Project Summary: Energy OASIS (**O**pen **A**ccess to **S**ustainable **I**ntermittent **S**ources)

Smart Microgrid Applied Research Team (SMART) Lab, British Columbia Institute of Technology

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PROJECT BACKGROUND

In British Columbia, where the majority of electrical power is generated from hydro-electric systems, motor vehicle emissions constitute the largest portion of the province's emissions. One way to reduce greenhouse gas (GHG) emissions is to electrify the transportation system. BC leads Canada in market interest for electric vehicles and related infrastructure. Advances are underway in vehicle battery technology and charging infrastructure, including the installation of "fast charging" stations that enable electric vehicles to be charged in a matter of minutes. Given the high instantaneous demand by "fast charging" of increasing numbers of electric vehicles there has been some concern of adverse impact on electric grid.

British Columbia Institute of Technology's (BCIT) Energy OASIS project demonstrates solutions that could be employed to help mitigate the impact of fast-charging on the grid. The Energy OASIS project was awarded $4.2M from the Federal Government to integrate photovoltaic panels and Li-Ion energy storage for a Level-3 electric vehicle charge station within BCIT's Smart Microgrid system.

RESULTS

A joint working group between BCIT's Smart Microgrid Applied Research Team (SMART) and BC Hydro took on the task of defining the OASIS initial blueprint. The project officially kicked-off in June 2012 with a partnership including BC Hydro, Panasonic Eco Solutions Canada (PESCA), Siemens Canada, Schneider Electric, and car2go. The OASIS system components include: a 500 kWh Li-ion Battery Energy Storage System (BESS), a 250 kW solar photovoltaic (PV) system, 2 DC Fast Charge (DCFC) stations for electric vehicles (EV), and a highly sophisticated energy management system (EMS). The EMS performs energy balancing between solar PV system generation, EV charging loads, battery energy storage system, and local power distribution grid.

After extensive on-site testing, including component commissioning, system integration, system functional testing and use-case testing, the system came online in March 2014. In the months following, component problems and deficiencies had to be addressed. During the first 4 months the operational up-time was less than 20%. Once the key issues were resolved, the average overall operational up-time for the first data year (March 2014 to 2015) was 42%. Ultimately the project has successfully demonstrated the use of a solar PV system to support EV charging stations through use of energy storage.

When fully operational the OASIS solar PV system is estimated to be capable of generating over 142MWh per year. Depending on how OASIS is configured, some of that energy can go towards supporting charging of electric vehicles, and some can go back into the BCIT grid to help offset costs of energy for the campus, and to helping reduce our carbon footprint.

The 2 DC quick chargers at Energy OASIS were used approximately 169 times over the first year, consuming 1296 kWh of energy. The vehicle models which used the chargers included the Nissan Leaf, Mitsubishi i-Miev and Tesla Model S. An average charging session was approximately 23 minutes long and used 7.67 kWh of energy. While the chargers have not yet been publicly announced, their use by EV drivers is relatively high, but still below the capacity that the system is capable of sustaining.

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BENEFITS

The project showcases the integration of renewables, energy storage, electric vehicle charging loads, and intelligent controls in a microgrid environment. Project outcomes support the growth of EVs, thus contributing to the reduction of GHG emissions in Canada. Furthermore, replication of the project could support electrification of remote, off-grid communities, and the development of urban renewable energy neighbourhoods and 100% RE cities.

NEXT STEPS

Several observations were made during the first data year and will be further tested. For example, the BESS was capable of storing energy from both the grid and the solar PV installation, and discharging the energy back to the grid or to the EV chargers but with a round trip loss of 30%. Longer term testing is required to confirm or disprove the observed loss.

SMART Lab researcher staff and collaborators continue to collect data on all Energy OASIS components, including the battery charging, the solar PV generation, and the electric vehicle charging sessions. The EV charging data being collected is currently being used in ongoing research on planning for electric vehicle fast charging station locations in BC and elsewhere in Canada, and the US.

The solar PV generation and energy storage data is being collected and analysed for ongoing research in renewable energy integration, for example for replication in both urban and remote renewable energy communities. BC has one of the largest number of remote off-grid communities in Canada. Most of these communities currently rely on diesel generation. In urban environments cities like Vancouver and Victoria have committed to using 100% renewable energy by 2050. Energy OASIS provides replication opportunities in support of solar PV and renewable energy solutions in urban neighbourhoods. SMART researchers are working with a number of external, and internal BCIT researchers, faculty and students on these and other activities. The team welcomes the opportunity to discuss other related research interests and potential project collaborations.

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