ASHRAE Ottawa Valley Chapter

Chapter Meeting #3 – November 15th 2016

Meeting Date:	November 15, 2016					
Location:	Centurion					
Attendance:	Total:	56				
	Members:	48	Guests:	8	Students:	5
Theme:	Research Promotion					
Tour:	None					
Tech Session:	Modeling occupants in buildings to predict energy use					
Table Top:	0					
Program:	Carleton University as a living lab: where research and operations meet					
Speakers:	Liam (William) O'Brien PhD, Eng. Associate Professor Civil and Environmental Engineering. PI Human Building Interaction Laboratory Carleton University.					
Prepared by:	Chris Fudge					

Social (17:30 – 18:20)

Business Session (18:20 –18:59)

- President Abbey Saunders called the meeting to order.
- President Saunders introduced the Board of Governors and the Executive.
- Secretary Chris Fudge introduced the guests for the evening.
- President Saunders introduced the new members.
- Governor Adriani M did a summary of the material covered during the tech session.
- Governor Adam Moons discussed the bowling event taking place Nov 16th at the Merivale Bowling Lanes.
- Past President Georges Maamari gave an overview of the upcoming TSSA seminar taking place November 24th.
- President Elect Adam Graham gave a short presentation on ASHRAE Research. Talked about the importance of ASHRAE Research. He discussed how the results of ASHRAE turn into reality, design guides, standards etc…. Discussed frame work of how ASHRAE research works and projects get off the ground. Last year OVC exceeded goal.

  Mr. Graham recognized all of the donors from the 2015-2016 Research Promotion campaign.

  Review ASHRAE research goals for this year of $29,000. President Elect Graham emphasized that 100% of the money donated goes towards research. In region II 100 % goes to region II.

Dinner (19:00 –)

Evening Program (19:30 –)

- Mr. Adam Graham draws the raffle tickets for the Senators Hockey game December 3rd. Mr. Adam Moons wins the draw! Tickets donated by Trane.

- President Abbey Saunders introduced tonight's speaker Dr. Liam O'Brien of Carleton University.
- Tonight's Program Carleton University as a living lab: where research, teaching and operations meet.
- The research project uses the entire campus a living lab. To achieve the data collection the entire campus has been digitized. The project involved collaboration between architecture and engineer faculties. Building performance visualization, advanced controls, occupant monitoring and modeling, BIM, fault detection and diagnostics and sensor position optimizations were all utilized to complete this study.
- The focus of tonight's presentation is the Canal building.
- The campus has been loaded into a 3D mapping tool where the buildings can be analyzed according to various factors such as occupant density.
- Sankey diagrams show how every joule of energy enters the campus and leaves.
    - Energy inputs broken down into Nuclear, Hydro, Solar etc…
    - Energy outputs are also shown to provide a visual of energy flows.
- Energy bills broken down to a by student employee level
- Different methods were used to normalize energy use, such as cost per student. Costs per student for energy came in around $500 /employee and student.
- Most attention paid to the Canal building which is equipped with loads of sensors.
- Architects made extremely detailed BIM models of building. These models were immediately simplified into CAD based models.
- Building performance visualization was used to help operators better operate their buildings to improve energy performance. These graphical tools allowed easy comparison of different times of day, week or heating vs cooling season.
- Sankey diagrams where developed to analyse both energy flows and cost flows.
- Sankey diagrams were used to analyse energy flows through air handling equipment.
- These diagrams provide graphical indication of where opportunities for energy savings lie.
- Detailed analysis done at the office level in terms of energy use at the Canal building.
    - CO2
    - Temp
    - Humidity
    - Air Flow Rates
    - Occupancy
    - Light levels
    - Motorised shading
- Professor hours tracked through occupancy.
    - Arrival and departure times analysed through data collection and tools to predict occupancy were used in creating algorithms.
    - Intermediate vacancy periods analyses to predict return time or if occupant will return
- Temperature learning.
    - Most occupants like temperatures that are less energy intensive that traditional

setpoints.
    - Personalised optimal temperatures can be developed based on preference resulting in energy savings.
    - Heating setpoints often in the 19 C range and cooling setpoints 24 C range.
- Default algorithms compared to adaptive algorithm. Adaptive algorithm adjusts the space set points towards the occupant preferences automatically.
    - Impressive energy savings resulted from adaptive algorithm.
    - Zero complaints from the adaptive algorithm.
- Lighting control also analysed to determine user preference.
    - Again resultant preferences were much lower than what traditional levels are.
- Occupant model development
    - Used to design appropriate window sizes for example.
    - During analysis it was found that occupants had tampered with occupancy sensors indicated people do not necessarily want the lights coming on based purely occupancy.
- Loads analysed based on orientation.
- Hoteling potential analysed based on occupancy detection. Do we need so many offices or could we have fewer offices that are shared.
- Fault detection and diagnosis (FDD). How can various data sets be used to determine faults in the building envelope, window leakage etc…
- Sensor placement and optimization.
    - Temperature sensor location. Using BIM to analyse appropriate location based on building orientation.
- Zone level virtual sensing. It is expensive to measure everything. However multiple sensors, inferences and mathematical modeling can be used.
- Auto-Commissioning
    - To be done prior to occupancy
    - Estimating light power, thermal resistance of building envelope.
    - Air balancing by estimating OA supply rate using CO2 mass balance models.
    - Use of BIM to obtain basic building information.
- Integrate BIM into operations.
- Real time visualization. Build up enough data infrastructure to provide interactive visualization for operators and other stakeholders.
- Immerse graduate students in operations.
- Health Sciences Building / SIF Grant was reviewed. This building will be equipped with additional data collection. Building including mechanical systems modeled in BIM.
- Professor Liam O'Brien recognized those people involved in the research project.
- President Abbey Saunders thanked Professor O'Brien and presented him with a gift.
- President Abbey Saunders reminded members to complete the electronic program evaluations forms that are sent out after the meeting.

Meeting adjourned 21:25