

2014 August 27

Support for Camrose Performing Arts Centre STARS Innovation Credit

To Whom It May Concern;

I am writing to express my very strong support for the Camrose Performing Arts Centre in its submission for a 2014 STARS Innovation Credit for the University of Alberta.

The Camrose Performing Arts Centre (CPAC) is a community-oriented facility that is breaking new ground in the application of sustainable building design and revolutionary new technology. CPAC is an exciting project that highlights sustainable building design within the Camrose and University of Alberta communities and beyond. In particular, it includes solar photovoltaics (PV) and light emitting diodes (LED) in an arts-performance building.

Solar PV is a fascinating and challenging technology that combines facets of visual, structural, electrical, energy, economics, emission reductions, grid connection and politics into one system. The 122-kW array of solar PV modules is integrated into the wall structure on all four directions of the theatre's fly tower and is expected to supply around 20% of the building's annual electric energy consumption. This is the largest building-integrated (BIPV) system in Canada and represents important leadership for Canada's building architectural and engineering disciplines. A BIPV system is one in which the system's solar PV modules are integrated into and form an important part of the building's wall or roof assembly instead of just being fastened on to the exterior of an existing assembly. The next-largest BIPV system is 86 kW on the flat roof of a building in Toronto.

As with most first-time leading-edge projects, challenges were encountered in designing and installing CPAC's BIPV system that were unique and not found in standard building-attached PV systems. These challenges arose because:

- of the azimuth orientation on all four walls causing this system to effectively be four PV systems in one, each with different outputs at different times of the day;
- PV array ventilation was reduced (for architectural reasons);
- of the vertical exposure to the sun as it sets in the western sky plus significantly-increased reflection from snow fields in March;
- of tight building dimensions, tolerance variations on the width of the PV modules and temperature-based expansion coefficients of the aluminum mounting rails; and
- of changes to the electrical code that caused inverter technology to change part way through the design process.



Some of these challenges are pushing the boundaries of our knowledge about integrating solar into the building design process, about their mounting on wall surfaces and about solar PV operation throughout the year. Measuring the system's energy performance will reveal the potential for solar PV in these less-conventional configurations.

Along with solar PV generation, CPAC also reduces its grid energy consumption in a number of significant ways, most notably by using very high-efficiency LED lighting, energy-efficient boilers, chillers, fans with infinitely-variable speeds and higher levels of insulation. The use of LED lighting for stage lighting in the theatre is unique and innovative – CPAC broke all kinds of new ground with this lighting. It is the first theatre in Canada that uses LEDs for its entire house and stage lighting – there are no incandescent lights. It is likely among the first 20 theatres in the world that have lighting based entirely on LEDs. This is especially important because theatres have stringent lighting requirements and theatre designers and owners are more comfortable in specifying and operating the well-known older technologies. Breaking through this barrier needs designers and owners that are willing to accept the technical specifications of these less-familiar technologies and then to demonstrate them to the world. It sounds like CPAC could become a destination for theatre owners, designers and actors wanting to experience this revolutionary new technology.

The requirements of a theatre are much more rigorous and specialized than many other lighting applications. To successfully implement LED lighting within CPAC is a great feat and serves as an example for other performing arts spaces under development or considering renovations. The LED stage lighting uses next generation seven-colour LEDs, which can change their colour and intensity. As a result coloured plastic films (called “gels”) are not needed in front of the lights in order to get the required colour tones and balance. Gels typically need to be replaced after every three hours of use because the huge amount of heat generated by the standard incandescent lighting bleaches out the colour from the gels. As a result, theatres have two sets of stage lights – one for rehearsals, which are not as bright, and one for performances. Because of LEDs' cool operating temperatures and their adjustable colour, only one set of stage lighting needed to be designed, purchased and installed in CPAC. Furthermore, because of the LED's cool temperatures, CPAC doesn't require as much building cooling equipment nor does it need to spend as much money on cooling energy. In addition the lifetime of the LED lights is around 90 times longer than incandescent lights (50 000 hours or 45 years of life if used three hours per day instead of 300 to 500 hours or six months). All of this adds up to savings in energy, replacement and labour, and initial equipment and infrastructure. It is estimated that the LED lighting reduced electrical loads from 184 kW to 25 kW and saved more than \$100 000 on infrastructure costs alone.

One of the key ways to better enable solar-electric generation is to bundle its costs and savings with energy efficiency measures. Solar PV facilitates energy efficiency by making energy efficiency more relationally exciting and thus motivating people to becoming more energy efficient. Energy efficiency facilitates solar PV by paying for most of it and increasing the portion of energy loads supplied by solar. We know that sustainability consists of three pillars of capital: economic capital, environmental capital and social capital – all of which are being successfully integrated into a high-profile setting by



the CPAC project. The table below highlights the conceptual value of bundling solar and energy efficiency across these pillars.

	Energy Efficiency	Solar PV	Energy Efficiency Combined with Solar PV
Return on economic capital	high	medium	medium
Return on environmental capital	high	high	high
Return on social capital	low	high	high

The application of all these new technologies will yield many years of research, evaluation, presentations and notable leadership for the University of Alberta.

In my opinion, the Camrose Performing Arts Centre is well deserving of an Innovation Credit through STARS, and is a building of which the University of Alberta and its partners and surrounding community can be very proud for many years.

University of Alberta
Quaecumque vera

Sincerely,

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Managing Partner
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