# Solar Energy Study Bulletin #2

# Kings County Landfill Site

# Meadowview, Nova Scotia

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## Introduction

In our earlier report, dated May 2016, on the feasibility of a solar electricity generating station for the closed landfill site in Meadowview, North Kentville, Nova Scotia, we estimated that a 3.87 megawatt (MW) solar generating facility could be installed there, which would generate at least 4.45 gigawatt-hours (GWh) of electricity per year. For details, see our earlier report.[1]

This bulletin contains our analysis of the relationship between potential solar electricity generation at the site and the electricity consumption of the adjacent Canadian Department of National Defence's Land Force Atlantic Area Training Centre at Camp Aldershot (herein referred to as "Camp Aldershot". Our intention is to better understand the electricity demand of this facility and estimate how much of the energy production of the solar generator could be used by Camp Aldershot, on a month-by-month basis.

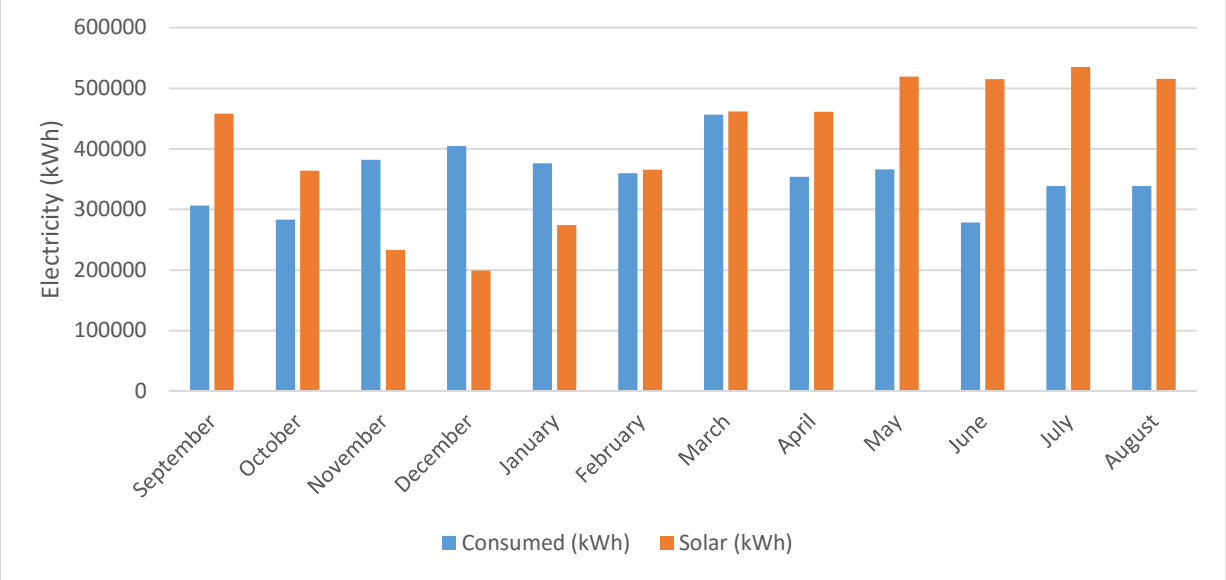
## Methods

Staff at the Department of National Defence, who manage Camp Aldershot, provided records for one year, of electricity consumption and peak power demand, based on their electricity bills from Nova Scotia Power. We estimated the solar electricity production in each month, using RETScreen renewable energy modelling software from Natural Resources Canada.

## Results – Monthly and Annual Solar Production

The chart below compares monthly electricity consumption at Camp Aldershot with estimated output of the proposed 3.87 MW solar array.

**Figure 1:** Monthly electricity consumption at Camp Aldershot and potential solar electricity production.




[1] Ryan Ferdinand & Wayne Groszko, Solar Energy Feasibility Study, Kings County Landfill Site, Nova Scotia Community College, May, 2016

As Figure 1 indicates, in most months of the year the potential production from the proposed solar array exceeds electricity consumption at Camp Aldershot. There are three months – November, December, and January, when consumption at Camp Aldershot exceeds potential solar electricity generation. In those three months, Camp Aldershot may use all of the solar array's production and more. In the other 9 months of the year, there is a potential solar energy surplus that could be sold to other customers or used for other purposes at the site.

On an annual basis, the electricity consumption of Camp Aldershot is approximately 4.24 GWh, and our RETScreen analysis estimates solar electricity production of 4.90 GWh[2], leaving an annual surplus solar energy production of 0.66 GWh. However, as Figure 1 shows, the surplus is generated from May to September, and the shortage of solar production is in November through January. It is difficult to store large quantities of electricity for long periods of time at this site, therefore it is unlikely that the surplus from the summer will be stored for use at Camp Aldershot in winter. Due to this seasonal variation, the largest amount of solar electricity that Camp Aldershot is likely to use in this scenario is 3.79 GWh per year, leaving 1.11 GWh per year to be sold to other customers when it is available. This is an over-estimate of the amount that Camp Aldershot will use. Due to hourly and daily variations, unless there is short-term storage as discussed below, mid-day surplus electricity will also have to be sold elsewhere, because there will frequently be times on sunny days, between 10 am and 2 pm, when solar power production will exceed the power demand of Camp Aldershot.

## Discussion – Value of Energy Storage

On an hourly and daily basis, if there is no electricity storage facility built with the solar array, such as a large battery or other storage device, then all the electricity from the array would need to be supplied instantaneously to Camp Aldershot, or to another customer, or be lost. Many times will occur when more solar energy is available than can be used at Camp Aldershot in that moment. For example, the peak load of Camp Aldershot rarely exceeds 1 MW, but on sunny days in the mid-day period the proposed solar array could readily produce over 3 MW. The excess rate of power generation at mid-day on sunny days must either be used by other customers, stored in a storage system for use later the same day, or foregone as lost potential.

The ability to store energy to cover short-term variations in solar generation and customer load is one of the strong arguments for including an innovative energy storage aspect to this project. A facility capable of storing and supplying a significant portion of Camp Aldershot's peak load (approximately 1 MW) for a period of a few hours, would greatly enhance the value of the proposed solar electricity station.

Another argument for including energy storage in the project is to gain the ability to decrease the peak demand of Camp Aldershot on the Nova Scotia Power electricity distribution system. As a Nova Scotia Power customer, the Department of National Defence pays a significant demand charge, amounting to about $95,000 per year, which is about one fifth of its annual electricity bill, for the service of using peak power. This charge is on top of the approximately $350,000 per year spent on the energy portion of the

[2] Note that the RETScreen analysis in this bulletin projects a slightly higher annual production (4.90 GWh/y), compared with the estimate from our earlier report (4.45 GWh/y). This is due to slight differences in the method of estimating, and is not a large enough difference to change the conclusions of this bulletin.

electric bills. Being able to reduce peak demand would decrease electricity bills significantly, while also contributing to improved performance of the Nova Scotia electricity network.

Adding an energy storage system will increase the capital cost of the project. However, energy storage brings significant advantages, as described above, and would also add an innovative feature to the project. Without storage, the solar PV array would need to sell its energy instantaneously to one or more customers, whenever the sun is shining.

## Conclusion

The size of the proposed solar PV array at the closed landfill site in North Kentville (3.87 MW of capacity) is appropriate in scale to the size of the load at Camp Aldershot. Solar electricity production will exceed the consumption of Camp Aldershot on an annual basis, and in 9 of the 12 months of the year.

While the annual production from the proposed solar array is similar to the annual consumption at Camp Aldershot, this Department of National Defence facility would only consume a portion of the projected solar production, due to differences in the timing of production and load. Camp Aldershot represents a significant and important potential key user of the electricity from the proposed solar array, but will not be the sole user of the electricity.

To take better advantage of the solar resource and apply it to the nearby load at Camp Aldershot at the times when it is needed to reduce peak load, an integrated energy storage system would be advantageous for this project. The storage facility and advanced power management facility will add capital cost, but will also enhance the value of the project. Adding storage to the project will be an innovative feature that will contribute to the national and global renewable energy transition, as the world confronts the need to develop more and better systems for storing renewable energy.

In any likely scenario, even including an appropriate amount of energy storage, there will still be excess electricity available for sale in the middle of the day on sunny days. To make the project successful, other customers are needed to purchase the mid-day surplus. Initiating a discussion with the Nova Scotia Health Authority may be helpful, as the Valley Regional Hospital is another large electricity consumer near the proposed site.