PROJECT PROPOSAL

1. **Project name: Quantifying Methane and Black Carbon Emissions from Flaring in the Oil and Gas Industry**

2. **Two-year budget: C$375,000**

3. **Short statement on the need identified (including current status), the project objective and the outcomes (achievable by June 2019) to address it**:
   North American leaders committed to reducing methane and black carbon (BC) emissions, which are climate-forcing and negatively affect human health and air quality. This project supports methane and BC measurement, enhanced emissions inventories, and promotes the adoption of cost-effective technologies and practices for field measurement, monitoring, and emissions mitigation.

   This project will measure methane and BC emissions at flaring sites in Mexico. Data collected will be used to develop: 1) measurement-based methane and BC emission factors; 2) a business-case approach for flare emission reduction projects; and 3) best practices for flaring that will have applicability within and beyond North America.

4. **Select the strategic priority(ies) that the project addresses:**

2015–2020 Strategic Priorities	Priority Areas
☒ Climate Change Mitigation and Adaptation ☐ Green Growth ☐ Sustainable Communities and Ecosystems	☐ Trade and the Environment (e.g., environment and innovations; movement of environmental goods and services) ☒ Methane emissions reduction ☐ Reduce and recover food waste ☒ Black carbon inventory ☐ Priority species and ecosystems (e.g., transboundary invasive alien species) ☐ Health of oceans (e.g., marine litter; ocean acidification; marine protected areas) ☐ Syndromic surveillance systems ☐ Mexican Emissions Control Area (ECA) ☐ TEK case studies

5. **Explain how the project can achieve more impact by working trinationally, and why the CEC is the most effective vehicle to undertake this work:**
   CEC is the most effective vehicle for this project, as it will leverage existing technical and financial collaboration between CEC member states under the CCAC. This expands the scope of an already funded CCAC project in Mexico to support the government in short-lived climate pollutant (SLCP) measurement, reporting, verification and reduction, and GHG emissions inventory development.

All jurisdictions will benefit from the data collected, new methodologies, best practices, and new emission factors. This helps Canadian, US and Mexican industry and governments in: 1) measuring and reporting of flaring BC and methane emissions, and 2) identifying cost-effective opportunities for emission reductions from oil and gas.

6. Describe how the project may capitalize on, or advance, the relationship between ecosystems, job creation, gender impacts, and income generation:

Flaring of methane and volatile organic compounds (VOCs) from oil production and liquid storage tanks emits methane, and black carbon (BC) particulates. These are potent climate forcers and have a negative impact on human and ecosystem health. Additionally, BC from flares is both a regulated $PM_{2.5}$ toxic emission and also a vector for introducing carcinogens such as polycyclic aromatic hydrocarbons (PAHs) into the environment.

The business case development as part of this project will demonstrate how to employ measurement technologies and methods to identify cost-effective opportunities to deploy technology solutions to reduce flaring in the North American oil and gas sector. Increased demand for such technologies in North America and global markets will result in high-quality engineering, technology manufacturing, and service jobs. Past Canada-Mexico-USA collaboration under the Global Methane Initiative and ongoing CCAC collaboration in this sector have clearly demonstrated that development and deployment of technical solutions in the oil and gas sector create jobs, support gender income equality and advance economic, environmental and social sustainability.

7. List the objectives and activities to be conducted to achieve measurable results:

Objectives (must be SMART[1])	**Main activities to achieve objectives (by 30 June 2019)**	**Measurable results**
By 30 June 2019, • Develop comprehensive methane and BC $PM_{2.5}$ particulate emission factors for flaring • Demonstrate methane and BC $PM_{2.5}$ particulate emissions-reduction technologies	• Measure methane and BC $PM_{2.5}$ particulate emissions before and after the implementation of mitigation project at three Pemex facilities • Develop an integrated, measurement-based economic business case for methane and BC $PM_{2.5}$ particulate emissions-reduction technologies, based on market commodity values of recoverable methane and liquefiable hydrocarbons from flare streams • Develop and demonstrate	• Advanced methane and BC $PM_{2.5}$ particulate emission factors for upstream and downstream flares • Increased awareness of government and industry about cost-effective technology for flaring reduction

[1] SMART: Specific, measurable, achievable, realistic and time-bound.

	replicable methodology for instantaneously measuring flare fuel flow rates, flare fuel chemistry, and methane and BC $PM_{2.5}$ particulate emissions • Reporting and dissemination of data analysis and results • Emission factor development and publication	

8. Describe how the project complements or avoids duplication with other national or international work:

The proposed project avoids duplication, as it proposes to expand the scope of currently funded, or currently planned, climate finance projects in Mexico under either the CCAC or future Canada-Mexico bilateral engagement, where it has been verified that the existing and future project scopes and financial resources specifically exclude both: (1) the measurement of black carbon emissions, and (2) the development of methane and black carbon emission factors for flaring. The proposed CEC collaboration with the CCAC will enhance the current CCAC project scope of supporting the government of Mexico's INDC commitments to reduce flaring, and methane and BC emissions associated with flaring. The current CCAC project objectives include development of front-end engineering and design and of an economic business case for near-term flare mitigation capital projects that will be implemented in Mexico. However, the current CCAC project scope does not include measurement-based quantification of: (1) baseline methane and BC $PM_{2.5}$ particulate emissions, (2) avoidable methane and BC $PM_{2.5}$ particulate emissions, or (3) $PM_{2.5}$ particulate emission factor development for methane and BC emissions flares.

The proposed CEC project will provide for measured facility baselines for methane and BC $PM_{2.5}$ particulate emissions from flaring at as many as two upstream production facilities and one refinery in Mexico. The BC measurement will be undertaken using the Sky-LOSA technology, which is the world's only technology capable of quantifying the mass flux of BC $PM_{2.5}$ particulate emissions in an entire flare plume, and unburned methane emissions will be quantified using a spectrometry-based plume transect system. Upon completion of the capital implementation projects, new facility baselines will be quantified using measurement to establish credibly the magnitude of sustainable methane and BC $PM_{2.5}$ particulate emissions reduction from the CCAC project.

Additionally, the proposed CEC project will demonstrate (and improve, if necessary) a replicable methodology for flare system instrumentation to simultaneously collect instantaneous flow rates of flare fuels and fuel chemistry data to correlate to the instantaneous mass flux of BC $PM_{2.5}$ particulates quantified by the Sky-LOSA technology and to time-resolved, unburned methane mass-flux data downwind from the plume transect system. This replicable method will yield flare-specific methane and BC $PM_{2.5}$ particulate emission factors (e.g., upstream solution gas, upstream production storage tank flashing flares, processing flares, downstream refinery flares, etc.) so as to advance the development of globally transferable emission factors for representative flare types, flare fuels and flare activities. At a minimum, the project will yield emission factors with activity coefficients that represent variables such as fuel flow rate(s), fuel chemistries, and flare dimensional parameters for the measured flares. With this knowledge, stake-holders will be equipped to evaluate the inventory of Pemex flares, enabling the

population of flares for which the measured flares are representative to be identified, in order to: (1) statistically evaluate the extrapolation potential of the developed factors to a broader population of analogous flares, and (2) identify and locate a statistically significant population of analogous flares for future quantification of measurement-based emissions in order to produce globally transferable emission factors for representative flaring activities.

9. **Describe opportunities for inclusion of traditional ecological knowledge (TEK), if applicable, and how these opportunities are incorporated into the project:**
N/A

10. **Describe opportunities for youth engagement, if applicable, and how these opportunities are incorporated into the project**:
N/A

11. **List significant involvement of other levels of government, Indigenous groups, local communities, experts, private sector, civil society and others, as applicable:**
The collaborative network that is engaged in the existing CCAC project and the proposed CEC project includes Mexican government agencies (e.g., INECC, Semarnat, CNH, Sener) and Pemex; Canadian government Ministries (i.e., ECCC, NRCan), not-for-profit organizations (e.g., Petroleum Technology Alliance of Canada [PTAC]), private sector (e.g., Clearstone Engineering, etc.), universities (e.g., Carleton U, U of Alberta), a national energy research laboratory (i.e., NRCan CanmetENERGY–Devon) and a Canadian oil and gas regulator (i.e., Alberta Energy Regulator, which has an existing MOU in place to support and inform Sener policy and regulatory development objectives).

The collaborators in the integrated CCAC/CEC project are also directly and indirectly involved in CCAC- and NALS-related committees and working groups where USA-based stakeholders (such as the US DOE, US EPA), the US State Department, and US NGOs (such as the US EDF, and Clean Air Task Force) are constantly apprised of activity updates.

12. **Identify relevant committee members and their federal agencies in each country committed to developing this project, and implementing it, if approved:**

Canada: ECCC, NRCan
Mexico: INECC, Semarnat, Sener, CNH
United States:
US EPA Office of Research and Development
- Air quality improvement
- Flaring best management practice development and technology improvements
- Flare combustion efficiency determination through trace gas and particle emissions measurement