



## Profile and Technical Skills

- Ph.D. in building engineering with professional training in architecture, and in-depth experience in both disciplines.
- Experienced in dynamic energy modeling of buildings and renewable energy systems, employing various software (e.g. MATLAB, MATCAD, HOT2000, e-Quest, AGI 32, EnergyPlus, ESP-r, RETScreen, SketchUP, AutoCAD, 3-D Max).
- Experienced in various research techniques including scientific methods of experimental design, data recording, and data analysis employing statistical methods.
- Proficient in technical writing and editing, with more than 15 journal papers, and 15 refereed conference papers.
- Possessing significant visual and verbal communication skills, such as preparing presentations and communicating ideas.
- Personality traits contributing to productivity, including organization, punctuality, independent and creative thinking, being hard working and industrious, good team membership and team leadership.

## Education

- 2012 **Ph.D. studies in Building engineering,**  
Concordia University, Montreal, Quebec.  
Research Topic: Investigation of design parameters for increased solar potential of dwellings and neighborhoods, aimed at developing design guidelines for optimization of solar potential of building shapes and neighborhood patterns. Thesis Rank: Excellent.
- 2008 **MSc. in Building Engineering**  
Concordia University, Montreal, Quebec.  
Research Topic: Microbial Volatile Organic Compounds in Full-Scale Stud Cavities – Identification and Transport Analysis.
- 2004 **MSc. in Architectures and Urban Planning**  
Technion - Israel Institute of Technology, Haifa, Israel.  
Research topic: Deployable systems in nature – structural characterization and architectural applications. Graduated *summa cum laude*.
- 1999 **Diplome d'Etude Supérieur ((DES) a combined BA-MSc degree in Architecture**  
Holy Spirit University, Beirut, Lebanon.  
Final Project and thesis: Design of cultural center for re-evaluation of arts, influenced by the *Purgatory of Dante*, and integrating the project into the urban center of Beirut in Lebanon. The project includes a thesis covering the background and literature review, the objective and methodology of the design process of the project, and complete design with working drawings. Graduated valedictorian.

## Academic Experience

- 2014-present: **Assistant Professor**  
University of Calgary, Faculty of Environmental Design (EVDS), Department of Architecture, Calgary, Canada.
- 2012-2014: **Postdoctoral Fellowship**  
Smart NSERC Smart Net-Zero Energy Buildings Strategic Research Network (SNEBRN), at Concordia University, Department of Building, Civil and Environmental Engineering.  
Responsibilities include: design of sustainable mixed-use developments (including residential and office buildings) and analysis of their energy performance, development and modeling of new concepts for building integrated photovoltaic/



thermal systems.

2008- 2012:

**Graduate research assistantship**

Concordia University, Faculty of Engineering, department of Building, Civil and Environmental Engineering, in the topic of solar optimized housing and neighborhoods. Accomplishments include:

- Identification of key solar design parameters and quantifying their effect on the solar potential of housing shapes and neighborhood patterns.
- Developing design methodology for net zero energy neighborhoods.
- Publications (4 journal papers and 8 conference papers), involvement in various energy-related projects (see below), international workshops (organization and participation) and presentation in seminars (e.g. Natural Resources Canada (NRCan), Dawson College Montreal, etc.).

2005-2008:

**Graduate research assistantship**

Concordia University Faculty of Engineering, department of Building, Civil and Environmental Engineering, in the topic of mold growth in buildings. Accomplishments include:

- Identification of MVOCs in stud cavities and their transport to the indoor space.
- Conducting full-scale experiments, and statistical analysis of the results.
- Publications (2 journal papers and 3 conference papers), publication of a book based on the thesis.

2001-2004:

**Graduate research assistantship**

Technion Institute of Technology, Haifa, Israel, Department of Architecture and Town Planning, on the topic of deployable structures in nature and their application to architecture.

Accomplishments include:

- Study of deployable structures in nature and their application to architecture.
- Publications (4 journal papers and a conference paper), winning of the IASS (International Association for Shell and Spatial Structures) Hangai prize for young researchers.

**Instruction**

2014-2016

- Sustainability in the Built Environment (2015- 2016), University of Calgary
- Solar Building Envelope Design (2015- 2016), University of Calgary
- Environmental Systems (2015- 2016), University of Calgary
- Lighting in Architecture (2014-2016)

2013-2014:

- Building Performance Simulation, Ryerson University, (Winter 2014).

2012-2013:

- Acoustic and Illumination (BLDG366) - winter 2013, Concordia University.

2001-2002:

- Secondary and high school teaching in Israel – subjects include Applied Art and Mathematics.

**Supervision**

2014-present

- I am currently supervising:
  - 3 Master students (thesis option), on the subjects of 1) the usage of advanced materials in the building envelope to reduce thermal loads in commercial buildings; and 2) Development of evaluation tool for climate change resilience, and 3) Multistory residential building performance
  - 3 PhD students on the subjects of: 1) Mixed use energy efficient communities; 2) Design of advanced curtain wall for enhanced energy performance and 3) affordable modular energy efficient housing.



- 2013-2014
  - A member of the PhD supervisory committee (2016)
  - Supervision of a group of PhD and Master students (Sep- Dec. 2013), under the Community Energy Management Team, for the pilot project of a large-scale smart net-zero community design launched by s2e Technologies Inc. (see below in Public and Professional Activities).
- 2011-2012
  - Main supervisor of a summer research trainee.
  - Co-supervising a master student in Concordia University (on the subject of architectural building design and energy efficiency)

### Professional Experience

#### Interior Architecture

- 1999-2004:
  - Interior designs for residential homes in Southern Lebanon.
  - Interior design projects in North Israel, including a shopping mall lobby and entrance, restaurant and several dwellings.
- 1995-1999:
  - Architectural practice in the offices of Profs Charles Btaich and Henri Hawa (Beirut). Wide exposure to different types of projects including public spaces (restaurants, shops, etc.) and residential houses. The training comprises: designing, detailed drawings and implementation of different interior spaces.

#### Architecture

- 1999-2000:
  - Founding and managing a private architectural practice. Design and supervision of multiple housing projects in Southern Lebanon.
- 2001-2005:
  - Design and supervision of residential houses in Israel.

### Public and Professional Activities

#### Energy related projects

- 2015-present
  - Solar Energy Positive Cabin (Miller cabin). This cabin, located in a remote area of the Kananaskis County will act as a research facility for the University's biological faculty to house a number of students as they perform their research.
- 2013-2014
  - Solar energy consulting for new mixed use community, West Campus, Calgary.
  - Solar community design – feasibility study for Okotocks new community (still ongoing).
  - Research & Design Team Leader – Community Energy Management Team, working on the Smart Community (net-zero pilot community) research team for s2e Technologies Inc. upcoming development efforts near London, ON. This initiative aims at exploring the application of environmental design principles in practice. These principles include both normative, well-established forms of interventions as well as the development of new, emergent approaches in architecture, planning, and environmental design.
  - Acting as solar energy and energy efficiency consultant for various architectural firms such as Laroche Architects (Montreal, Qc). <http://www.montrealgazette.com/homes/small+fiercely+efficient+chalet/9974199/story.html>
- 2011 -2012:
  - A member of the study team of Large Scale Solar Seasonal Storage (lead by Natural Resources Canada-NRCAN). This project aims at applying solar seasonal thermal energy storage system, together with passive solar design of housing units and neighborhoods to a large community (1000+ units).

#### Organization of Workshops and Conferences



- 2015
  - Co-organizing and co-chairing the Interdisciplinary congress (May 2016), Energizig by Design.
- 2014
  - Organizing and chairing a workshop on net zero energy buildings and communities (May 2015). The workshop brought together construction and technology industry leaders and large number of researchers/academics in Canada.
- 2013
  - Organizing and co-chairing a workshop on Design of NZEB. The main theme of this workshop was the evolution/integration of low-energy and sustainable techniques/technologies from buildings to communities (www.solarbuildings.ca, SNEBRN Newsletter Issue 3 - December 2014).
  - Organizing a workshop on Energy-positive facades and perimeter zones. This workshop brings together researchers and senior PhD students, from 15 Canadian universities, working on issues related to energy efficient/energy generator building envelopes and perimeter zones.
- 2011
  - Assisted in organizing 6-day PhD Workshop on net-zero energy buildings for 35 international students taught by 15 professors and industry professionals.
- 2010
  - Assisted in organizing a three-day meeting for 90 national and international solar energy and building researchers and industry experts.

#### Webinars

- 2012
  - Webinar on the **Design of Solar Communities**, addressed especially to builders and developers around Canada, developed and disseminated in collaboration with Natural Resources Canada (NRCan).
- 2013
  - Webinar on **Planning and Designing Net Zero Energy Communities** organized by the Net Zero Energy Coalition.

#### Academic and Public Leadership and Services

- Leader of the project of the design net- zero energy communities as part of NSERC Smart Net -Zero Energy Building Research Network (SNEBRN) (2015-2016).
- Leader of the education committee created by the Smart Net -zero Energy Strategic Research Network (SNEBRN) as part of the CREATE program, aiming at disseminating lessons learned and expertise of designing NZEBs to the architectural community, and at identifying education issues (for architects and engineers) to facilitate/enable efficient design of NZEBs. The committee includes academic individuals from different universities (Concordia, Carleton, Dalhousie and Ryerson) (2013-2014).
- Associate Editor for the journal Indoor and Built Environment (2013-2016).
- Reviewer for a number of refereed journals such as Applied Energy, Solar Energy, Renewable Energy, Indoor and Built environment and International Journal of Space Structures.
- Acting as the main supervisor for the solar energy design of Solar Decathlon 2015, for the Montreal group, composed of McGill and Concordia students (2013).

#### Research Funding

- 2016 Eyes High Doctoral Recruitment Scholarship (ca 125K)
- Building Excellence Research and Education Program Grant Award, BC Canada, 2016-2017 (40K).
- Natural Sciences and Engineering Research Council of Canada (NSERC) Engage Grant, 2016 (25K).
- Natural Sciences and Engineering Research Council of Canada (NSERC)



- Discovery Grant for the years 2015-2020 (110K).
- EVDS MakeCalgary Grant ( 2015, 2016) (20K)
- NSERC Smart Net -Zero Energy Building Research Network (SNEBRN) research grant for the years 2015-2016 (ca 45K)
- EVDS Startup fund for the years 2014-2015 (20K)
- Industry support from s2e technology Inc. (2013-2014)
- Natural resources Canada- on an individual level to facilitate participation and presentation of my work in two IEA tasks (IEA task 41 - Solar energy and architecture (from 2010-2012), and IEA task 51- Solar energy and urban design (from 2013).

### Extracurricular Activities

1998 to present: Oil painting and mixed media.  
Beyond my academic activities, I am a painter. I have produced some sixty oil paintings over the last thirteen years and continue to be active in this field. I participated in several exhibitions and won the excellence prize in one major competition in Jerusalem, in 2003.

### Awards, Distinctions and Fellowships

- 2016 Sustainability Award for the Campus as a Learning Laboratory, for the course of Sustainability in the built environment.
- Award for Outstanding Contribution: Innovative Direction in Modeling, awarded for the paper "Solar Optimized Neighborhood: Evaluation and Guidelines", e-Sim Conference (IBSA Canada), Halifax, May 2012.
- Thesis Accelerator Award, Concordia University, for the academic year 2012.
- National Research Canada (NRCan) grant for the participation in IEA task 41- Solar Energy and Architecture, 2010- present.
- ASHRAE grant-in aid scholarship, for the year 2011-2012.
- Professor Hugh McQueen Award for excellence, for the academic year 2010 - 2011.
- Bill Graham- NSERC scholarship, for the academic years 2010-2012.
- J. W. McConnell Memorial Graduate Fellowship Concordia University, for the academic years 2009-2011.
- Frederick Lowy scholars, Concordia University, for the academic years 2008-2011
- Graduate Student Association Conference Travel Award, Concordia University, for the academic years 2009 and 2010.
- Power Corporation of Canada graduate fellowship, Concordia University, for the academic year 2008-2009.
- Campaign for a New Millenium Graduate Scholarship, Concordia University, for the academic year 2006-2007.
- Concordia University Graduate Shuffle Scholarship, Concordia University for the academic year 2005-2006.
- International tuition fee remission award, Concordia University, Quebec, Canada, for the academic year 2005-2006.
- Thesis Research Prize of Excellence for the Thesis Biological Deployable Systems - Characterization and Architectural Application, for MS degree in architecture, Technion -Israel Institute of Technology, 2005.
- Hangai Prize for young researchers in the field of space structures for paper titled "Deployable Structures in Nature: Examples, Analysis and Realization" presented at the 2004 IASS symposium at Montpellier, France. The prize is



awarded annually at the international IASS symposium to four young researchers, based on rigorous review.

- Technion, Israel Institute of Technology scholarship, Academic years 2001-2002, 2002.

## PUBLICATIONS

### Papers in refereed technical journals

1. Hachem C, ElSayed, M. (2016), **Patterns of façade system design for enhanced energy performance of multistory buildings**, *Journal of Energy and Buildings*, in press.
2. Hachem, C., (2016). **Impact of neighborhood design on energy performance and GHG emissions**, *Journal of Applied Energy*, Volume 177, Pages 422-434.
3. Hachem C., Cubi, E. Bergerson, J. (2015). **Energy performance of a solar mixed-use community**, *Sustainable cities and communities* (Special issue), <http://dx.doi.org/10.1016/j.scs.2015.08.002>.
4. Hachem, C., (2015), Integrated design considerations for solar communities, *Journal of Green Buildings*, V 10, N2.
5. Hachem C., A. Athienitis, P. Fazio, (2014). **Energy performance enhancement in multistory residential buildings**, *Journal of Applied Energy*, 116, pp. 9-19
6. Hachem C., Fazio, P., and Athienitis, A., (2013). **Solar optimized residential neighborhoods: Evaluation and design methodology**, *Journal of Solar Energy*, 95, 42-64.
7. Hachem C., A. Athienitis, (2013). **Effect of Residential Building Design on Energy Performance**, *ASHRAE journal*, Volume 55, Issue 1, Pages 72-74.
8. Hachem C., A. Athienitis, P. Fazio, (2012). **Evaluation of energy supply and demand in solar neighborhoods**, *Journal of Energy and Buildings*. Volume 49, Pages 335-347.
9. Hachem C., A. Athienitis, P. Fazio, (2012). **Design of roofs for increased solar potential of BIPV/T systems and their applications to housing units**. *ASHRAE Transactions RNS-00226-2011.R1*.
10. Hachem C., A. Athienitis, P. Fazio, (2011), **Investigation of Solar Potential of Housing Units in Different Neighborhood Designs**, *Journal of Energy and Buildings*, Volume 43, Issue 9, Pages 2262-2273.
11. Hachem C., A. Athienitis, P. Fazio, (2011), **Parametric investigation of geometric form effects on solar potential of housing units**, *Journal of Solar Energy*, Volume 85, Issue 9, Pages 1864-1877.
12. Hachem, C., Chaubey, Y., Fazio,, Rao, J. and Bartlett, K., (2010), Statistical analysis of **microbial volatile organic compounds in an experimental project: identification and transport analysis**, *Indoor and Built Environment*, 19(2): 275-285.
13. Hachem,C., Fazio, P., Rao, J., Bartlett, K., Chaubey, Y., (2008); **Identification and Transport Investigation of Microbial Volatile Organic Compounds in Full Scale Stud Cavities**, *Building and Environment*, Volume 44, Issue 8, Pages 1691-1698.
14. Hachem, C., Karni, E., Hanaor, A., "Evaluation of Biological Deployable Systems", *International Journal of Space Structure*, Vol.20, No 4, 2005,189-200
15. Hachem, C., Hanaor, A., "Folding Sleeves – Variations on a Theme of the Earthworm", *International Journal of Space Structure*, Vol.20, No 3, 2005, 127-146.
16. Hachem, C., Hanaor, A., "Deployable Applications Based on Biological Organisms", *Journal of the International Association for Shell and Spatial Structures*, Vol.46, No 2, 2005, 94-106.



17. Hachem, C., Karni, E., Hanaor, A., "**Deployable Structures in Nature: Examples, Analysis and Realization**", Journal of the International Association for Shell and Spatial Structures, Vol.45, No 3, 2004, 190- 198.

**Additional Publications and Presentations**

**Conference papers**

1. MacGregor, A. and Hachem, C. (2016). Cold-Climate Supermarket attached Greenhouse: A Case Study, Eurosun Conference, Spain.
2. Hachem, C., (2016) Environmental impact of various neighborhood designs, SimAUD 2016, London.
3. MacGregor, A. and Hachem, C. (2016) Investigation of Design Strategies For Improved Energy Performance In Supermarkets: A Case Study, eSim 2016.
4. ElSayed, M. and Hachem, C. (2016). Development of optimization methodology for increased energy efficiency of PV integrated curtain wall systems, eSim 2016.
5. Bigalia, E., Hachem, C., ElSayed M., and Athienitis, A. (2016). Solar energy potential for commercial building façade retrofit, eSim 2016.
6. Hachem C., Cubi, E. Bergerson, J. (2015). Energy performance of a solar mixed-use community, 4th Climate Change Technology Conference, Montreal, Canada.
7. Hachem, C., (2015), Design of a base case mixed-use community and its energy performance, 6th International Building Physics Conference, Torino, Italy.
8. C. Hachem, P. Fazio and A. Athienitis, (2013), Design of curtain wall facades in multistory buildings for improved solar potential and daylighting distribution, ISES Conference, 3-7 Nov., Cancun, Mexico.
9. C. Hachem, P. Fazio and A. Athienitis, (2013), Effect of Housing Density on Energy Performance of Solar-optimized Residential Configurations, CISBAT Conference, 4-6 September, Lausanne, Switzerland.
10. Hachem C., Athienitis, A., and Fazio, F., Design Methodology of Solar Neighborhoods, Solar Heating and Cooling Conference, Energy Procedia, July 2012.
11. Hachem C., Athienitis, A., and Fazio, F., Solar Optimized Neighborhood Patterns: Evaluation and Guidelines, eSim 2012, 7th Biennial Building Simulation Conference of IBPSA-Halifax, Canada, May 2 - 3, 2012.
12. Hachem C., Fazio, P., and Athienitis, A. Energy Implications and Solar Energy Potential of Housing Units 'Shapes, The 5th International Building Physics Conference (IBPC5), Kyoto, Japan, May 2012.
13. Hachem C., Athienitis, A., and Fazio, F., Design of Roof Morphology for Increased Solar Potential of BIPV/T Systems, ISES Conference, Kassel, Germany, August 2011.
14. Hachem C., Athienitis, A., and Fazio, F., Evaluation of Alternative Neighborhood Patterns for BIPV Potential and Energy Performance, CISBAT, Lausanne, Switzerland, September 2011.
15. Hachem C., Athienitis, A., and Fazio, F., Design of Solar Optimized Neighbourhood, ASHRAE conference, Montreal, June 2011.
16. Hachem C., Athienitis, A., and Fazio, F., A Study of the Influence of Housing Unit Form and Density on Solar Potential, EuroSun conference, Graz, Austria, 28 Sep.-1 Oct., 2010.
17. Hachem C., Athienitis A, Fazio P. and O'Brien W., Design Of Passive Low Energy, Low Cost Housing: A Case Study, Canadian Solar Building Conference, Totonto, 2009.
18. Hachem, C., K. Bartlett, P. Fazio, J. Rao, Y. Chauby, Sampling and Evaluation of Mold Related Volatile Organic Compounds in Full Scale Stud Cavities, ASTM symposium, April 2009, Vancouver, Canada.
19. Hachem, C., Chaubey, Y., Fazio, P., Rao, J., Bartlett, K.; Statistical Analysis of Mold Related Volatile Organic Compounds in Full Scale Stud Wall Cavities, the Forth



- International Building Physics Conference (IBPC4), Istanbul, June (2009).
20. Hachem, C., K. Bartlett, P. Fazio, J. Rao, C. Chaubey, Investigation of Microbial Volatile Organic Compounds and Their Transport through the Building Envelope, Nordic Conference of Building Physics, Copenhagen, Denmark, June 2008.
  21. Hachem, C., Karni, E., Hanaor, A., "Deployable Structures in Nature: Examples, Analysis and Realization", Shell and Spatial Structures, from Models to Realization, Proc. IASS Symposium, Montpellier, 20-24 September, 2004.

#### **Books and Chapters in books**

1. Jun-Tae Kim, Jin-Hee Kim, Ahmed Hassan, **Caroline Hachem**, and Fred Edmond Boaf, 2016. *Net Zero Energy Mass Customized Houses ZEMCH: Toward the Delivery of Zero Energy Mass Custom Homes-Chapter 9.* , published by Springer.
2. [Hachem, C.](#) , [Fazio P.](#), [Bartlett, K.](#)2010, *Microbial Volatile Organic Compounds in Full Scale Stud Cavities* (published MS thesis), LAP Lambert Academic Publishing, AG & CoKG.
3. Hachem, C. and Hanaor, A., "Folding Sleeves - Variations on a Theme of the Earthworm", 2009, in Motro R., Editor, *Structural Morphology and Configuration Processing of Space Structures*, Part B: Structural Morphology, Multi-Science, Brentwood, Essex, pp.115-138.

#### **Theses and Dissertations**

- Investigation of Design Parameters for Increased Solar Potential of Dwellings and Neighborhoods, Dissertation for Doctor in Philosophy (ranked excellent), Department of Building, Civil and Environmental Engineering, Concordia University, Montreal, Quebec, Canada.
- Microbial volatile organic compounds in full scale stud cavities, identification and transport analysis, Dissertation for Master of Applied Science, Department of Building, Civil and Environmental Engineering, Concordia University, Montreal, Quebec, Canada, 2008.
- Biological Deployable Systems Characterization and Architectural Application, Thesis submitted in partial fulfillment of the requirements for the MS degree in architecture, The Technion, Israel Institute of Technology, October 2004.
- "Le Nouvel Eldorado - Centre d' Evaluation des Arts - selon Dante", Memoire pour le Diplôme d'Etude Supérieur en architecture (DES), University of Holy Spirit Kaslik, October 1999.

#### **Selected Seminars and Invited Talks**

- Chairing and speaker at the Interdisciplinary congress (May 2016), Energizing by Design.
- Moderating a panel discussion on the Topic of "Designing Cities", as part of the Interdisciplinary congress (May 2016).
- Panelist, the City Dark (24 Nov 2015), IES Calgary Section.
- Invited speaker in the International Seminar – Arquitectura E Ingenieria De Envloventes De Edificios, organized by the schools of Architecture and Engineering of Pontifical Catholic University of Chile, Nov 2015. <http://web.ing.puc.cl/~live/simposio/expositores.html>.
- Invited speaker and chairing a session in CZEBS-iiSBE-APEC Symposium, Aug 2015.
- Invited speaker in Open Symposium on Solar Energy in Urban Planning, Trondheim, Norway, March 2015.
- Invited speaker for 2013 Building Saskatchewan Green Conference, Oct 25<sup>th</sup>.
- Seminar on the subject of Planning and Designing Solar Neighborhoods, in





- Australia/Canada/Sweden joint seminar, organized by CRC for Low Carbon Living. Held in Sydney, Australia, February, 2013.
- Panelist on the subject of Building Integrated Photovoltaic Systems, at CANSIA (2012), Toronto Canada.
  - Health Symposium, on the subject of Sick Buildings Syndromes – Identification of Mold in wall cavities, Montreal, May 2012.
  - Seminar on the subject of design parameters for energy efficiency buildings and communities, at Dawson College, Montreal, February 2012.
  - Seminar on the subject of Net Zero Energy Communities, at Illinois Institute of Technology Chicago, January 2012.
  - Seminar on the design of large-scale solar communities, delivered for a group from the industry sector in collaboration with National Resources Canada (NRCan), Calgary, October 2011.
  - PhD International Workshop (for international PhD students), on the subject of architectural integration of solar technologies in buildings, Concordia University, June 2011.

**Miscellaneous publications**

- ASHRAE funding research on building shape and density, by Jessica Krippendorf, *Journal of Commerce* July 4, 2011.  
<http://www.joconl.com/article/id45095>
- A small but fiercely efficient chalet, Article in Montreal Gazette by Joanne Penhale, Special to THE GAZETTE 06.24.2014.  
<http://www.montrealgazette.com/homes/small+fiercely+efficient+chalet/9974199/story.html>