ADVANCE CONTRACT AWARD NOTICE (ACAN)

1. Title

Building Energy Mapping and Analytics Concept Development Study (BEMA-CDS)

2. Definition

An Advance Contract Award Notice (ACAN) allows departments and agencies to post a notice, for no less than fifteen (15) calendar days, indicating to the supplier community that it intends to award a good, service or construction contract to a pre-identified contractor. If no other supplier submits, on or before the closing date, a Statement of Capabilities that meets the requirements set out in the ACAN, the competitive requirements of the government's contracting policy have been met. Following notification to suppliers not successful in demonstrating that their Statement of Capabilities meets the requirements set out in the ACAN, the contract may then be awarded using the Treasury Board's electronic bidding authorities.

If other potential suppliers submit Statement of Capabilities during the fifteen calendar day posting period, and meet the requirements set out in the ACAN, the department or agency must proceed to a full tendering process on either the government's electronic tendering service or through traditional means, in order to award the contract.

3. Background

CanmetENERGY-Ottawa, an energy R&D division within the Energy Technology Sector of Natural Resources Canada (NRCan) has a mandate to lead the development of energy science and technology solutions for the environmental and economic benefit of Canadians. Investigation into the improvement of housing and buildings energy-related data, along with the potential value of mapping or spatializing energy end-use and efficiency opportunities information for stakeholder groups such as municipalities and utilities, is a research priority in the context of CanmetENERGY-Ottawa's Canadian Energy End-use Mapping (CEE Map) project.

Over 400 Canadian municipalities have completed community energy and emissions plans for which they acquire data and conduct or procure modelling. Electric and natural gas utilities procure Conservation Potential Reviews (CPR) and establish Demand Side Management (DSM) programs to achieve energy conservation and efficiency targets in buildings. Nationally, Canadian federal government departments conduct surveys and building energy modelling to inform policy and program development, changes to equipment standards and energy performance requirements in the National Building Code.

Although building stock and energy performance data for municipal, utility and federal government policies, programs and planning processes may be required at different spatio-temporal resolutions, on a fundamental level it is essentially the same. What's required for all of these processes is an understanding of the building stock: number of buildings, their ages, types, and floor areas and other energy-related characteristics of buildings in the stock, grouped by building archetype. Energy use is derived from different sources and methods including measured and modelled data; various statistical and aggregation techniques are applied inconsistently by different organizations to estimate current and projected end-use and efficiency opportunities.

Strategic policy, planning and program efforts of municipalities, utilities and federal government policies, programs, codes and standards are not harmonized in terms of their reliance on consistent and authoritative underlying data and assumptions on the building stock, its energy use and efficiency opportunities. This lack of data coordination results in duplication of effort, lost energy savings and lost opportunities for climate change mitigation and resilience. Access to and use of consistent, authoritative data on the building stock and its energy performance is a systemic challenge that no one organization can fix alone.

Potential to Improve the Impact of Energy Efficiency Policy and Programs through Interoperable Spatialized Data
Recent advancement in building energy modelling and simulation has led to the production of big data on housing and building energy use and efficiency opportunities in new and existing dwellings. Specifically, the CanmetENERGY-Ottawa lab through its Housing Technology Assessment Platform (HTAP) and Building Technology Assessment Platform (BTAP) is able to generate thousands of potential technology packages at various cost increments on the path to net zero energy housing and buildings for thousands of building archetypes or typologies in all Canadian weather regions. This data is developed in support of the National

Building Code, energy efficiency programs and equipment standards led by NRCan's Office of Energy Efficiency.

There is a growing recognition and consensus that housing and building energy information is required at a low level of geography. The hypothesis is that by integrating this information into an online map-based authoritative decision platform, it will provide increased value to decision makers by better enabling them to access data and information on building energy previously in the domain of building and computer scientists. While multiple models have been developed on a desktop basis, the leading edge will be putting these maps online and drawing data dynamically from multiple sources to inform decision making.

In order to guide Research and Development (R&D) in this emerging area, the CanmetENERGY-Ottawa division of NRCan requires a current and comprehensive understanding of the state of building energy mapping and analytics.

4. Objectives

NRCan high level requirements to be addressed via the Building Energy Mapping and Analytics Concept Development Study (BEMA-CDS) include:

1. **Characterize the state of development of energy mapping and analytics in the building stock broadly.**
   - Identify and describe the main types of model users (both direct and indirect), as well as their main use cases;
   - Identify and describe the main building stock and energy models under development, their features and use cases to which they are applied;
   - Identify types of model developers, including characteristics, motivations and general strategies with respect to model development, and maintenance;
   - Characterize offline and online implementations, and provide examples of models that implement open standards;
   - Identify gaps including common data gaps, and interoperability standards or demonstrable implementations of standards;
   - Identify areas of future research, development and demonstration where Canada could meaningfully contribute to the knowledge base in the domain, and
   - Document the above, and other requirements, in an engineering report.

2. **Inform and propose an architecture and open, geospatial standards to enable mapping and analytics of residential energy use and optimization.**
   - Develop an interoperable architecture based on open standards that will enable different platforms to exchange data; , and
   - Develop and iterate a proposed model architecture based on stakeholder comments.

In support of achieving the study's objectives, some of the themes that, through discussion and mutual agreement between NRCan and the contractor, may be explored include:

Building Archetypes and Classifications
While common building types such as the United States Department of Energy archetypes are commonly used for building design and energy optimization, a common challenge is that different organizations define building types differently. One approach is to classify buildings into a hierarchy of types. Understanding of common building types and examples of classification hierarchies may be sought.

Building Energy End-use Characterization
The predominant modelling approach for characterizing building energy use in spatial models is through archetyping. That is, grouping buildings in the stock into typical representative buildings for simulation and analysis. Investigation of stock models where buildings are modelled individually may be explored. Another more common approach is for simulation to be performed for archetypes representative of a number of buildings in a defined geographic area. Methods for streamlining and automating the integration the results of building energy analysis from housing and building simulation models into spatial building stock models is of interest in both approaches.

Distributed Renewable Energy Technologies
Examples of the main types of technical potential analysis methods for various building stock integrated renewable energy technologies is of interest. What open, standards-based approaches exist for geospatial analysis for integration of distributed renewable energy technologies in the building stock, such as solar photovoltaics (PV) and other renewables?

Information Technologies and Standards Currently in Use
What are the information systems currently in use within municipalities and utilities? What are the opportunities and restrictions around buildings and energy data analytics to support strategic energy planning? Are there examples of open spatial data and standards already in use by municipalities and utilities? What lessons that can be learned from those implementations that are relevant for building energy mapping and analytics?

Integration of Measured Data for Model Validation and Inventory Purposes
Several models known to NRCan have integrated measured energy use data from utilities. While utility demand side management programs are often evaluated with modelling, use of measured data for monitoring and evaluation of programs is a promising approach. What data workflow routines exist that enable access to measured utility data in a manner compliant with privacy and commercial interests that can help fulfill municipal needs for energy inventories? Have any jurisdictions demonstrated an integrated approach to handling of modelled and measured building energy data for inventory and future scenario analysis purposes, as well as model validation?

Future Scenario Development
What additional opportunities can be afforded by cloud and high performance computing capacity? For instance, parametric runs of neighbourhood or city-scale simulations to identify which technology packages are notionally more cost-effective is of potential interest.

Big Data Challenges
Other projects have noted big data challenges including storage, volume and velocity of big data. A challenge particular to the CEE Map project is how to triage the housing and building modelled energy data to depict simplified results for decision makers. Computational methods for filtering large datasets, to prioritizing a subset of results according to certain parameters for integration and portrayal is a key challenge for building energy mapping and analytics. Finding out how others have managed these issues in spatial buildings and energy models that use big data is key.

Data Silo Challenges
To accurately characterize energy end-use and efficiency opportunities in the housing and building stock, it is vital to relate many kinds of building attributes, parcel and meter locations, modelled and measured energy data, in a manner that ensures protection of personal and confidential business information. This involves building and energy data that may be stored as shapefiles or geodatabases across various organizations. Will projects that have been successful in accessing and integrating building and energy data on a one-off basis, creating energy maps that can be built and maintained over time, be more feasible if the underlying data could be stored and maintained by the data custodians, closest to the source?

By improving a linked open building and energy data environment, NRCan anticipates a series of business benefits including: improved discoverability, improved access, improved connectivity, improved interoperability, enhanced infrastructure and enhanced openness.

Machine Learning
The availability of data to efficiently train ML models is still an issue. Although it is understood that a large variety of geospatial data are available through standardized interfaces, are these applicable to buildings and energy characterization, including through the use of machine learning tools?

Artificial Intelligence
What aspects of emerging Artificial Intelligence capabilities are relevant to the domain of building energy mapping and analytics? What applications can feasibly extend the capabilities of energy mapping, be it through improving data, or automation and efficiencies in processing or portrayal?

Applicable OGC Standards
With a wide array of standards at various levels of maturity, which OGC standards are potentially applicable to the domain of buildings and energy mapping? Should new, open geospatial standards be developed?

Green Button
The Green Button is an Open Automated Data Exchange (OpenADE) standard that allows utilities and customers to securely exchange customer usage data. What is the potential for this standard to be leveraged an integrated into open online building energy maps? What opportunities exist for citizen science and volunteering of measured utility data by individuals and businesses?

Blockchain
It is understood that certain electric utilities are using blockchain to manage contracts for renewable energy supply to the grid. It is not known if any utilities are applying blockchain to transaction management in conjunction with Demand Side Management (DSM) programs, or if this technology is applicable and suitable for this purpose.

Transition Management and Institutionalization
While many building stock and energy models are developed in research settings, demonstrations of successful transitions from research to operational environments is of interest. What are criteria of success in transition management and institutionalization? Are there other approaches for ensuring a building stock and energy model once built, is accessible and may be run periodically to produce information as required?

5. Project Requirements

5.1 Tasks & Activities

The objectives of this project shall be achieved by the contractor through the following deliverable themes. Detailed information for each deliverable is presented in subsequent subsections:

- Building Energy Mapping and Analytics Request for Information (RFI)
- Building Energy Mapping and Analytics Architecture Model
- Result Validation Meeting
- Building Energy Mapping and Analytics Engineering Reports

Building Energy Mapping and Analytics Request for Information

The contractor will conduct research and development and deliver to NRCan the following surveys and information products required to administer a Request for Information (RFI) on Building Energy Mapping and Analytics:

- One set of questions to be administered as a survey.
- One set of questions to be administered as semi-structured interviews with key respondents.
- Set-up and administration of the survey via a web-based platform to be mutually agreed upon by NRCan and the contractor.

To support the RFI activity, NRCan will facilitate access to:

1. A list of contacts deemed relevant to building energy mapping and analytics
2. A list of building stock and energy models and preliminary review of selected models.
3. Other background research as available.
4. Review of proposed draft questions by qualified individuals

Building Energy Mapping and Analytics Architecture Model

The contractor will deliver to NRCan a proposed architecture and associated open, geospatial standards for creating an online interoperable map of building energy end-use and efficiency, with analytics functionality that supports future scenario analysis of the energy, carbon and cost implications of energy end-use and efficiency measures in the housing stock. The proposed

architecture shall: provide components and protocols between components (e.g. servers and clients) that are always permanent in information systems (e.g. Smart Grid). The proposed standards shall demonstrate formats and encodings that will be best suited to enable access, use and sharing of building energy mapping and analytics data.

Building Energy Mapping and Analytics Engineering Report Version 1

The contractor shall deliver to NRCan an engineering report summarizing the results of the RFI and architecture model activities. This shall include:

- A summary of the findings of the BEMA-CDS RFI. Quantitative summaries of responses obtained through the survey shall be presented in text, table and graphic formats. Qualitative responses from the interviews shall be provided as well.
- Contextual information gleaned from relevant background literature.
- The proposed architecture and open geospatial standards necessary to support building energy mapping and analytics.

Result Validation Meeting

Upon completion of the above tasks, the contractor shall facilitate an in-person meeting to review and validate the results of these activities. This shall include:

- The ability for NRCan personnel to meet with representatives of the contractor, RFI respondents and other experts as deemed necessary to discuss task results.
- The modification and/or edition of content to version 1 of the engineering report based on meeting discussions.
- Summary presentations, formulation of key discussion questions and notetaking throughout the meeting by the contractor.
- Making all meeting materials available to NRCan in a timely manner after the meeting has occurred.

NRCan shall provide a venue in Ottawa, Ontario, Canada to support the in-person meeting.

Building Energy Mapping and Analytics Engineering Report Version 2

The contractor shall incorporate outcomes and decisions from the Result Validation Meeting into a second version of the engineering report. This report shall be provided to NRCan in a timely manner after completion of the Result Validation Meeting.

Montreal Technical Committee Meeting Discussion

Results described within engineering report version 2 shall be presented by the contractor at the June 2020 OGC Technical Committee meeting in Montreal. At a minimum, the results must be presented to the Energy and Utilities Domain Working Group. If the working group agrees with the content of the report, the contractor shall facilitate a vote by the OGC Technical Committee to have the report accepted by the Technical Committee.

Building Energy Mapping and Analytics Engineering Report Version 3

A third and final version of the engineering report incorporating any changes as suggested through the Montreal Technical Committee Meeting discussions shall be provided by the contractor to NRCan. This final version of the report shall also be made available to the public through the OGC consensus process.

5.2 Deliverables

A summary of deliverables and associated delivery dates is presented in the table below:

Deliverables	Completion Date
Project setup and Kickoff Meeting with NRCan	December 20, 2019
Public project set up – Building Energy Mapping and Analytics Concept Development Study Website	January 8, 2020
Request for Information Released	January 31, 2020
Deadline for RFI Responses	March 17, 2020
Analysis of RFI Responses – Engineering Report Version 1	April 30, 2020
Validation Meeting in Ottawa	April 30, 2020
Engineering Report Version 2	May 29, 2020
Presentation to the OGC Technical Committee Meeting in Montreal in June 2020	June 19, 2020
Final Engineering Report	June 30,2020

6. Trade Agreements

Applicable Limited Tendering Provision under NAFTA (Article 1016.2)
1016.2(b) - where, for works of art, or for reasons connected with the protection of patents, copyrights or other exclusive rights, or proprietary information or where there is an absence of competition for technical reasons, the goods or services can be supplied only by a particular supplier and no reasonable alternative or substitute exists.

Applicable Limited Tendering Provision under Canada-Chile (Article Kbis-09)
Kbis-09 (b) - where, for works of art, or for reasons connected with the protection of patents, copyrights or other exclusive rights, or proprietary information or where there is an absence of competition for technical reasons, the goods or services can be supplied only by a particular supplier and no reasonable alternative or substitute exists.

Applicable Limited Tendering Provision under Canada-Colombia (Article 1409)
1409 (b) where the goods or services can be supplied only by a particular supplier and no reasonable alternative or substitute goods or services exist for any of the following reasons:
(iii) due to an absence of competition for technical reasons.

Applicable Limited Tendering Provision under Canada-Honduras (Article 17.11)
17.11 (b) a good or service being procured can be supplied only by a particular supplier and a reasonable alternative or substitute does not exist because:
(iii) there is an absence of competition for technical reasons.

Applicable Limited Tendering Provision under CFTA (Article 513:1)
513:1(b) – if the goods or services can be supplied only by a particular supplier and no reasonable alternative or substitute goods or services exist for any of the following reasons:
(iii) due to an absence of competition for technical reasons.

Applicable Limited Tendering Provision under Canada–Panama Free trade agreement (Article 16.10)
16.10 (b) the procurement can be carried out only by a particular supplier and a reasonable alternative or substitute does not exist because:
(iii) of the absence of competition for technical reasons.

7. Title to Intellectual property

Not applicable.

8. Contract Period

The period of the Contract is from date of Contract to June 30, 2020 inclusive.

9. Estimated Cost

The estimated maximum value of the contract is $110,00.00 to $115,000.00 including all applicable taxes.

10. Exception applied as per the Government Contracts Regulations and applicable trade agreements

Sole Source Justification - Exception applied as per the Government Contract Regulations (GCR):

(d) Only one person or firm is capable of performing the contract

The contractor must:

1) Be an international geospatial standards development and testing organization who develops international open geospatial standards in an open environment with governance linkages to the broader standards and Web communities, including at a minimum the International Organization for Standardization (ISO) and the World Wide Web Consortium (W3C).
2) have experience developing and maintaining open, international geospatial standards that have achieved widespread adoption by the global geospatial community.
3) have experience issuing Requests for Information to the international geomatics community on domain-specific geospatial topics and consolidating responses into engineering reports and proposed interoperable, open spatial data architectures;
4) have enabled geospatial data analysis focused on buildings and energy using open standards such as CityGML;
5) have experience developing Earth observation applications using Light Detection and Ranging (LiDAR) cloud data (big data), based on OGC and other relevant standards, with relevant OGC standard/domain working groups;
6) have experience in identifying and characterizing buildings based on existing linked data environment geospatial web services via linked open data technologies;
7) have experience in geospatial web service and application development using data, and must have experience in developing these for buildings-related applications; and
8) have in place an Innovation Program (or equivalent) that will enable future research to be completed that will build on outcomes of the BEMA-CDS. This program must be capable of producing results that can be officially accepted and implemented by the OGC.

11. Name and Address of the Proposed Contractor

Open Geospatial Consortium
35 Main Street, Suite 5
Wayland, MA 01778-5037
USA

12. Inquiries on Submission of Statement of Capabilities

Suppliers who consider themselves fully qualified and available to provide the services/goods described herein, may submit a Statement of Capabilities in writing, preferably by e-mail, to the contact person identified in this Notice on or before the closing date and time of this Notice. The Statement of Capabilities must clearly demonstrate how the supplier meets the advertised requirements.

13. Closing Date

Closing Date: December 6, 2019
Closing Time: 02:00 PM EST

14. Contract Authority

Len Pizzi
Senior Procurement Officer
Natural Resources Canada
183 Longwood Road South
Hamilton, ON
L8P 0A5
Telephone: (905) 645-0676
Fax: (905) 645-0831
E-mail : len.pizzi@canada.ca