

Bruno Faucher, P. Eng., M.Sc., M. Env.



GREENHOUSE ENGINEER

EDUCATION

1990	B.Sc. (Agricultural engineering) Laval University, Quebec, Canada
1995	M. Sc. (Agricultural engineering) Laval University, Quebec, Canada
2003	2 nd cycle Diploma, Environnement Management, Sherbrooke University, Québec, Canada
2004	M. Env (Environmental Science), Sherbrooke University, Québec, Canada
2018	1 st Degree Black Belt in Taekwondo.

PROFESSIONAL ASSOCIATIONS

Member of the **Quebec Order of Engineers**
Member of the **Canadian Green Building Council**
Member of **Association of Educational and Research Greenhouse Curators (AERGC)**
Member du **Committee of Controlled Environment Technology and Use (NCERA-101)**

SPECIALIZATION

Greenhouse energy use analysis. Research greenhouse design. Commercial greenhouse design and feasibility studies. Development of new greenhouse systems and components. Programming, costing.

PROFESSIONAL EXPERIENCE

2004-: DESIGN/PROJECT ENGINEER, as part of the design team of GREENHOUSE ENGINEERING, Toronto, Ontario, Canada and as part of CAPITAL GREENHOUSE.

Design Engineer responsible for specific design work on various portions of projects. Carries out all attributed design tasks and collaborates in planning, designing and coordinating with other consultants, users groups and Client. Collaborates in developing drawings and specifications. Design work involves mechanical and control specialties. Carries out site visits and commissioning phase.

Institutional greenhouse projects

- University of Sherbrooke, Qc, Canada.

Complete and detailed design of a new research greenhouse complex. Design of all the greenhouse systems and components, such as structure & glazing, heating, cooling, A/C, growing systems, irrigation, supplemental lighting, horizontal & vertical motorized curtains, controls. Two air conditioned compartments. 4 200 ft² of research greenhouse, divided into six independent

compartments and one central corridor divided into three sections. Containment level of PPC-2 for the greenhouses. Total project cost of 6.4 M\$. Construction phase to start in spring 2021.



University of Sherbrooke

- McGill University, Ste-Anne-de-Bellevue, Qc, Canada.

Complete and detailed design of a new teaching greenhouse complex. Design of the greenhouse systems and components, such as structure & glazing, growing systems, irrigation, supplemental lighting, horizontal & vertical motorized curtains, controls. 4 800 ft² of new teaching greenhouses, divided into 7 compartments. Construction project of 10.6 M\$. Construction to start soon.



McGill Université

- University of California in Irvine, CA

Planning and programming (POR) of a new research greenhouse complex. 10,000 ft² of new greenhouses, divided into two wings and a total of 10 compartments per wing. Users need analysis, program of requirement document. Performance specifications. Currently during design phase. .

- Bishop's University, Lennoxville, Qc. Canada.

Complete design, drawings and specifications for a new roof-top research greenhouse. Design of all the greenhouse systems and components, structure and glazing, heating system, ventilation, growing systems designed for hop crops, supplemental lighting system, fog system, light spillage curtain system, control system. 1 200 ft² of new research rooftop greenhouse in one single zone. Total value of the project of approximately 3.5M\$. Project completed in 2019.



Bishop's University



- McGill University, Montreal, Qc. Canada.

Planning and programming of a new research/teaching greenhouse complex and support building. Users need analysis, program document (POR), conceptual design, cost estimating. Completed.

- University of Saskatchewan, Sask. Canada.

Complete design, drawings and specifications for new roof-top research greenhouse complex. Design of all the greenhouse systems and components, structure and glazing, heating system, ventilation, growing benches, supplemental lighting system, movable light canopies, fog system, light spillage system, control system, PPC-2 level containment greenhouse. 4 500 ft² of new research rooftop greenhouse, divided into 12 individual compartments and a central corridor. Total value of the project of approximately 3.5M\$. Construction completed in 2018.



CRSB-Saskatoon



- University of Montreal, Quebec, Canada

New research phytozone. Re-arrangement of an existing greenhouse, creating 6 new research zones. Complete design, drawings and specifications. Heating, cooling, lighting, control systems. Construction supervisions, start-up and commissioning. Project value of 800k\$. Project completed in 2017.

- Agriculture and Agri-Food Canada, Ste-Foy, Canada.

Complete design, drawings and specifications for new research greenhouse complex. Design of all the greenhouse systems and components, structure and glazing, heating system, ventilation, growing benches, supplemental lighting system, movable light canopies, fog system, control system, BSL-2 level containment greenhouse. Construction supervisions, start-up and commissioning. 5 000 ft² of new research greenhouse, divided into 8 individual compartments and a central corridor. Total value of the project of approximately 4.3M\$. Construction completed in 2018.



AAFC Ste-Foy



- Laval University, Quebec, Canada
Up-grade and improvement of existing research greenhouses (5 complexes). Upgrade of the control systems, ventilation, movable light canopies, shade systems and vertical curtains, rain water harvesting systems. Project value of 2.0 M\$. Completed in 2019.
- University of Sherbrooke, department of Biology, Sherbrooke, Québec, Canada
Pre-project feasibility study. Planning and programming of a new rooftop research greenhouse complex and support building. Users need analysis, conceptual design, cost estimating. 3 800 ft² of new rooftop greenhouses in 13 research zones and 1 corridor. Estimated construction value of 4.9 M\$. Currently under design.
- Bright Farms, New York, NY
Complete programming, design and construction documents for a new hydroponic greenhouse. 85,000 ft². Complete design including, greenhouse structure and glazing, HVAC, shading, growing systems (hydroponics), controls. Estimated value of 3.9 M\$.
- Agriculture and Agri-Food Canada, Soils and Crops Research and Development Centre, Ste-Foy, Québec, Canada
Pre-project feasibility study. Planning and programming of a new research greenhouse complex and support building. Users need analysis, conceptual design, cost estimating.
Feasibility phase for a new research greenhouse facility. 6 100 ft² of greenhouses in 10 research zones and 1 corridor, 13 100 ft² of renovated support building and 3 500 ft² of new construction Estimated construction value of 8.4 M\$.
- Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Centre, London, Pesticide-free wing, Ontario, Canada.
Research greenhouse complex, 2,400 ft², divided into 5 research zones, which one as PPC-2A containment level. Greenhouse structure, radiant hot water heating system, ventilation, irrigation, motorized shade curtains (horizontal & vertical), evaporative cooler units, A/C compartments, growing benches, computerized control system. Responsible for the programming phase, design of the greenhouse systems and specifications.
- Agriculture and Agri-Food Canada, Horticulture Research and Development Centre, St-Jean-sur-Richelieu, Québec, Canada
Renovation of an existing research greenhouse complex. Design of the greenhouse systems, heating, ventilating, shading, lighting, controls. Renovation of 21 research zones. Shop drawings review, construction supervision. Renovation value of 1.5 M\$. Renovation project completed in 2012.



AAFC St-Jean, Qc, Canada



- Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Centre, London, Ontario, Canada.
Research greenhouse complex of 6,400 ft², divided into 7 research compartments. Greenhouse structure and cladding systems, radiant heating systems, ventilation, irrigation, shade, evaporative cooler units, A/C cooling, growing benches. Responsible for the programming phase, greenhouse design and specifications. . Construction completed in 2012.
- State University of New York, Syracuse, NY. Exterior Rehab Illick Hall Greenhouses
Research rooftop greenhouse complex of 7,200 ft², divided into 12 zones. 4,000 ft² will be for Teaching & collections, 2,300 ft² of research greenhouses and 860 ft² of quarantine space. . Greenhouse structure and cladding systems, radiant heating systems, ventilation, irrigation, shade, growing benches. 5 zones are A/C. Responsible for the design of the greenhouse systems and components, specifications and coordination with the other consultants.
- Agriculture and Agri-Food Canada, Semi-Arid Prairie Agricultural Research Center, Swift Current, Sask, Canada.
Research greenhouse complex of 6,400 ft², divided into 10 research compartments. Greenhouse structure and cladding systems, radiant heating systems, ventilation, irrigation, shade, evaporative cooler units, growing benches. « Design-build » project. Responsible for the programming phase, greenhouse design and specifications. . Project completed. .
- Agriculture and Agri-Food Canada, Harrington research farm, Harrington, PEI., Canada
Research greenhouse complex of 3,600 ft², divided into 6 research compartments. Greenhouse structure and cladding systems, radiant heating systems, ventilation, irrigation, shade, evaporative cooler units, growing benches. « Design-build » project. Responsible for the programming phase, greenhouse design and specifications. . Project completed.
- University of Massachusetts, in Amherst, MA, Bowditch Greenhouse
Research greenhouse complex of 9,700 ft², divided into 12 research zones. 4,600 ft² will meet the BL2P containment level. Greenhouse structure and cladding systems, radiant heating systems, ventilation, irrigation, shade, evaporative cooler units, growing benches. 2 zones are A/C. Responsible for the design of the greenhouse systems and components, specifications and coordination with the other consultants. Development of a greenhouse energy model for LEED certification. Project completed in 2011. LEED gold Certification.



Bowditch greenhouses



- Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Centre, London, Ontario, Canada.
Programming phase for a new research greenhouse complex. Users need analysis, conceptual design, cost estimating, POR (program of requirement).
- Agriculture and Agri-Food Canada, Horticulture Research and Development Centre, St-Jean-sur-Richelieu, Québec, Canada
Programming phase for a new research greenhouse complex. 7 800 ft² of greenhouses in 20 research zones and 2 corridors. Estimated construction value of 5.7 M\$.
- ITA de Saint-Hyacinthe, Québec, Canada
Teaching Greenhouses for technology transfer, 5,000 ft² of new greenhouses. Construction cost analysis.
- Alberta Infrastructure, Brooks Crop Diversification Centre South, Brooks, Alberta, Canada
New greenhouse complex of a total area of 57,600 ft². 11 600 ft² of research greenhouse up to BL2P+ containment level and 46,000 ft² of Venlo glass and polyethylene greenhouses for vegetable crops. Greenhouse structure and cladding systems, radiant heating systems, ventilation, irrigation, shade, evaporative cooler units, growing benches. Pre-production greenhouse with 10 heads fertilization system, 16 mixings for randomised irrigation nutrients. First research greenhouse project LEED certified even. Responsible for the LEED issues. Construction value of 11 M\$, Project completed in 2011. This project achieved LEED Gold certification.
- Agriculture and Agri-Food Canada, Central Experimental Farm, Ottawa, Ontario, Canada
14,000 square feet research greenhouse complex, divided in 16 individual zones. Greenhouse structure with insulated glass panel glazing, radiant heating, forced ventilation (evaporative coolers), supplementary lighting, shade systems and irrigation. 4M\$ project complete in 2009.



- Faculty of Agriculture and Faculty of Forestry, Laval University, Quebec City, Quebec, Canada
30,000 square feet of new research greenhouse complex. Greenhouse structure with insulated glass panel glazing, radiant heating, forced ventilation (evaporative coolers), supplementary lighting, shade systems, irrigation and fog. 10M\$ project Commissioned 2007.



Forestry



Applied researches

Community greenhouse projects

- Iqaluit community greenhouse society, Iqaluit, NU
Feasibility study and business plan for a new greenhouse complex and indoor growth facility for a great North community. Improvement of existing greenhouses.
- Centre d'innovation social en agriculture, Chisasibi Business Service Center, Québec, Canada
Specifications for a greenhouse technical feasibility study. Feasibility study to evaluate the possibility for the local community of Chisasibi of producing their own vegetables under greenhouses. Along with realistic elaborated crop growing schedules, a greenhouse layout including greenhouse components and systems as well as most probable costs were proposed. The proposed greenhouse layout was 2 140 m² blocs of and a 30 m² propagation area, totalizing 310 m² of covered greenhouse space. A central service building (used as potting area, harvesting area, sales, packaging, etc.) separates the entire greenhouse complex. The service building area covers 40 m². The proposed greenhouse was simple, energy efficient, durable and sustainable.

2001-2003: ROCHE Ltée., Thetford Mines, Quebec, Canada.

PROJECT ENGINEER

Project Management. Business Development. ISO 9001 coordinator.

1994-2001: AGRITECHNOVE INC., St-Anselme, Quebec, Canada.

DESIGN ENGINEER

Design Engineer responsible for specific design work on all or various portions of a project. Carries out all attributed design tasks and collaborates in planning and tracking project costs. Supervises and collaborates in developing working drawings. Design work involves structural, mechanical and control specialties. Carries out site visits and commissioning as required by the contract.

Development of computerized tools for greenhouse design.

Institutional greenhouse projects

- Agriculture Canada, Saskatoon Research Station, Saskatoon, Saskatchewan, Canada
12,000 square feet, 27 zones for research in 5 greenhouses. A frame type structure polycarbonate and glass glazing, radiant heating (steam/hot water), forced ventilation with cooling pads, supplementary lighting, automated irrigation, custom benching. Commissioned 1997.



- Faculty of Agriculture, McGill University, Montreal, Quebec, Canada
6,500 square feet, 8 zone, research greenhouse complex. A frame type structure with insulated glass panel glazing, radiant heating and forced ventilation, with supplementary lighting, shade curtain, drip and mist irrigation and custom benching. Including labs in basement. Commissioned 1995.



- Agriculture Canada, Pacific Agri-Food Research Centre, Agassiz, B.C., Canada
14 zone research greenhouse complex. Venlo type structure with glass glazing, radiant heating and ventilation systems with irrigation, shading, fog systems and custom benching.



- Agriculture Canada, Lethbridge Research Centre, Lethbridge, Alberta, Canada
24,000 square feet, in 35 zones of research greenhouse complex. Greenhouse structure with glass glazing, radiant heating and ventilation systems with irrigation, shading, swamp cooling and benching. Actively involved with a Value Engineering Workshop.
Quarantine greenhouses: 1,130 square feet of level-3 greenhouses, divided into 4 individual zones. Heating load and cooling load calculations, glazing, shading, benching and irrigation design. Specifications writing.
- Agriculture Canada, Fredericton Potato Research Centre, Fredericton, New-Brunswick, Canada
8,600 square feet, in 17 zones of research greenhouse complex. Greenhouse structure with glass glazing, radiant heating and ventilation systems with irrigation, shading, fogging, lighting and benching.



- Virginia Commonwealth University, Richmond, Virginia, USA
2,000 square feet, 4 zone (for different climates), rooftop research greenhouse complex. A frame type structure with insulated glass panel glazing, radiant heating and forced ventilation, with supplementary lighting, shade curtain, drip and mist irrigation and custom benching. Commissioned in 1999.
- USDA/ARS Crops Research Laboratory, Fort Collins, Colorado, USA
13,000 square feet over 15 zones in independent greenhouse. A-Frame greenhouse structure and isolator cubicles within some compartments. Programming phase, mechanical design, heating load and cooling load calculations, ventilation design. Specifications writing.
- USDA Miles City, Montana, USA
Programming phase for a new research greenhouse complex.
- USDA/ARS BARC-West, Beltsville, Maryland, Montana, USA
BL3-Ag Maximum Security Biocontainment Greenhouse and Laboratory. Heating load and cooling load calculations. Electrical and control points list. Greenhouse sequences of control.
- University of California at Riverside Insectary, Riverside, California
2,700 square feet over 18 zones in independent greenhouse. Gothic type structure with double inflated Teflon film glazing. Heating and cooling load calculations.
- Ottawa Central Farm, Agriculture-Canada, Ottawa, Ontario, Canada
Technical and financial feasibility study of a research greenhouse complex.

Conservatory greenhouse projects

- The Governor General of Canada, Official Residence Tropical House, Rideau Hall, Ontario, Canada
Renovation of existing tropical house. Design of mechanical systems: heating, irrigation, fogging, natural ventilation, controls. Project completed in 2010.



- Villa Cataract, Quebec City, Canada
Renovation of a historical conservatory built in 1922, for the Quebec Government. Heating load calculations and on-site survey.



- Science North, Sudbury, Ontario, Canada
Butterfly house for the Natural Science Museum. Design of mechanical systems: irrigation, fogging, natural ventilation.



- Butterfly House, Niagara Botanical Gardens, Niagara Falls, Ontario, Canada
11,000 square feet butterfly conservatory. Heating, ventilating and cooling loads (HVAC) and lighting calculations.



Other greenhouse projects of significance

Various Feasibility Studies:

- City of Sainte-Foy, Quebec, Canada: Technical and financial feasibility study of a one hectare commercial greenhouses complex.

Computerized development

- Development of computerized software for greenhouse design, such as heating, cooling, solar gain, ventilation, fogging.

1993-94: LAVAL UNIVERSITY, Ste-Foy, Quebec, Canada.

RESEARCH ASSISTANT

Mathematical modeling of machinery circulation in Agricultural fields. (M. Sc. thesis)

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