**Invitation for Proposals**

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**CUSTOMER ENERGY SOLUTIONS INTEREST GROUP (CESIG)**

**CEATI PROJECT No. CESIG-10-02**

# ENERGY EFFICIENT SWITCHING EQUIPMENT FOR PROTECTION AND CONTROL

CEATI International Inc. (CEATI) invites the submission of proposals to perform research work on the following topic:

## TITLE

*Energy Efficient Switching Equipment for Protection and Control*

## INTRODUCTION

Low voltage AC loads such as 3-phase and single phase electric motor loads operating at voltages of 600V, 60Hz and below, require switching devices for protection and control purposes, as covered by NEMA standards. For electric motors these devices are generically referred to as "motor starters". Traditional motor starters consist of three components that are connected in series: a circuit breaker (electro-dynamic protection), a thermal protective device (overload relay) and a contactor.

These devices incorporate two circuits working at two different voltages:

- The power circuit used to connect the load to the power supply that is part of the power line ("heavy currents circuit").
- The control circuit that is an electromechanical device activated by a coil that could be excited at lower voltages ("light currents circuit").

These devices do not consume "standby power". They consume power ($P_{loss}$) only when the loads are energized:

- Active power losses due to resistances of those three components inserted in power circuits when traversed by "heavy currents" and dissipated as heat ($I^2R$ losses).
- These power losses generate energy losses which can be minimized by the introduction of new solid state or low power devices.
- Power losses on the control circuit ("light currents") used to keep the electromechanical control device energized.

In order to reduce power losses, the traditional electromechanical control circuit is replaced by an electronic control device with reduced number of power contacts. An important reduction of power losses has been obtained as a result of introducing these two major modifications.

- Reduction of $P_{loss}$ dissipated as heat by switching devices for low voltage AC loads will enable:
    1. Significant power demand and energy savings on all commercial and industrial applications
    2. Reduction of temperature rise of the equipment, inside the distribution boards (DBs) and in motor control centers
    3. Reduced intensity of insulation degradation process in DB circuitries
- By reducing the temperature rise of switching devices, the energy consumed by HVAC installations in motor control centers will also be reduced.
- Influence on electric motors:

1. Reduction of the number of power contacts will reduce the probability of occurrence of unbalanced DC resistance on the power contacts; this will result in a reduction of unbalanced voltages applied to loads with direct improvement in electric motor efficiency
2. Electronic control will enable a reduction of overvoltage spikes and other transients occurring during device trips

- The new equipment withstands up to 2-3 consecutive load tripping (and re-closures) that will enable reduction on materials and energy spent to manufacture power contacts by reducing 2-3 times the material consumption on power contacts used to be replaced after tripping or re-closures.
- Other non-energy benefits:
    1. Reduced dimensions of the DBs (this will influence Canadian Electrical Code) and NEMA standards.
    2. Reduced manpower costs to fit new equipment
    3. Reduced maintenance costs for changing contacts.
    4. Easy interface connection on control circuit (useful for smart meter initiative)

Currently, new electronic switching devices (motor starters) are available in sizes up to 20 HP, 600V.

## PROJECT OBJECTIVES

The objectives of this study are:

1. to undertake a technology and market assessment study of the current industry practice, for traditional and energy-efficient switching/starting and solenoid control technologies;

2. to estimate/establish the potential energy and demand savings by switching to the most efficient technologies available (in sponsor jurisdictions).

## SCOPE

Electric and electronic control devices to be included:

1. Traditional and Low power dissipation motor starters and controls
2. Traditional and Low holding power electronic solenoid coil controls
3. Three-phase zero-load power devices

The market and technology assessment will address the outline indicated below. Data for traditional switching devices (coil and solenoid operated) and new electronic or low power devices serving the same function must be presented separately.

1.0 Purpose & Objectives

Provide a brief summary of what the report is about and why it was created.

## 2.0 Technology Analysis

### 2.1 Description of Technologies

Describe the physical and functional characteristics of the new technologies and explain the principles behind their operation. Compare them to other traditional technologies performing the same function and explain the differences, advantages and disadvantages of the new technologies.

### 2.2 Demand and Energy Savings Potential

Provide expected energy savings and explain how the savings are achieved. Explain what variables in application will affect savings and how. Identify the best and worst application scenarios for achieving maximum energy savings. Support data with examples and case studies.

### 2.3 Reliability

Describe the expected service life and required maintenance of the technologies and compare them to competing technologies.

### 2.4 Power Quality

Describe any affect that the new technologies have on power quality, how the technologies are affected by power quality and what steps can be taken to mitigate power quality concerns.

### 2.5 Health and Safety

Explain any Health and Safety related concerns or benefits that may be connected to the manufacture or use of the new technologies.

### 2.6 Environmental Impact

Explain what impact the new technologies have on the environment in their manufacture, use, maintenance and disposal. Is there any potential impact on GHG emissions?

### 2.7 Functional Impact of Improved Technology

Summarize the tangible changes that will result from the introduction and application of these technologies.

## 3.0 Market Analysis

### 3.1 Market Application

Describe the current market for the new technologies. Identify the buyers, sellers, decision makers, decision drivers and roadblocks influencing their market uptake. Explain the purchasing processes that are generally followed and the channels of distribution.

3.2 Market Penetration

Determine the current degree of market penetration for the new technologies. Identify the number of existing traditional devices. Provide a breakdown of the number and percentage of each type of device that has been installed, new and as replacement equipment, over the last five years. Measure and explain any evident changes or trends in the numbers. Provide dollar value sales figures as well as number of units for each item. Data is to be presented for each province separately, and for all of Canada.

3.3 Market Potential

Determine the potential market for the new technologies. Estimate the degree to which the new more efficient devices can replace the traditional devices used by industry. Estimate the number of new more efficient units that could eventually be installed annually and in total and the ratio of new electronic to traditional coil and core installations that could conceivably be achieved. Provide a time line for achieving maximum market penetration. Data is to be presented for each province separately, and for all of Canada.

3.4 Impact on Manufacturing Industry

Describe the impact that the new technologies have had and will have on the manufacturers of products for this application in terms of capital investment, labour, training, profit and cash-flow. Identify and locate the manufacturers.

3.5 Price Analysis

Describe the current pricing of the new technologies and how they compare to competing technologies. Forecast future pricing trends and how the growth and distribution of the technology will respond to the changes. Explain how costs for both new and retrofit installations will be affected.

3.6 Promotion Analysis

Explain what agencies or other drivers are in place to encourage the development and dissemination of these new technologies.

3.7 User Analysis

Describe consumer perspective on the new technologies and their applications. What do the users think of the way that the function is presently handled and do they appreciate the benefits provided by the new technologies? Provide a cost/benefit analysis using the current technology as a baseline. Estimate the reduction in maintenance cost over the life of electronic switches, solenoids and other coil and core devices based on the maintenance practices applied to existing installations. Data is to be presented for each province separately, and for all of Canada.

3.8 Potential Partners, Allies & Opponents

List and describe potential sources of support for and opposition to the new technologies. Suggest a strategy to develop beneficial relationships and reduce opposition through cooperation and partnership arrangements.

4.0 Recommendations

5.0 References

5.1. Canadian standards – identify existing relevant government and industry standards.

5.2. U.S. standards – identify existing relevant government and industry standards.

5.3. International standards – identify existing relevant government and industry standards.

5.4. Other references – identify other relevant information sources.

## POTENTIAL BENEFITS

A conservative estimate conducted by BC Hydro, considering only motor applications up to 20 HP, reveals that the energy savings available from the transformation of this application would be in the order of 160 GWh per year in Canada and approximately ten times more in the United States.

## DELIVERABLES

The successful proponent is expected to prepare a ready-to-publish report on the results of the investigation and present the results to funding consortium members. The completed report must be submitted for CEATI approval in editable, electronic format (Microsoft Word). In addition, the platform and version should be specified for any software or programs to be developed.

Progress reports will also be required on either a quarterly or milestone basis - normally these are scheduled to coincide with the completion of the identified tasks.

The successful proponent is also expected to provide the following:

- A ten to fifteen (10-15) slide Power Point Presentation. This should be composed of three main sections:
    1. The factors motivating the initiation of the work;
    2. A description of the main findings;
    3. Summary of the conclusions and recommendations for future research.

- Contents for the Project's Technical Brief. This is a summary of the report (between 1,000 and 1,500 words), which is published separately by CEATI. Proponents are not responsible for the preparation of a ready-to-print Technical Brief, but solely to provide the contents for the following 4 sections: Background, Summary, Conclusions and Recommendations.
    1. The Report Background section should be short (approximately 200 words) and should detail the reasons the work was conducted.
    2. The Summary section should be approximately 700 words. It must provide a general description of the work program.
    3. The Conclusions section should be about 150 words and should provide a general outline of the key results (do not include specifics).
    4. The Recommendations section should be about 200 words and should include a description of the potential applications of the results.

Please note that all reporting must be submitted in English. If written English is not the author's strong suit, it is recommended that a technical writer be hired to review the document prior to submission.

## BUDGET AND SCHEDULE

The proposal must contain a schedule and a quote of required remuneration for the work in US or Canadian dollars. All prices shall be presumed to be in Canadian dollars (CAD) unless explicitly specified otherwise in the proposal. Proponents' responses to this section must include a full breakdown of the budget and schedule, including an indication of rates and hours and the task allocation for the key personnel by task and must correspond to any phases or milestones outlined above. (Please refer to the Proposal Template for more information).

It is expected that this project can be completed (draft final report submitted for review and approval) within 4-6 months of initiation.

The proposal must include the names and qualifications of the key individuals who will be involved, as well as the name of the accountable manager.

**CEATI is not bound to accept any proposal but any selection will take into account technical merit, qualifications, price and schedule. A proposal may be accepted in whole or in part. A commitment to proceed with the first phase of a multi-phase project does not automatically imply that the work of the subsequent phases will be undertaken**.

## ALTERNATIVE WORKS

Proponents shall generally follow the above description of work, but are encouraged to offer alternative works if these alternatives will meet the objectives and provide a better end product to the utilities sponsoring this work. Alternatives shall be fully described including logistics explaining why the alternate works are being offered and the benefits to be realized by the funding utilities. Where alternatives are proposed, separate budgets shall be calculated for each alternative.

## SUBMISSION OF PROPOSALS

The consideration of proposals received will be limited to those who indicate their intent to employ a suitable experienced project team and who possess proper facilities to perform the work. Receipt of this "IFP" does not necessarily constitute a prior determination by CEATI that your organization has the requisite experience and facilities.

The proposal must be properly completed and executed in accordance with the CEATI guidelines available at http://www.ceati.com/guidelines.php, and shall be submitted to CEATI as an attachment in Microsoft Word at the following website: www.ceati.com/private/submissions. Be sure to indicate project number "**CESIG-10-02**" on the submission form. For assistance, please contact us at 514-866-5377 x 236.

## CLOSING DATE FOR RECEIPT OF PROPOSALS

**Thursday, April 8, 2010, 4:00 pm EDT**