Building Highly Energy-Efficient K-12 Schools: Practical Insights and Strategies Workshop – Q&A Document

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Climate Challenge Network:

- Ian Jarvis, Executive Director
- Marc Madi, Energy Efficiency and Decarbonization Lead (Education Facilities)
- Kajen Singham, Energy Efficiency and Decarbonization Project Lead
- Carolyn Shier, Project Manager (Education Facilities)

Workshop Panelists:

- Hassan Shahrukh, Energy Manager, Facility Projects, Calgary Board of Education AB
- Andrea Lawson, Design Team Lead, Nova Scotia Department of Public Works NS
- Luke Smeaton, Manager of Sustainability, Energy, and Environmental Planning, North Vancouver School District BC
- Steve Allum, Manager, School Energy and Environmental, Halton Catholic District School Board ON

Workshop Description:

- Climate Challenge Network is conducting a national research project on behalf of Natural Resources Canada's Codes Acceleration Fund, which is examining the operating energy efficiency of recently constructed K-12 schools. We have benchmarked energy performance of more than 200 schools from 5 Canadian provinces which opened since 2015, including an NECB2020 reference archetype school.
- Results show a wide range of performance, and discussions with school boards are uncovering the planning, design, energy modelling, construction, commissioning, and operations factors associated with the best performers. The workshop, with 65 participants from 38 school boards, governments and industry, provided an opportunity for attendees to learn about findings to date and hear a panel discussion about lessons learned which can enable every new school to meet high efficiency standards.

Question	Response
Is there any evidence that one province's delivery model is superior to the others?	**Marc Madi:** That's a great question and one of the things we are looking to uncover in the next stages of the research.
What are the reference energy standards for BC new schools? Thanks.	**Luke Smeaton:** The BC Building Code references NECB 2020 for schools. There are currently no Energy Step Code or Zero Carbon Step Code targets for schools.
Alberta Infrastructure had a study conducted that determined that GSHP was not a solution for cold climates. A GSHP system requires a balance of the heating and cooling loads to ensure the ground temperature is maintained.	**Marc Madi:** Agreed. For geothermal systems to work properly, long-term thermal simulation should be done to ensure the ground remains thermally balanced between heating and cooling seasons. For cold climates, that might means having a larger borehole field to allow more surface area and quicker ground rebalance, but where land limitations do not permit, an additional replenishing heat source like solar thermal panels or electric boiler (operating during night at off-peak rates) would ensure thermal balance.
	Kajen Singham: Hi Mark, we'd definitely be open to reviewing and including the study AI has completed on this within our work on this project. Please let us know if you'd be able to share this study with us.
For Geothermal, is it necessary for a building to have cooling load during the summer month, to balance the heat content in the geothermal field?	**Marc Madi:** Generally, yes. Cooling helps maintain ground thermal balance (whatever is extracted in the winter for heating is replenished during the summer). In some cases, additional replenishing sources like solar thermal or electric boilers operating off-peak could be used to help in replenishing.
You mentioned that the cost/benefit analysis for geothermal systems is questionable due to varying electricity rates. Have any of the facilities in this analysis installed renewable energy systems to offset peak electricity demand and annual electricity costs associated with geothermal or other electrification activities?	**Marc Madi:** Since geothermal relies on electricity, it is significantly impacted by electricity rates and rate structures. We expect that future electrical rates will encourage such electrification. We haven't yet examined the system details of the top performers.
How does your calculated ekWh/ft^2 compare to EnergyStar PM K-12?	**Ian Jarvis:** They are generally comparable. ESPM is a comparative ranking system (percentile) while EUI is numeric and more readily related to building system and operational metrics being examined for this project.

The BC Energy Step Code and Zero Carbon Step Code do not include above Code targets for schools specifically. Rather, school performance is expected to follow the requirements of the Environmental, Social and Governance Framework for Capital, and its CleanBC pillar sets resilience, green building, GHG performance and EV readiness requirements.	**Marc Madi:** Thanks, Adrian!
Questions for the school boards. How open are school boards to operating new equipment, such as air-to-water heat pumps? There is a significant budget implication to adding this type of equipment to schools. If school boards shut them off to simplify operation, that is not a justified use of project budget.	**Luke Smeaton:** Great point. Speaking from the perspective of a school district that has had air-to-water heat pump systems in place for almost 20 years, it is still a big challenge. Internal trades staff are easily able to troubleshoot and repair boilers, but refrigeration equipment, including heat pumps, generally requires external contractors.
Does any jurisdiction or sector use LEED standards and are they included in the new code updates?	**Luke Smeaton:** For the longest time there was a mandate for all new provincial projects to achieve LEED Gold. It actually stemmed from a throne speech of a premier years ago, and that was used as a cornerstone of the strategy for new projects for many years. Enforcement and the requirement to actually certify weren't overly strong, although we as a school district did certify a number of projects. In the early days our desire to certify projects did waver a little. We tried to focus on a really impactful and pragmatic approach to holistic green building performance, looking at how we can leverage the big picture not just energy, looking at everything from materials to energy to commissioning. And so, for us we definitely utilize LEED. And I think as the new ESG framework for capital projects is more widely implemented, there is still a reference to LEED. It's not the only approach to demonstrating green building performance, but it's certainly a useful tool. **Adrian Mohareb, Climate Action Secretariat, Province of B.C.:** LEED is not a Building Code option, at least for BC, because LEED goes above and beyond the scope of the Building Code. However, as Luke stated, LEED Gold is an option (but not a mandate) under BC's Environmental, Social and Governance Framework for Capital.

How would you anticipate the optimal project process might differ between new builds and retrofits for schools?	**Hassan Shahrukh:** I'll speak specifically to retrofits, because for new builds we basically provide inputs to our infrastructure team, and I would say we have less control over what happens in the end. With retrofits, we focus on lifecycle cost. Upfront costs matter, but at the same time we make decisions from a lifecycle cost perspective. For example, if we're going to be running something for a 10-year or 15-year lifecycle period, are we going to see a net present value positive on that side? Or, even if it is negative, can we make it work with a grant or subsidy that we can apply for? The other thing we are doing right now is work on the electricity side, focusing more on heat pumps.
How important has it been to receive support and additional capital funding to build more energy efficient schools, above the usual capital funding model?	**Andrea Lawson:** There was some discussion on that, and I believe that some budgets were increased to allow for sustainability elements. So, the government has considered it – increasing the budget slightly. **Luke Smeaton:** Preface by saying that the whole process for capital project delivery with schools (in BC) is in flux at the moment. There has been a shift, and school construction is now the responsibility of the Ministry of Infrastructure. One of the projects we've currently got in the works is an elementary school, and during design, a year and a half ago, we were able to unlock an additional 3% capital funding from what was then the Ministry of Education and Childcare to achieve a 50% greenhouse gas reduction. So, there was an offer of additional capital funding, recognizing some premium costs involved with taking a more progressive approach.
What steps can we take to make the handoff more seamless from DPW to the RCE's, and what work can we do to align the goals of both organizations as early as possible in the design process?	**Andrea Lawson:** We started using the Efficiency Nova Scotia Commercial Building program in our most recent schools. We really haven't got to the handoff process yet. But I see using that program as we move forward for all our schools. Setting up a meeting to discuss with us would be a great idea.

Steve: does Halton focus on project delivery methods that are more collaborative than traditional design-bid-build?	**Steve Allum:** All of Halton Catholic DSB's construction and facilities are managed by the same department. So that makes the board agile to make decisions quickly. We do solicit feedback from educators and others when we go into designing new schools. But largely, I would say that our collaboration involves our own team here in facilities, as well as heavily leaning on architects and engineers that we have come to work with and value over the last number of years. We have a preferred engineering group and preferred architects, and that has paid dividends for us because we can take designs that we've done previously and maybe tweak them slightly but not have to reinvent the wheel. We also take stakeholder feedback and make some tweaks to see what worked and what didn't.
Beyond the New Construction initiatives discussed today, as part of the life cycle renewal replacement over the facility use life, what guidelines or practices are included in new builds to sustain energy efficiency. For example, what maintenance strategies are recommended to minimize component drift or poor performance? When should the equipment and controls be recommissioned over the useful life?	**Steve Allum:** We have a holistic approach to facility operations. We have a person that solely does building automation and operations of the schools. My role dovetails with his on most days. We do use our interval metering as a continuous commissioning mechanism. That is working for us, instead of against us – it can be a deluge of information if you don't get it working for you. Now that it is all alarmed, we know exactly when energy is being used throughout the day. That aids us in our ability to continuously commission the schools, and that is a large part of how we maintain efficiency. As far as maintenance, it revolves around the same mechanism and system. Operational transparency helps guide our maintenance to where we need to go, oftentimes dictated by the age of the school. Our renewal work centres around equipment that's at the end of its life cycle, using our management systems to guide decision-making and our day-to-day work.
Northern Lakes College, which operates small remote campuses in northern Alberta, has had success piloting use of highly insulated modular units integrating solar PV and geothermal systems. Let me know if you'd like to connect to learn more about their approach.	**Kajen Singh:** We'd definitely like to learn more about these pilots and the successes you've seen. Please connect with us at CCNet.

The consumer carbon tax was a driver towards electrification. Do you have a sense whether school board decision makers are going to use the removal of the consumer carbon tax to end electrification efforts?	**Ian Jarvis:** Governments have limited levers to move the economy in a low carbon direction. The financial one is self evident, with grants and incentives as carrots and taxes as a stick. The carbon tax became so toxic that it's no longer a pragmatic option, taking away one lever. However, while the economic calculation has shifted making some projects less viable, the climate crisis has not changed and the many school boards we work with appear to remain committed to being part of the solution.
What impact do you think removal of carbon tax will have on energy efficiency projects for school boards?	
We speak about mechanical systems and new technology to help with GHG emissions and improved efficiency. However, there is little and sometimes no focus on the state of the envelope especially in retrofit situations. How are we going to address this?	**Ian Jarvis:** We will be examining the impact of building envelope standards and practices with individual school boards as part of this work, in particular thermal bridging and air tightness.