

1. Letter of Interest

March 4, 2015

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

Dear Mr. Hohmann,

The Center for Advanced Applied Research and Technology (CAART), a multidisciplinary firm of research scientists, energy professionals, educator/trainers, and subject matter experts, is pleased to submit our letter of interest for RFP No. 15-010, the Multi-Sector Approach to Reducing Greenhouse Gas Emissions in the Metropolitan Washington Region.

Our team of professionals has collaborated to produce a preliminary plan that we believe will address the goals of MWAQC AND CEEPC to reduce greenhouse gas emissions in the Energy, Transportation, Land Use, and Built Environment sectors in the Washington Metropolitan Area. Our plan includes realistic, implementable recommendations, cost analysis, and technical reporting.

CAART possesses a combined 25 years of expertise in the fields of alternative and renewable energy, building energy efficiency, and sustainable agriculture, and has completed services in relation to the pre-development, design, construction, and management using integrative design engagement under a systems approach for environmentally related projects that encompass greenhouse gas emission evaluations.

Cesarie, our MBE/DBE partner, is a woman-owned, disadvantaged, veteran-owned, small business serving commercial and government customers in all phases of utilities, energy consulting and management, and environmental services.

We look forward to participating in this important project to reducing greenhouse gases, and believe our core expertise in the fields of alternative energy, alternative fuels, green building, energy efficiency, energy management, and our research and technical analysis expertise, meet the needs of the COG Region Forward plan.

Thank you for giving us the opportunity to participate.

Sincerely,
Dr. Corey Dickens
CAART – Director of Sustainability

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3. Executive Summary

CAART is a Veteran-Owned Small Business located in the D.C. and Baltimore Metropolitan areas, serving local, state and federal government agencies, as well as commercial customers, in all phases of utilities, energy management and environmental services. CAART is submitting a fixed price request of \$295,138 for the scope of work that consist of preparing a technical report that quantifies benefits, costs and co-benefits and describes implementation approaches and time frames for realistic and long range greenhouse gas reductions in land use, transportation, and energy/built environment sectors. More specifically, CAART will be responsible for the overall management of the contract, GHG analysis/modeling, and stakeholder presentations.

Included in this price quote is a subcontract to Cesarie Energy and Environmental Services, a Woman-Owned Disadvantaged Small Business (MDOT MBE/DBE:08-111) with 25% of the contract, located in the D.C. and Baltimore Metropolitan areas, that has services that spans 15 years of services in the energy sector. Cesarie will be responsible for stakeholder outreach, engagement, presentations support, document formation and document submission.

4. Team Competence

a. Prime Competence

Key technical personnel will be Dr. Corey Dickens and Dr. George Evans from CAART. In collaboration, they will provide the strategy, analysis, implementation and GHG research. Both have independently and in collaboration worked on various projects that involve renewable or sustainable development in relation to green house gas assessment, where they have used or managed the use of tools necessary to complete the assigned scope of work listed in Table 1.

TOOL	SECTOR	OUTPUT
INDEX	Sketch Planner	Land Use, Transportation, Built Environment
System Advisor Modeler (SAM)	Energy	Cost, Energy Generation, GHG Emission
Hybrid Optimization of Multiple Energy Resources (HOMER)	Energy	Cost, Energy Generation, GHG Emission
Motor Vehicle Emissions Simulator (MOVES)	Transportation	GHG Emission
Energy Information Administration (EIA) Database	Energy, Transportation, Built Environment	Sector Energy Consumption
EPA Facility Level Information Green House Gases Tool (FLIGHT)	Built Environment	GHG Emission
Portfolio Manager	Built Environment	Energy Consumption
Jobs and Economic Development Impact (JEDI)	Energy	Economic Impact
EPA Vehicle Miles Travelled (VMT) Spreadsheet	Transportation	Towards GHG Emission

Table 1 - Sector Tools

b. Subcontract Competence

Other personnel includes include Ms. Ruth Williams and Ms. Neca Rocco from Cesarie, the DBE partner (Table 2). Cesarie will serve as administration and engagement support. Ms. Rocco and Ms. Williams will set up schedules, timelines, provide outreach to regional stakeholders, organize COG meetings, and organize subgroup engagements. In addition, they will be providing support in relation to report and documentation formation and submission.

DBE SUBCONTRACTOR	PERCENTAGE OF CONTRACT
Subcontractor: Cesarie	25%
Address: 203 Creighton Circle, Fort Washington, MD 20744	
Certifying State: MD DBE Certification#: MBE/DBE:08-111	

Table 2 - DBE Participation Plan

c. Example Projects

Two projects that exemplify work that parallel the tasks for this contract are:

1. **Correlation between Energy Generation and the Heat Island Effect in the Baltimore Region-** This project involve developing a whitepaper towards the 2014 NSF Urban Sustainability Solicitation. The work involved the pre-development work towards proposing the development of environmental indicators that correlated the heat island effect to the energy generation sector, building sector, and transportation sector for the Baltimore/Baltimore County region. In addition strategies were assigned to reduce heat island effect and green house gas emission over a 20 year period. To accomplish this work, an assessment of sketch planning tools, building energy data management and energy generation modeling tools where tested and evaluated. After properly choosing tools, a preliminary sketch was performed using GHG Proof (sketch software) to analyze predetermined strategies.
2. **200MW Offshore Wind Feasibility Analysis** – This project involved the feasibility and cost analysis for the Governor O’Malley’s 500MW offshore wind project. The goal was to model the initial 200MW solicited by the Maryland Energy Administration to project generation capacity, project cost, and potential return on investments, economic impact, and green house gas avoidance. Tools used for the project included HOMER (micro-grid modeling software from the Department of Energy), SAM (power plant modeling software from the National Renewable Energy Laboratory), and JEDI (energy generation cost analysis software from the National Renewable Energy Laboratory).

d. Subgroup Engagements

Approximately half of the task focuses on engagement with subgroups to provide GHG reduction strategies and provide consensus for the initiatives. In order to perform these, task the CAART has a well round team of experts that possess a diverse knowledge about GHG emission standards and systems today and their future direction.

Before having the engagements the CAART team will put in the leg work to have reduction strategies planned out starting with the Empower Maryland plan from the O’Malley administration and currently documented initiatives. Since CAART’s has specializes in Energy and energy efficiency, our team already understands the issues around the Offshore Wind Project, issues around the proposed Biomass Energy Plant on Eastern Shore, the needs of expected energy demand, and the uptake of energy storage in the PJM system.

On the built environment side, a member of our team works with the DOE Greater Philadelphia Innovation Hub, research group that provides next generation standards and technology for building efficiency, and another member our team assisted with the development of regulations for residential/commercial weatherization. In addition, a member of the CAART team has provided major support towards the integration of energy benchmarking with Portfolio Manager in Baltimore City.

In relation to transportation, the team understands the potential roles for alternative fuels, such as NG and bio-fuels, in comparison to gasoline. Likewise the team understands the growth demands related to electric vehicles, hybrid transit buses, low GHG truck stop equipment, NG for freight trucks, and hybrid fleet vehicles. Furthermore, the team has a thorough knowledge of CAFÉ standards and fuel efficiency/GHG Emission standards for medium- and heavy-duty vehicles.

The land use component will be based on future changes in relation to development, demographics, and socioeconomic drivers. The team will draw on regional master plans to determine future direction for land use change.

e. Methodology for Maryland Greenhouse Gas Analysis

Task 4: 2012 GHG Inventory

The first task is to perform a GHG inventory for 2012 in all sectors (transportation, land use, and energy/built environment) using the sketch planner INDEX. The 2012 year is chosen as the basis for the baseline to ensure enough accurate and complete data can be used to provide a comparison model. As for using INDEX, it is a robust tool that assesses identified conditions, allows for future scenario modeling, measures scenarios with performance indicators, and ranks scenario achievements. In addition, INDEX is design to support the stakeholder planning process which is a characteristic of this scope of work.

Transportation

The transportation sector will be subdivided in to two areas, off road and on road. Off road will include emissions from rail and planes. Data to estimate emissions will have to be leveraged from the appropriate transit agency.

On road transportation is composed of emission from private automobiles, public transit (buses), and fleet vehicles. The EPA VMT spreadsheet tool will be used with VMT data from regional agencies. The VMT data will be used in the EPA tool MOVES2014 to estimate GHG emission.

Land Use

The land use sector will be subdivided to access residential, cropland, and forestry areas. GHG emission is calculated based on land use change. Therefore for the baseline inventory, the land usage will be identified and classified.

Energy/Built Environment

The energy and built environment will be addressed through energy production facilities, while the built environment will be subdivided into the three categories commercial, residential, and industrial. The emissions from energy production facilities will be determined from the EPA database FLIGHT, which is a green house gas reporting system. As for the built environment, emission data from the built environment will be gathered from EIA database, regional

agencies, utility companies (through electricity and natural gas usage), and through tools such as Portfolio Manager.

Forecasting

The forecasting will be based on land use changes, socioeconomic, and demographic growth projections from the various region agencies in conjunction to strategies and targets addressed during stakeholder subgroups for the time intervals 2012-2020, 2020-2040, and 2040-2050. Policies will be tied to the strategies and targets and various sketch scenarios will be performed in conjunction to the various modeling tools from each sector that can estimate future emissions.

Each sector will be modeled based on projected changes. For land use, carbons sequester elimination or release will be evaluated using the Intergovernmental Panel on Climate Change 2006 Guidelines for National Greenhouse Gas Inventories (IPCC 2006). The guidelines identify approaches and methodologies to classifying land areas and determining net GHG flux based on land changes. The data used to determine use and change will be leveraged from the U.S. Department of Agriculture (USDA), National Resources Inventory (NRI), USDA Forest Service (USFS), Forest Inventory and Analysis (FIA) Database, and regional agencies.

Energy emissions will be modeled based on projected generation installation or retirement using plant modeling tools. For example, if the entire offshore wind projects (500MW) get completed in 2020, then the 500MW system would be modeled using the System Advisory Modeler (SAM) to project energy generation, cost, and GHG avoidance for the life of the energy plant (25 years).

For the transportation sector, projected automobile usage will be determined based on regional department of transportation data and population growth. This data will be used in relation to VMT data and MOVES2014 to estimate GHG emissions.

f. Task 6: Exploration of GHG Goals and Targets

The challenge in for this section will be identifying the stretch goals and targets. The team will leverage the stretch goals and targets from other states, such as California, that have performed these studies. But once the stretches have been identified, a methodical cross reference between where regulations stand and how they need to evolve to accomplish the goals and targets will be evaluated and analyzed.

5. Resume of Key Project Staff

a. Corey Dickens, Ph.D.

Summary of Qualifications

- BS, MS and Ph.D. in Electro Physics
- Several years of experience for performing feasibility and system design for various alternative energy technology systems
- Subject matter expert: Smart Grid (HAN, utility systems, micro-grids)-Lonwork Certified
- Subject matter expert: Efficient Lighting- Efficient Lighting Certified
- Subject matter expert: Photovoltaic - Entry Level Certification
- Experience with US offshore renewable systems integration (technology development, policies, FERC licensing, interconnection and integration)
- Experience with sustainable community modeling (economic Impact and GHG reductions)
- Wrote grants to support center (DOD, DOE, NSF-IGERT, NSF-CCLI, STTR, SBIR and assisted with NASA URC Proposal)

Professional Experience

Principle Partner, V.P., Director of Sustainability, CAART, Baltimore, MD. 9/13-Present

- Formulated a 5 year road map for overall energy services under the company
- Developed comprehensive strategy to pursuing energy related contracts in the State of MD
- Organized and redefined company research model towards 21st century related technologies (Smart Grid and renewable)

Director of Energy Education and Research Development, Morgan State University, Baltimore, MD. 9/09-Present

- Developed MSU Power and Energy Curriculum
- Infused critical thinking concepts into Power Systems, Materials and Electronics courses
- Founded Maryland Energy and Education Research Lab (MEERL)

Center Director (Semiconductor Center for Electronic Devices and Circuits), Morgan State University, Baltimore, MD. 8/03-8/08

- Developed vision, mission and implemented policies in relation to the daily operation for the center
- Wrote, procured and managed research contracts and grants
- Developed integrated training, research and course work program

Assistant Professor, Morgan State University, Baltimore, MD. 8/00-Present

- Taught Power Systems, Electronic Materials and Devices, Introduction to Electrical Laboratory, Introduction to Electrical Engineering, Semiconductor Integrated Circuit Fabrication, Power Systems, Power Electronics, and Electronic Circuits

Semiconductor Researcher, Materials Science Center of Excellence, Howard University, Washington, DC. 8/92- 6/00

- Grew wide band gap semiconductor epitaxial films, AlN/SiC, SiC/SiC, SiC/Si, AlN/Al₂O₃, and GaN/Al₂O₃, via metal organic chemical vapor deposition
- Assisted with the bulk growth of SiC and AlN via sublimation
- Characterized epitaxial films with C-V, Hall, AFM, and Auger spectroscopy
- Developed a wet etch fabrication process for AlN/SiC metal-insulator-semiconductor field effect transistors

Relevant Projects

Energy Efficiency Related Projects

- Heat Island Modeling: Developed strategy to decrease heat island effect, reduce green house gases, and conserve energy in relation to energy generation, built environment, and transportation in Baltimore City. The project included sector identification and the development of heat environmental indicator using a data driven approach DSIP Framework to determine descriptive index. Supported by Morgan State University
- Baltimore Public School System Energy Efficiency Retrofitting: Developed a STEM energy student training program to provide student service learning credit for students that participate in the energy audit analysis for their school. The training includes building energy modeling, efficient lighting design, and benchmarking. In addition, the model includes a funding model independent of the BCPS budget and partnering with community stakeholders. Supported by Morgan State University
- Howard University Energy Efficiency Retrofit: Provided energy audit and analysis for two engineering buildings. Retrofit included day lighting, T12-T8 replacements, and mechanical upgrades. The retrofit provided an upfront return of approximately \$40,000 (cash and technology) and a potential cost savings of \$80,000 over a ten year period. Supported by Bryant Mitchell LLC.

Renewable Energy Projects

- Hybrid Design: Provided review for feasibility and design for 300KW Solar and 300KW Wind renewable energy system. Also assessed bid cost and provided support for final bid submission. Supported by MDRGROUP for Talbot County Sewage Department
- Offshore Wind: Projects for MD Offshore wind initiative included: 1) Converter technology assessment which included converter design and simulations using PSPICE and Simulink tools. Supported by Morgan State/MHEC/Maryland Energy Administration, 2) Energy capacity transmission impact on Mid-Atlantic region that

entailed load flow studies using PSSE, 3) Cost and Feasibility analysis Supported by Morgan State/MHEC/Maryland/PJM

- Solar Community Project: Performed feasibility and cost analysis for a Community Solar Electricity Pilot Project located in Gbarnway, Liberia. The project consisted of 147 kWh solar PV systems to power 175 households, a school and a clinic. Supported by Solumba Construction
- Community Biomass Project: Performed feasibility and cost analysis for the construction, test and commissioning of 60 kW Kwendin Community Biomass Electricity Pilot Project for the Kwendin Village in Yarwein Mehnsonnoh District, Liberia. The project included a power house, biomass material storage centers, 3 x 20 kW Gasifiers and a generator set, a distribution line, and meters. Supported by Solumba Construction

Education and Training

- Howard University, Washington, DC, Electrical Engineering, Ph.D. 1992-2001
- Cornell University, Ithaca, NY, Electrical Engineering, M.Eng. 1991-1992
- Morgan State University, Baltimore, MD, Electrical Engineering, B.S. 1987-1991

b. Dr. George Evans

Summary of Qualifications

- Home Energy Auditor BPI 5013502
- USEPA Certified Renovator Initial Course ID# NAT-RV-I-18597-1-EN-2-23-10-06
- Certified Construction Project Manager CCPM
- Member of the Association of Energy Engineers
- Green Building Designer Registration # EDU 0000-1047-76
- Indoor Air Quality Consultant ID # (IAC2) 01-3706
- National Association of Home Inspectors # 0801201
- HUD Inspector ID 1351
- Member Green Building Institute

Firm Experience

- Center for Advanced Applied Research Corporation (CAART) 2013 (CEO FOUNDER)
- MDR Inspection and Analysis (MDR Group) 2000 (CEO FOUNDER)
- ITBC LLC (ITBC) 2011 (CEO Co FOUNDER)
- Consultants Managers Engineers Technology (CMET) 1996 (CEO FOUNDER)

Education

- Post Doctorate MS Computer Science Loyola University 2004
- Ph D Engineering Administration Western State University 1998
- MS/BS Construction Engineering and Building Technology 1994

- RETS/Kaplan College Industrial Electronics Communications Engineering Certificate
Baltimore, Maryland Completion October 1970- April 1972

Relevant Projects

Energy Efficiency Related Projects

- Training and certification testing of City of Building Energy auditors
- Building Airflow Testing at Quantico Marine Base new Communications facility
- Blower door testing for 1012 doors for Baltimore City Housing Authority

Renewable Energy Projects

- Build out of Solar Thermal Plants in Washington DC and furnishing
- Build out of Solar Thermal Plant for Herford School in Aberdeen Maryland

6. Price Proposal

The total fixed cost being requested for the scope of work is **\$295,138**. The cost will cover all services being requested across the contract time frame from March to January (Table 3).

Task	Activities	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Task 1: Work Plan and Schedule	Identify Tasks, Assign Dates											
Task 2: Sector Subgroup and Review Proposed Strategies	Identify initial GHG reduction strategy (Meetings 3 - TBD), Prepare Tech. Memo., Prioritize list and gain consensus (Meeting 3)											
Task 3: GHG Reduction Strategies for MSWG	Prepare draft Tech. Memo. / Present Strategies for feedback with MSWG (Meeting 1 - May 8th) / Solidify Tech. Memo with final list of strategies											
Task 4: Analyzed Selected Strategies	Identify implementation approaches and time frames/ Quantify GHG reductions, cost, and co-benefits/ Prepare Tech. Memo. With analysis/ Present to subgroups (Meetings 3 - TBD)											

Task 5: Prepare/Present Interim Technical Report	Present to MSWG (Meeting 1 - July 31st)											
Task 6: Explore GHG Goals and Targets	Research other GHG studies/ Identify achievable, stretch goals and targets/Identify goals and targets that need varied government intervention/ Document exploration in Tech. Memo.											
Task 7: Technical Memorandum on Exploration of GHG	Prepare Final Report/ Present to MSWG (Meeting 1 - Sept. 25th)/Present to COG staff, TPB, MWAQC, CEEPC (Meeting 1 - Dec. TBD)/ Present to COG Board (Meeting 1 - Jan. TBD)											

Table 3 - Schedule

<u>Activity</u>	<u>Description</u>	<u>Amount</u>	<u>No. of Hrs</u>	<u>Cost/Activity or Item</u>	<u>Cost/Hr</u>	<u>Total</u>
Direct Cost (DC)						
Key Personnel						
Dr. C. Dickens	Management, Strategy, Analysis, Implementation, Technical Reports, Presentations, Work Plan, Final Report		720		\$110.00	\$79,200.00
Dr. G. Evans	Strategy, Technical Reports (4), Presentations (7), Work Plan (1), Final Report (1)		440		\$90.00	\$39,600.00
Fringe	Fringe	0.32		\$118,800.00		\$38,016.00

Travel						
Miscellaneous Stakeholder	Stakeholders in individual sectors and regions will be engaged to aggregate data for GHG Models; Travel with n 100 Mile radius	TBD				\$0.00
Presentations	Several meetings will be held to inform the COG, subgroups, and the MWAQC, TPB, MSWG, and CEEPC; Travel within 100 Mile radius	7				\$0.00
Supplies/Equipment						
Supplies	Clerical supplies	1		\$2,000.00		\$2,000.00
Software	Index software license and support	1		\$6,000.00		\$6,000.00
Equipment	Computers dedicated to research	2		\$850.00		\$1,700.00
Projector	Presentation Projector	1		\$3,000.00		\$3,000.00
Subcontract						
Cesarie	Outreach, engagement, support on technical reports and presentations		480		155	\$74,400.00
Total Direct Cost						\$243,916.00
Indirect Cost (IC)	Description	Percentage	DC	Total		
Indirect	General and administrative fees - 10%	0.1	\$243,916.00	\$24,391.60		
Profit	Description	Percentage	DC+IC	Total		
Profit	10%	0.1	\$268,307.60	\$26,830.76		
Overall Total	\$295,138.36					

7. References

a. CAART References – Dr. Corey Dickens

1. 2014 - Pre-development Whitepaper: “The Correlation between Energy Generation and the Heat Island Effect in the Baltimore Region” for the 2014 NSF Urban Sustainability Solicitation. Contact: Dr. Maryanne Ackers, Dean of Architecture and Planning, Morgan State University, Baltimore, Maryland, 443-885-3225.
2. 2014 - Feasibility and Cost Analysis : 1,000 kW Mini Hydropower Pilot Project for the Mein River located in Suakoko District, Liberia; 147 kWh Community Solar Electricity Pilot Project located in Gbarnway, Liberia; and 60 kW Kwendin Community Biomass Electricity Pilot Project for the Kwendin Village in Yarwein Mehnsonnoh District, Liberia. Contact: Dr. Olawabi Oludare, Civil Construction Manager, Solumba Construction, Baltimore, Maryland, 571-288-3975.
3. 2013 - Feasibility and Cost Analysis: 200MW Maryland Offshore Wind Farm. Contact: Dr. Carl White, Associate Dean of Graduate Studies and Research, Morgan State University, Baltimore, Maryland, 443-885-3913.

b. Cesarie References- Ms. Ruth Williams

1. 2013 – Subcontractor - Examination of Electric Distribution Company in Case No. 9298: Task - Evaluation of environmental and economic impact of proposed infrastructure and staffing plans of the five major electric distribution companies after electric service interruptions in the State of Maryland due to the June 29, 2012 Derecho storm. Contact: Dolline M. Serra, Procurement Officer, Public Service Commission, Baltimore, Maryland, 410-767-8009