluable in identifying process improvements to programs and projects to improve clients' ability to achieve their government sector goals or corporate mandates. In addition, she has practical paralegal skills that enhance her research and analysis. These skill sets are equally significant and important when delving into complex policy issues for clients.

Ms. Dolan has the following research and analysis, evaluation, benchmarking, and project management experience:

MARYLAND ENERGY POLICY RESEARCH AND ANALYSIS

- Provided evaluation and analysis of Maryland Energy Administration EmPOWER energy efficiency and renewable energy programs in light of program-specific goals and Maryland energy policies including: reductions in energy use state-wide and in state buildings, increases in renewable energy production in-state, and regulatory and programmatic barriers to program success:
    - MCEC – Finance (MHELP) – evaluated program design; led marketing materials review; conducted in depth interviews with contractors, program partners, and non-participating contractors to determine what was working well and what needed improvement; provided qualitative analysis based on interviews.
    - Jane E. Lawton Loan Program (JELLP) – Developed interview guides and conducted in depth interviews with participants and non-participants, Completed comprehensive review of all loan materials and provided qualitative analysis on recommendations overall for the program.
    - Maryland Energy Administration's Clean Energy Economic Development Initiative (CEEDI) - Reviewed program documents and data, directed survey design review, conducted in depth interviews with all market actors, and provided analysis of responses to determine how well the program worked and investigated its ability to leverage funds; assessed marketing communications and strategies and provided recommendations on improvements; Provided qualitative analysis on program processes based on interview feedback.

BENCHMARKING AND EVALUATION

- Led market research effort on environmentally sustainable initiatives underway in several market sectors, such as healthcare, hospitality, and higher education, including developing program evaluation criteria and benchmarks, with emphasis on Maryland and the mid-Atlantic.
- Survey specialist in charge of operational sustainability survey design and implementation for the U.S. Green Building Council carbon neutrality and corporate sustainability planning data collection and analysis effort. Responsible for drafting interim reports.
- Developed methodology, identified key components, and performed competitive benchmarking analyses for pricing and product evaluation; performed demographic analysis for a wireless communications company.

MARYLAND PROJECT MANAGEMENT/COORDINATION

- Managed data collection, coordination and analysis for water and wastewater conservation project as part of the State Environmental Footprint. Interviewed state environmental coordinators to assess possible process improvements to implementing a more streamlined reporting process and ultimately a reduction in state agency water consumption. Assisted in drafting program recommendations for the Governor's Office.
- Managed the state agency procurement database for Maryland's competitive energy procurement. Reviewed and verified accuracy of existing state account lists, through comparison with utility and agency records, and recompiled tens of thousands of accounts in spreadsheets grouped specifically for this procurement.
- Provide on-site and report drafting support to staff engineer and senior staff for commercial energy and water audits, including research on regulations and incentives pertinent to project development and implementation.

MARKET RESEARCH AND ANALYSIS

- Researched existing and next generation technology in Combined Heat and Power, Multi-Building Systems, and Grid Integration for DOE's Net Zero Energy Commercial Building Consortium's next generation technologies inventory report. Assisted in drafting and editing report.
- Initiated and executed competitive, market and industry analyses for new and existing telecom products, providing executive management with strategy and market entry recommendations.

RELEVANT PARALEGAL STUDIES COURSEWORK

- Advanced Legal Research and Writing, including preparation of legal memoranda and case briefs, discovery and drafting Interrogatories, motions, and persuasive writing; Business Law; Legal Ethics; Case Analysis.

EDUCATION

Bachelor of Arts, Economics, University of Connecticut
Paralegal Studies Program Certificate (ABA Approved), Anne Arundel Community College

Michael A. Kenney
TRANSPORTATION AIR QUALITY SPECIALIST

Expertise

Transportation-related air quality assessment services. Also provides climate change and human health evaluations.

Experience

32 years - Private consulting and public regulatory agency

Education

BA / 1976 / Environmental Science / University of Maine

MS / 1979 / Environmental Engineering Sciences / University of Florida

Post-Graduate Studies / 1987-93 / Industrial Hygiene and Environmental Health / University of South Florida

Certifications / Registrations

1994 / Certified Hazardous Materials Manager, CHMM No. 5503

1995 / Qualified Environmental Professional, QEP No. 06930024

2003 / Certified Industrial Hygienist, CIH No. 8719

Biographical Summary

Mr. Kenney's responsibilities include project management as well as hands-on technical involvement with a variety of assignments associated with transportation-related air quality, greenhouse gas/climate change and haz. mat. issues. He also has considerable experience with regulatory agency coordination and environmental analyses. Project types include those which would result in improvements to roadways, airports, seaports, and military installations

Representative Projects

South Jersey Transportation Planning Organization (SJTPO) Regional Greenhouse Gas (GHG) Emissions Inventory. Involved in the preparation of the GHG emissions inventories for transportation-related sources (i.e., motor vehicles, aircraft, off-road equipment) for this region-wide assessment.

Puerto Rico Department of Highways & Transportation, Transportation Conformity Determination. Project manager for Transportation Conformity Determination for the San Juan Metropolitan Area Transportation Plan. Involved emission inventory and dispersion modeling of PM-10, development of mitigation measures and extensive agency coordination.

Federal Aviation Administration (FAA) Airport Air Quality Handbook. Project Manager for the development of this new resource designed to provide FAA staff, airports and other stakeholders with guidance on assessing aviation-related air quality. This includes (but is not limited to) emissions inventories, atmospheric dispersion modeling, mitigation measures, agency coordination and General/Transportation Conformity.

MDOT US 31, Allegon / Ottawa / Muskegon Counties, Michigan - Performed "CO hot-spot" air dispersion analyses for select worst case conditions along project corridor, presentation of results and preparation of technical memorandum. Also prepared Transportation Conformity supporting documents involving agency coordination, Transportation Plan and State Implementation Plan analyses, and affirmative conformity determination.

Paola Pringle
TRANSPORTATION AIR QUALITY SPECIALIST

Expertise

Air quality and noise analyses in support transportation improvement projects.

Experience

13 years - Regulatory/Consulting

Education

BS Environmental Engineering / MS Management

Biographical Summary

Mrs. Pringle predominately specializes in mobile source air quality assessments but also involved in air permitting and compliance, regulatory agency coordination, air emission inventories, and air dispersion modeling. Paola also has extensive experience with air quality tools/models such as: ROADMAP, CAL3QHC, CAL3QHCR, ISC/AERMOD, BPIP, AP-42, SCREEN3, INPUFF, MOBILE6.2, MOVES, EDMS, FDEP's EAOR, TRI-MEweb, e-GGRT, and TANKS programs. She has particular experience in assessing criterial pollutants and greenhouse gases and is among the first to successfully obtain the U.S. EPA specialty training for MOVES.

Representative Projects

South Jersey Transportation Planning Organization (SJTPO) Regional Greenhouse Gas (GHG) Emissions Inventory. Involved in the preparation of the GHG emissions inventories for transportation-related sources (i.e., motor vehicles, aircraft, off-road equipment) for this region-wide assessment.

Florida Department of Transportation (FDOT) Roadway Air and Noise Assessments. Task Manager and/or Technical Analysts for a wide assortment and large number of roadway projects including (but not limited to) Beckett Bridge (Pinellas County), Downtown Interchange (Hillsborough County), SR 858/SRA1A (Hallendale Beach Boulevard), SR 686 (East Bay Drive), SR 688 (Ulmerton Road), SR 45 (US 41), CR 296, SR 860 (Miami Gardens Drive), SR 699 (Blind Pass Road).

Federal Aviation Administration (FAA) Airport Air Quality Handbook. Involved in the development of this new resource designed to provide FAA staff, airports and other stakeholders with guidance on assessing aviation-related air quality. This includes (but is not limited to) emissions inventories, atmospheric dispersion modeling, mitigation measures, agency coordination and General/Transportation Conformity.

North Carolina Department of Transportation (NCDOT) Air and Noise Assessments. Technical analysts involved in the assessment of air and noise impacts associated with the US23/I-26, North and East Charlotte Outer Loops.

Attachment E. Price Proposal (Confidential Business Information)

Multi-Sector Approach to Reducing Greenhouse Gas Emission in the Metropolitan Washington Region

RFP #15-010

Labor Category	Staff Name	Loaded Hourly Rate	RFP Tasks														Total	
			1. Work Plan & Schedule		2. Meet with Sector Subgroups and Review Proposed Strategies		3. Presentation of GHG Reduction Strategies for Analysis to MSWG		4. Design & Analyze Selected Strategies		5. Prepare and Present Interim Technical Report		6. Explore GHG Goals and Targets in each Sector		7. Prepare & Present Final Technical Report			
			Hrs	Dollars	Hrs	Dollars	Hrs	Dollars	Hrs	Dollars	Hrs	Dollars	Hrs	Dollars	Hrs	Dollars	Hrs	Dollars
Principal Facilitator	Thomas Peterson	$150.05	8	$1,200.41	20	$3,001.03	16	$2,400.83	8	$1,200.41	18	$2,700.93	12	$1,800.62	20	$3,001.03	102	$ 15,305.26
Technical Manager	Stephen Roe	$114.89	12	$1,378.72	48	$ 5,514.89	16	$1,838.30	64	$7,353.19	10	$1,148.94	20	$2,297.87	16	$1,838.30	186	$ 21,370.20
Analyst/Project Mgr.	Scott Williamson	$64.75	32	$2,071.91	48	$3,107.86	16	$1,035.95	32	$2,071.91	16	$1,035.95	24	$1,553.93	24	$1,553.93	192	$ 12,431.45
Jr. Analyst/Contracts Admin.	Loretta Bauer	$49.51	24	$1,188.32	-	$ -	-	$ -	-	$ -	-	$ -	-	$ -	-	-	24	$ 1,188.32
Staff Analyst	Holly Lindquist	$53.87	-	$ -	68	$3,663.00	16	$ 861.88	80	$4,309.41	18	$ 969.62	32	$1,723.76	8	$ 430.94	222	$11,958.62
Jr. Analyst	Arianna Ugliano	$41.89	-	$ -	88	$3,686.31	24	$1,005.36	120	$5,026.79	20	$ 837.80	44	$1,843.15	28	$1,172.92	324	$ 13,572.32
Subtotal Labor			**76**	**$5,839.36**	**272**	**$18,973.09**	**88**	**$7,142.32**	**304**	**$19,961.70**	**82**	**$6,693.23**	**132**	**$9,219.34**	**96**	**$7,997.12**	**1,050**	**$ 75,826.16**
Other Direct Costs Subcontractors:																		
Cambridge Systematics	David Jackson	$192.36	4	$ 769.44	32	$ 6,155.52	24	$ 4,616.64	32	$ 6,155.52	28	$5,386.08	16	$ 3,077.76	16	$ 3,077.76	152	$ 29,238.72
	Jay Evans	$319.32	-	$ -	2	$ 638.64	2	$ 638.64	8	$ 2,554.56	4	$1,277.28	-	$ -	4	$ 1,277.28	20	$ 6,386.40
	Chris Porter	$231.93	-	$ -	4	$ 927.72	4	$ 927.72	8	$ 1,855.44	2	$ 463.86	2	$ 463.86	2	$ 463.86	22	$ 5,102.46
	Rich Denbow	$205.49	-	$ -	4	$ 821.96	12	$ 2,465.88	8	$ 1,643.92	16	$3,287.84	4	$ 821.96	4	$ 821.96	48	$ 9,863.52
	Suseel Indrakanti	$139.48	-	$ -	24	$ 3,347.52	8	$ 1,115.84	58	$ 8,089.84	4	$ 557.92	-	$ -	2	$ 278.96	96	$ 13,390.08
	David Kall	$151.25	-	$ -	8	$ 1,210.00	4	$ 605.00	32	$ 4,840.00	16	$2,420.00	-	$ -	-	$ -	60	$ 9,075.00
	Stacy Cook	$139.75	-	$ -	28	$ 3,913.00	4	$ 559.00	-	$ -	12	$1,677.00	32	$ 4,472.00	12	$ 1,677.00	88	$ 12,298.00
Independent Consultant	David von Hippel	$125.00	-	$ -	64	$ 8,000.00	10	$ 1,250.00	60	$ 7,500.00	8	$1,000.00	36	$ 4,500.00	8	$ 1,000.00	186	$ 23,250.00
Johnson Consulting Group	Katherine Johnson	$160.00	-	$ -	28	$ 4,480.00	6	$ 960.00	-	$ -	4	$ 640.00	28	$ 4,480.00	4	$ 640.00	70	$ 11,200.00
Sage Energy	Geri Nicholson	$220.00	-	$ -	-	$ -	-	$ -	16	$ 3,520.00	4	$ 880.00	-	$ -	-	$ -	20	$ 4,400.00
	Gretchen Dolan	$120.00	-	$ -	-	$ -	-	$ -	40	$ 4,800.00	8	$ 960.00	-	$ -	-	$ -	48	$ 5,760.00
	Laura Kossey	$ 80.00	-	$ -	-	$ -	-	$ -	60	$ 4,800.00	16	$1,280.00	-	$ -	-	$ -	76	$ 6,080.00
KB Environmental	Mike Kenney	$175.00	-	$ -	-	$ -	2	$ 350.00	38	$ 6,650.00	4	$ 700.00	4	$ 700.00	2	$ 350.00	50	$ 8,750.00
	Paola Pringle	$ 90.00	-	$ -	-	$ -	8	$ 720.00	160	$ 14,400.00	12	$1,080.00	24	$ 2,160.00	8	$ 720.00	212	$ 19,080.00
Subtotal Subcontractors			**4**	**$ 769.44**	**194**	**$ 29,494.36**	**84**	**$ 14,208.72**	**520**	**$ 66,809.28**	**138**	**$21,609.98**	**146**	**$20,675.58**	**62**	**$10,306.82**	**1,148**	**$ 163,874.18**
Reproduction				$ -		$ -		$ 100.00		$ -		$ 150.00		$ -		$ 150.00		$ 400.00
Travel				$ -		$ 660.50		$ 660.50		$ -		$ 660.50		$ -		$ 660.50		$ 2,642.00
Subtotal ODCs				**$ 769.44**		**$ 30,154.86**		**$ 14,969.22**		**$ 66,809.28**		**$ 22,420.48**		**$ 20,675.58**		**$11,117.32**		**$ 166,916.18**
G&A on ODCs	29.2%			**$ 224.75**		**$ 8,808.23**		**$ 4,372.51**		**$ 19,514.99**		**$ 6,549.02**		**$ 6,039.34**		**$ 3,247.37**		**$ 48,756.22**
GRAND TOTAL			**80**	**$6,833.56**	**466**	**$ 57,936.19**	**172**	**$ 26,484.04**	**824**	**$106,285.98**	**220**	**$ 35,662.74**	**278**	**$ 35,934.26**	**158**	**$22,361.81**	**2,198**	**$ 291,498.56**

Notes: CCS Project Management Hours are included in Task 1.
Travel covers one CCS Technical Manager travel costs to in-person meetings/presentations.

Attachment F. DBE Certification Letters

Maryland Department of Transportation
The Secretary's Office

Martin O'Malley
Governor

Anthony G. Brown
Lt. Governor

James T. Smith, Jr.
Secretary

November 13, 2014

KATHERINE JOHNSON
JOHNSON CONSULTING GROUP
1033 LINDFIELD DRIVE
FREDERICK, MD 21702

Dear KATHERINE JOHNSON (cert # 10-768):

We are pleased to inform you that your company has been found eligible to continue its certification as a Minority Business Enterprise (MBE), Disadvantaged Business Enterprise (DBE), Small Business Enterprise (SBE), and/or Airport Concessions Disadvantaged Business Enterprise (ACDBE) effective November 13, 2014.

Your firm remains certified for the services for which you have been approved and officially notified in writing. Your current certification status can be found in the Maryland Department of Transportation's (MDOT) Directory of Certified MBE/DBE/SBE/ACDBE Firms available online at http://mbe.mdot.state.md.us/directory. MDOT's online directory is the official record of your firm's certification status. It is important that you carefully review the accuracy of your listing in the Directory. If you have any questions about your firm's certification status, contact MDOT's Office of Minority Business Enterprise (OMBE) immediately at 410-865-1269 or 1-800-544-6056.

If you wish to expand the area(s) of work for which your firm is currently certified, you may request an Expansion of Services. The application for expansion of services can be found at http://www.mdot.maryland.gov/Office of Minority Business Enterprise/ExpansionCover.html Please submit your application request to:

Maryland Department of Transportation
Office of Minority Business Enterprise
7201 Corporate Center Drive
Hanover, MD 21076
410-865-1309 (fax) or mbe@mdot.state.md.us

Your firm must be recertified annually in order to maintain its certification. We will contact you when it is time to begin the next recertification process.

Sincerely,

Randy Reynolds
Director, Minority Business Enterprise

My telephone number is _____
Toll Free Number 1-888-713-1414 TTY Users Call Via MD Relay
7201 Corporate Center Drive, Hanover, Maryland 21076

Maryland Department of Transportation
The Secretary's Office

Martin O'Malley
Governor

Anthony G. Brown
Lt. Governor

James T. Smith, Jr.
Secretary

July 1, 2014

GERALDINE NICHOLSON
SAGE ENERGY CONSULTING, LLC
2820 CARROLLTON ROAD
ANNAPOLIS, MD 21403

Certification No. 13-400

Dear GERALDINE NICHOLSON:

We are pleased to inform you that your company has been found eligible to continue its certification as a Minority Business Enterprise (MBE), Disadvantaged Business Enterprise (DBE), Small Business Enterprise (SBE), and/or Airport Concessions Disadvantaged Business Enterprise (ACDBE) effective July 1, 2014.

Your firm remains certified for the services for which you have been approved and officially notified in writing. Your current certification status can be found in the Maryland Department of Transportation's (MDOT) Directory of Certified MBE/DBE/SBE/ACDBE Firms available online at http://mbe.mdot.state.md.us/directory. MDOT's online directory is the official record of your firm's certification status. It is important that you carefully review the accuracy of your listing in the Directory. If you have any questions about your firm's certification status, contact MDOT's Office of Minority Business Enterprise (OMBE) immediately at 410-865-1269 or 1-800-544-6056.

If you wish to expand the area(s) of work for which your firm is currently certified, you may request an **Expansion of Services**. The application for expansion of services can be found at http://www.mdot.maryland.gov/Office of Minority Business Enterprise/ExpansionCover.html Please submit your application request to:

Maryland Department of Transportation
Office of Minority Business Enterprise
7201 Corporate Center Drive
Hanover, MD 21076
410-865-1309 (fax) or mbe@mdot.state.md.us

Your firm must be recertified annually in order to maintain its certification. We will contact you when it is time to begin the next recertification process.

Sincerely,

Randy Reynolds
Director, Minority Business Enterprise

My telephone number is _____
Toll Free Number 1-888-713-1414 TTY Users Call Via MD Relay
7201 Corporate Center Drive, Hanover, Maryland 21076

METROPOLITAN WASHINGTON
UNIFIED CERTIFICATION PROGRAM

DDOT • 55 M Street S.E., 3rd Floor • Washington, D. C. 20003• (202) 671-0479
WMATA • 600 Fifth Street, N. W., 3rd Floor • Washington, D. C. 20001• (202) 962-6493

District Department of Transportation

February 25, 2014
Sent *via* Regular Mail

Ms. Leola Carrol Fowler, President
KB Environmental Sciences, Inc.
9500 Koger Blvd. Ste 211
St. Petersburg FL, 33702

RE: Certification No. 14-02-05-N

Dear Ms. Fowler,

We are pleased to inform you that your firm has been found eligible as a Disadvantaged Business Enterprise (DBE) with the Metropolitan Washington Unified Certification Program (MWUCP), effective **February 10, 2014** MWUCP participants include the Metropolitan Washington Area Transit Authority (WMATA) and the District of Columbia Department of Transportation (DDOT). **Your firm is subject to the requirements of the Disadvantaged Business Enterprise regulations, *Title 49, Code of Federal Regulations, Part 26*, as amended and all laws of this jurisdiction applicable to the transaction of business.** You are currently certified in the following North American Industry Classification System (NAICS) Code(s):

541620	Environmental Consulting Services
541310	Architectural Services
541618	Other Management Consulting Services

If you wish to add to the list of approved NAICS Codes, you must make such request in writing with supporting documentation to the MWUCP participant from which the original certification was received.

As a certified DBE, you are required to submit an annual "No Change"/"Notice Regarding Change" statement, attesting to your continued status as a "socially and economically disadvantaged individual". You must also submit the following: (1) a *Personal Net Worth Statement (PNW); (2) the Individual Income Tax Return for that

year; and (3) the Firm's Federal Tax Return for that year. The requisite forms are available at http://dbe.ddot.dc.gov.

You can access *these forms on http://dbe.ddot.dc.gov. The "No Change"/ "Notice Regarding Change" Statement and supporting documentation should be mailed annually on or before your firm's certification date to:

District Department of Transportation
Office of Civil Rights
55 M Street S.E. 3rd Floor S.E.
Washington, DC 20003

If a change in the ownership, control or management of your firm has occurred, you must complete and submit a "Notice Regarding Change" statement immediately subsequent to the change.

Firms desiring information about DDOT procurement opportunities should go on line at http://dbe.ddot.dc.gov. To do business with WMATA, go on line at www.wmata.com or www.metroopensdoors.com to register as a vendor and for bidding opportunities.

A firm is considered graduated in all or some of the areas of work grouped under the NAICS Codes if the firm exceeds the size standards listed under the NAICS Codes. If a firm exceeds the size standard in any of its approved NAICS Codes, it is no longer certified as a Disadvantaged Business Enterprise under that specific NAICS Code. If a firm exceeds the size standards in all of its approved NAICS Codes or the established Personal Net Worth standard, it is no longer eligible to participate as a Disadvantaged Business Enterprise under the Federal U.S. Department of Transportation Program.

Your certification does not automatically expire, however; your firm must submit the required documents annually on or before your firm's certification date. Failure to provide the requested documents in a timely manner will result in immediate actions to decertify your firm's eligibility as a Disadvantaged Business Enterprise with the Metropolitan Washington Unified Certification Program.

If you have any questions, please contact Malcolm Jackson, Equal Opportunity Specialist Consultant at 202-741-0635 or via email at Malcolm.jackson@dc.gov

Sincerely,

Malcolm Jackson for Lisa Gregory

Lisa Gregory, Chief
Office of Civil Rights
District Department of Transportation (DDOT)

DDOT/GP