

UBC SUSTAINABILITY SCHOLARS PROGRAM
Summer 2018

Research project title

Evaluating the Impact of Heat Pumps in Skidegate, Haida Gwaii

Goal or Operations Plan objective

This project aims to evaluate the impact that installation of heat pumps has had on individual households in Skidegate, on the community of Skidegate as a whole, and on the Southern Grid of Haida Gwaii. Key objectives for this research include:

- Establishing baseline conditions prior to heat pump installation (e.g., primary heating types, annual and seasonal energy consumption and load, greenhouse gas and air pollutant emissions, behaviours related to household energy management, etc.)
- Establishing conditions post-heat pump installation (e.g., heat pump make and model, power factor for heat pump in heating and cooling mode, annual and seasonal energy consumption and load, greenhouse gas and air pollutant emissions, behaviours related to heat pump usage and household energy management, etc.).
- Analyzing and documenting changes between the pre-and post-scenarios and developing recommendations to inform future projects.

Outline scope of project and why it is of value to your organization. Describe how and when the scholar's work will be actionable.

BC Hydro provides electricity to Non-Integrated Area (NIA) customers on the southern grid of Haida Gwaii, including Skidegate, via a Diesel Generating Station (DGS) at Sandspit (responsible for providing approximately 30% of energy needs) and via a renewable energy plant owned by an Independent Power Producer (responsible for providing approximately 70% of energy needs). Other communities on the Southern Grid include Sandspit, Queen Charlotte and Tlell. The cost of service in BC Hydro's NIAs exceeds the revenue recovered through the tariff rate; NIA customers pay about \$0.12/kWh, while BC Hydro's marginal cost of generation in some NIA communities is as high as \$0.35/kWh and varies with the price of diesel. In addition, diesel generation emits greenhouse gases and other air pollutants.

BC Hydro recognizes that are business benefits to be gained through more aggressive pursuit of demand-side management (DSM) in NIAs, including: reducing our cost of service; delaying/avoiding capital spending on DGS capacity upgrades; energy savings, reduced diesel use and GHG emissions, and; reputational benefits in the form of strengthened relationships with remote communities and First Nations. DSM also provides benefits to communities including: improved home comfort; lower energy costs; improved air quality; climate mitigation, and; a sense of empowerment around their energy future.

While we recognize these benefits, we also understand there are challenges associated with the implementation of certain DSM measures in NIA communities. For this project, we are focusing on ductless air source heat pumps and would like the support of a Scholar(s) to both quantitatively and qualitatively assess the impacts they've had in Skidegate and on the southern grid of Haida Gwaii.

In 2015-16, the Skidegate Band Council installed heat pumps in approximately 360 homes on reserve in an effort to improve energy efficiency and reduce household energy costs. BC Hydro provided rebates on approximately 325 eligible heat pump installations via its Home Renovation Rebate program. We propose to use data from this project as a case study to explore the impacts that heat pumps have had on individual households in Skidegate, on the community of Skidegate as a whole, and on the Southern Grid of Haida Gwaii, including.

- **Impacts on Energy and Costs, GHG Emissions and Air Quality:** Pre and post-heat pump energy consumption and energy cost data will be provided to calculate actual energy and energy cost savings. In addition, data on pre-existing heating types and on heat pump makes and models will be provided to assist in estimating impacts on GHGs and air pollutant emissions.
- **Load Impacts:** Traditional heat pumps have high starting currents (spike loads). It will be useful to compare the load profile of ductless heat pumps versus traditional heat pumps versus baseboard heaters. There is a concern that coincident spike loads from a large number of heat pumps in the community may cause power quality issues in the system. Medium resolution (15

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min snapshot) community load data can be provided for periods before and after heat pump installation.

- **Impacts on the Customer (Customer Experience):** The Scholar will be expected to conduct surveys or interviews with customers and stakeholders to better understand behaviours as they relate to household energy management and to shed light on some of the challenges and opportunities associated with heat pump installation, operations and maintenance from the customer perspective.

Research results and lessons learned from this study will inform further follow-up with customers in Skidegate, as well as provide insight into the design and delivery of future DSM programs for NIA communities.

Deliverables

- A project kick-off meeting and regular project meetings with BC Hydro staff
- A final report, containing a summary of completed work (e.g., research methods, inputs, data analysis, results and recommendations) with details provided in appendices
- A final presentation to BC Hydro staff and key stakeholders
- Executive Summary for the UBC Sustainability Scholars online project library.

Department

- BC Hydro Conservation & Energy Management

Time Commitment

- This project is expected to take 250 hours to complete.
- This project must be completed between April 30 and August 10, 2018
- The scholar should aim to complete approximately 20 hours of work per week with the majority of those hours taking place Monday to Friday from 9am to 5pm.
- The work location is flexible and will be discussed with the scholar. Some elements of the project may require that the scholar be in our downtown Vancouver office or at our Burnaby (Edmonds) campus (e.g., project meetings), while other aspects of the work could be completed remotely.

Skill set/background required/preferred

- ✓ Excellent research and writing skills
- ✓ Familiarity with research methodologies and survey techniques
- ✓ Strong analytical skills
- ✓ Ability to work independently
- ✓ Demonstrated time management skills
- ✓ Deadline oriented
- ✓ Project management and organizational skills
- ✓ Familiarity with qualitative research methodologies and implementation
- ✓ Familiarity with quantitative research methodologies and implementation
- ✓ Comfortable interacting with strangers to conduct public/in person surveys
- ✓ Electrical engineering background considered an asset

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