S.18-103

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Simon Fraser University
Strand Hall 3100
8888 University Drive
Burnaby BC
Canada V5A 1S6

MEMORANDUM

ATTENTION: Senate | TEL

FROM: Peter Keller, Vice-President, Academic and Provost, and Chair, SCUP

RE: Full Program Proposal for the Master of Applied Science in Sustainable Energy Engineering (SCUP 18-29)

DATE: October 17, 2018 | TIME

At its October 10, 2018 meeting, SCUP reviewed and approved the full program proposal for the Master of Applied Science in Sustainable Energy Engineering within the Faculty of Applied Sciences, effective Fall 2019.

Motion:

That Senate approve and recommend to the Board of Governors the full program proposal for the Master of Applied Science in Sustainable Energy Engineering within the Faculty of Applied Sciences, effective Fall 2019.

c: K. Oldknow
E. Fiume

SFU GRADUATE AND POSTDOCTORAL STUDIES

SCUP 18-29

Simon Fraser University
Maggie Benston Centre 1100
8888 University Drive
Burnaby, BC V5A 1S6

TEL 778.782.3042
FAX 778.782.3080

gradstudies@sfu.ca
www.sfu.ca/grad

MEMORANDUM

ATTENTION Senate Committee on University Priorities (SCUP)

DATE September 24, 2018

FROM Jeff Derksen,
Chair of Senate Graduate Studies Committee (SGSC)

RE: Full program proposal for a Master of Applied Science in Sustainable Energy Engineering

For approval:

At its meeting of September 11, 2018, SGSC approved full program proposal for a Master of Applied Science in Sustainable Energy Engineering and is recommending it to SCUP for approval, effective **Fall 2019.**

Motion:
That SCUP approve and recommend to Senate the full program proposal for a Master of Applied Science in Sustainable Energy Engineering within the Faculty of Applied Science.

SFU
OFFICE OF THE DEAN
Faculty of Applied Sciences
Simon Fraser University

MEMORANDUM

Attention Dr. Jeff Derksen
Dean, Graduate Studies

Date August 24, 2018

From Dr. Mirza Faisal Beg mfbeg@sfu.ca
Faculty of Applied Science, Graduate Studies Committee

Re: Full Program Proposal for Sustainable Energy Engineering graduate degrees and Professional Master's in Mechatronic Product Realization

---

The faculty of Applied Sciences Graduate Program Committee would like to send two items to the SGSC for consideration. These are:

1) The full program proposal for the Sustainable Energy Engineering MASc and PhD degrees revised as per the feedback provided by your office.
2) The full program proposal for the Professional Master's in Mechatronic Product Realization revised as per the feedback provided by your office.

FAS GPC has approved both of these submissions via an electronic vote. I request you to place these on the agenda for the next SGSC meeting.

SFU FACULTY OF APPLIED SCIENCES

8888 University Drive,
Burnaby, BC
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MEMORANDUM

ATTENTION	Faisal Beg, Chair Faculty of Applied Sciences Graduate Program Committee	DATE	August 1st, 2018
FROM	Kevin Oldknow, Director Sustainable Energy Engineering Program	PAGES	1/1
RE:	SEE MASc and PhD Full Program Proposals		

Please find enclosed the following documents for consideration by the Faculty of Applied Sciences Graduate Program Committee:

1.) Sustainable Energy Engineering

I. MASc Full Program Proposal (Revised)

II. PhD Full Program Proposal (Revised)

Kevin Oldknow, Ph.D., P.Eng.

SFU SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Master of Applied Science (MASc) in Sustainable Energy Engineering

Full Program Proposal

August 2018

Faculty of Applied Sciences

PART A: Information required by the Ministry of Advanced Education

EXECUTIVE SUMMARY

Overview of the SFU's history, mission, and academic goals

As Canada's engaged university, Simon Fraser University is defined by its dynamic integration of innovative education, cutting-edge research and far-reaching community engagement. SFU was founded in 1965 with a mission to bring an interdisciplinary approach to learning, embrace bold initiatives, and engage with communities near and far. Today SFU is consistently ranked amongst Canada's top comprehensive universities and is one of the world's leading teaching and research institutions.

The Sustainable Energy Engineering (SEE) program will align and reinforce SFU's strategic and academic plans, as well as reinforce the Province of British Columbia's commitment to stimulate industry-focused programs that support high demand occupations in the province's technology sector. This will be achieved through the delivery of a program that provides a unique and specific education including foundational engineering principles, design practices, current technologies, economics and policies associated with the global Clean Technology (cleantech) sector.

Students will emerge from the program with the multidisciplinary skills needed to meet the province's growing demand for cleantech professionals, as well as the capacity to become national and international leaders in developing engineering solutions for a sustainable world. It is further expected that the potential for significant positive societal impact will draw a diverse student body, in contrast with traditional engineering programs.

Proposed credential to be awarded

Master of Applied Science (MASc) in Sustainable Energy Engineering.

Location of program

The Sustainable Energy Engineering program will be hosted in a new facility that is being purpose-built to deliver a cutting-edge engineering program with a focus on sustainable energy. Located adjacent to the existing SFU Surrey campus and exemplifying best practices in sustainability design, the building is intended to serve as a living lab for participating students and as a sustainable design showcase for SFU, the City of Surrey and the Province. Its proximity to the SFU Surrey campus, Surrey City Hall, and the developing Clean Technology (cleantech) industry clusters within the South Fraser region, will allow for enhanced collaboration in the provision of a sustainably oriented, industry-aware graduate engineering program.

Academic unit(s) offering proposed program

This program will be offered by the SFU Faculty of Applied Sciences, and will be administered by the Faculty of Applied Sciences directly. A total of 22 faculty and 16 staff are expected to be hired in conjunction with mounting and deployment of the SEE undergraduate and graduate programs, with hiring expected to occur between 2018-2021 for faculty, and 2018-2020 for staff. Teaching and service assignments for faculty members associated with the SEE program will be administered by the Program Director, and staff associated with the SEE program will be managed by the FAS Dean's Office.

Anticipated program start date

Fall 2019

Anticipated completion time

It is anticipated that the program will typically be completed in two years of full time study.

Summary of proposed program

a) Aims, goals and/or objectives of the proposed program

The objective of the proposed program is to educate engineers who will lead research into the sustainable harvesting, conversion, storage, distribution, utilization, transition, and management of energy and environmental resources.

b) Anticipated contribution of the proposed program to the mandate and strategic plan of the institution

The proposed program in Sustainable Energy Engineering builds upon the Faculty of Applied Sciences' commitment to technology-based innovation, and furthers SFU's interest in supporting advanced research that will contribute to the development of vibrant, healthy and technologically innovative communities. Through industry partnerships, international-level thought leadership and research, and progressive curriculum, this program is positioned to advance Faculty and University level goals in several key areas such as expanding industry collaborations within the South Fraser Region, strengthening ties with the City of Surrey and surrounding municipalities, and expanding the talent pool of advanced researchers in areas related to sustainable energy and clean technology.

The program also aligns with the Province's commitment to provide increased funding to industry-focused programs that support high demand occupations in the BC technology sector and with the University's interest in encouraging strategies that, as mentioned within the President's Goals and Objectives 2015-16 "support continued implementation of BC's Skills for Jobs Blueprint and the development of an associated strategy to ensure SFU meets its enrolment targets for programs that educate for high demand occupations" such as Engineering and establish SFU as "the leading engaged university defined by its dynamic integration of innovative education, cutting-edge research, and far-reaching community engagement".

c) Linkages between the educational goals and the curriculum.

The program aims to offer a unique ecosystem for advanced research in sustainable energy engineering by drawing on existing strengths at SFU in general, and FAS in particular. Through training in formal coursework and hands-on research, SEE graduates will be capable of working with integrity to invent, improve, design and deploy sustainable clean energy technologies addressing the clean energy needs for now and the future.

d) Potential areas/sectors of employment for graduates and/or opportunities for further study.

Graduates of the Sustainable Energy Engineering MASc program will acquire a diverse range of knowledge and research skills that will enable them to pursue various career opportunities related to energy harvesting, conversion, storage, distribution, and energy-efficient systems and machines in a wide range of sectors, including wind, solar, geothermal, hydro-electric power, fuel cells, gas turbines, biomass, transportation, oil and natural gas as researchers, entrepreneurs, and consultants. These opportunities may be in the fast-growing cleantech sector in BC, or the graduates may find employment in other parts of Canada and the world. Relevant National Occupational Classification (NOC) codes include:

- 2131 Civil Engineers
- 2132 Mechanical Engineers
- 2133 Electrical Engineers
- 2141 Industrial and Manufacturing Engineers
- 2173 Software Engineers

This program will also prepare them for pursuing the Doctor of Philosophy (Ph.D.) degree in Sustainable Energy Engineering and related Engineering disciplines at SFU and at other universities across Canada and internationally.

e) Delivery methods

The program will be a combination of face-to-face lecture-based courses, seminar courses, directed-studies, and advanced research courses conducted in state-of-art research labs leading to a graduate thesis.

f) Program strengths

Graduates will receive training in advanced research into novel clean energy technologies. They will also be provided opportunities for broadening their education by electives in energy-related economics, environmental science, business and entrepreneurship.

g) **An overview of the level of support and recognition from other post-secondary institutions, and relevant regulatory or professional bodies, where applicable and plans for admissions and transfer within the British Columbia post-secondary education system.**

Active consultation within the SFU community regarding the SEE initiative (including prospective undergraduate and graduate programs) has been underway since mid-2016. This dialogue will continue moving forward, with particular emphasis as additional graduate programs (e.g. course-based MEng and Professional Master's) are developed with a particular emphasis on pan-university involvement and interdisciplinarity.

External consultation has included dialogue with advisory council members, industry, and professional / regulatory bodies including Engineers and Geoscientists BC (previously the Association of Professional Engineers and Geoscientists of BC). Corresponding letters and statements of support are provided in Appendix 3.

Admissions requirements for the program have been articulated, and will be implemented, such that prior studies at other BC post-secondary institutions (e.g. bachelor's degrees in related areas of engineering) will be readily recognized during the application processes.

h) **Related programs in the institution or other British Columbia post-secondary institutions.**

The SFU SEE program will be uniquely positioned as the only masters level research-intensive regional program that applies directly to sustainable energy systems and the related cleantech sector. The UBC Master of Engineering Leadership program in Clean Energy Engineering seems to be the most closely related to the proposed MASc degree in the SFU SEE program. However, unlike the two year research-intensive MASc in the SFU SEE program, the UBC degree is a combination of technical (60%) and leadership development (40%) aspects covered over a one-year term. The University of Victoria has an Institute for Integrated Energy Systems that conducts graduate level research but does not offer a MASc degree in energy engineering. It should be noted, however, that the Civil Engineering graduate program at UVic does include course offerings in sustainability and green buildings. BCIT has a School of Energy, but it does not mount any undergraduate or graduate programs directly in the area of energy engineering.

Contact information

Dr. Kevin Oldknow, P.Eng.
Associate Dean, Faculty of Applied Sciences
Director, Sustainable Energy Engineering Program
778.782.9254
koldknow@sfu.ca

PART B: Information required by Simon Fraser University

PROGRAM DETAILS

a) Graduation requirements, target audience

The Master of Applied Science (MASc) in SEE is a research-intensive program that has a primary emphasis on the MASc thesis rather than course work.

The target audience for the MASc program in SEE is students with an undergraduate (bachelor's) degree in electrical engineering, computer engineering, mechanical engineering, engineering science, mechatronic systems engineering, or a related area. Applicants must satisfy the University admission requirements as stated in Graduate General Regulation 1.3 with a 3.0 cumulative grade point average (B average) from a recognized university, or equivalent.

This program consists of course work (12 units) and a thesis (18 units) for a minimum of 30 units. Students who lack the necessary background knowledge may, at the discretion of the supervisor or the supervisory committee, be asked to complete additional courses beyond the program requirements in order to broaden the students' preparation for undertaking thesis work. Also if necessary, The Western Deans' Agreement will support MASc students in SEE taking elective courses at participating institutions in BC.

Students must complete

SEE 896 (0): MASc Research Seminar*

and three of (with a minimum of two SEE courses)

SEE 820 (3) Materials Design for Energy Systems
SEE 821 (3) Membranes and Filtration
SEE 850 (3) Energy Storage Systems
SEE 891 (3) Directed Studies
SEE 893 (3) Special Topics I
SEE 894 (3) Special Topics II
SEE 895 (3) Special Topics III
MSE 722 (3) Fuel Cell Systems
MSE 780 (3) Manufacturing Systems
MSE 821 (3) Advanced Conduction Heat Transfer
MSE 822 (3) Advanced Convection Heat Transfer
ENSC 801 (3) Linear System Theory
ENSC 802 (3) Stochastic Systems
ENSC 810 (3) Statistical Signal Processing
ENSC 833 (3) Network Protocols and Performance
ENSC 835 (3) Communication Networks
ENSC 854 (3) Integrated Microsensors and Actuators

and one three unit graduate elective course in consultation with the senior supervisor

and a thesis

SEE 898 (18) MASc Thesis

*Students must enroll in this course every term

b) Admission requirements

Applicants must satisfy the University admission requirements as stated in Graduate General Regulation 1.3 with a 3.0 cumulative grade point average (B average) from a recognized university, or equivalent.

c) Evidence of student interest and labour market demand

A survey of 96 cleantech and sustainable energy technology companies in Canada (conducted by The Delphi Group in the Fall of 2016 as part of the development process for the Sustainable Energy Engineering initiative[1]) identified the following cleantech segments as those expected to see the highest global growth over the next decade:

1. Energy storage and battery technology;
2. Clean power generation;
3. Smart grid, transmission, and distribution;
4. Clean transportation technology;
5. Energy efficiency, conservation, and demand-side management;
6. Green building design and construction; and
7. Water and wastewater.

For the market opportunities in British Columbia more specifically, BC-based companies selected (1) green building design and construction, (2) clean transportation technology, and (3) energy efficiency, conservation, and demand-side management as the top growth segments over the next decade. Many see higher growth potential outside of BC for their cleantech solutions in the short-term, although it may not require going far from home given potential increasing demand from other Western provinces such as Alberta and/or West coast states including California, Oregon, and Washington.

Cleantech companies that responded to Delphi's survey identified a shortage of skilled and qualified engineers available in Canada for supporting the growth of their businesses.

Survey respondents suggested that a program offering a more "broad-based" energy systems focus that includes techno-economics and a specialization in certain areas of environmental or clean technology (such as energy storage and smart grid, a broad range of renewable energy technologies, alternative fuels and technologies, and resource optimization solutions) would add value to the industry and fill a current gap in the market.

[1] Canadian Cleantech Industry Consultation. Findings & Summary Report. October 2016. The Delphi Group.

d) Eligibility for scholarships, awards, and financial aid

Students will be able to apply for awards funded from the university's operating budget, including entrance scholarships and graduate fellowships. Students will also be eligible for Teaching Assistantships and Research Assistantships. Normally, students in this program will be eligible for financial aid so that students may qualify for a loan if necessary.

e) Program evaluation and academic/administrative oversight

As mandated by Senate, the program will be externally reviewed at seven-year intervals. In addition, oversight will be provided by a SEE Steering Committee (refer to Appendix 4).

f) Main competitors outside BC

Graduate programs outside of B.C. with foci in the space of sustainable energy engineering include those listed below. Common threads amongst the programs (including the proposed SEE program at SFU) include a focus on renewable energy, and placement of energy systems technologies in a broader framework of ecological, economic and regulatory contexts. This is reflective of a growing global focus on graduate education in these areas. Distinctive aspects of the proposed SEE program include focal points for research that map onto the overarching themes of smart cities, clean transportation and sustainable manufacturing, as well as a strong focus on research and thesis work (some of the programs listed above are specifically course focused).

Carleton Univeristy: MASc, MA, MEng programs in Sustainable Energy
https://graduate.carleton.ca/cu-programs/sustainable-energy-masters/

University of Exeter: MSc, PhD, MPhil, MSc programs in Renewable Energy
http://emps.exeter.ac.uk/renewable-energy/postgraduate/

Berkeley University of California: Ph.D., M.A., M.S programs in Energy & Resources
http://grad.berkeley.edu/program/energy-resources/

University of Michigan: MEng in Energy Systems
http://energy.umich.edu/students/degree-programs

University of New South Wales, Sydney: MEngSc in Renewable Energy
https://www.engineering.unsw.edu.au/study-with-us/postgraduate-degrees/renewable-energy

TU Eindoven: MSc, PhD in Sustainable Energy Technology
https://www.tue.nl/en/education/tue-graduate-school/graduate-programs/sustainable-energy-technology-graduate-program/

University of Oldenburg, Master/Bachelor and PhD programs in Renewable Energy
https://www.uni-oldenburg.de/en/energycourses/programmes-in-renewable-

energy/programmes-masterbachelor/
http://phd-renewable-energy.de/en/course-structure/

Aalborg University: MSc in Energy Engineering
http://www.en.aau.dk/education/master/energy-engineering

University of Calgary: MSc in Sustainable Energy Development
http://haskayne.ucalgary.ca/programs/sedv/about

University of Toronto: MEng, MASc, PhD with Emphasis in Sustainable Energy
http://gradstudies.engineering.utoronto.ca/professional-degrees/emphasis-in-sustainable-energy/

RESOURCES

a) **Enrolment Plan**

An initial intake of 15 students in the masters level program is expected to grow to a steady state intake of approximately 30 students per year by year 4, with a steady state enrolment of 60 FTE (the projected distribution of graduate students between masters and doctoral levels is consistent with historical averages in FAS programs). These projections are also consistent with the funding levels that have been announced by the Provincial Government's Ministry of Advanced Education, Skills and Training for graduate students in SEE at SFU.

b) **Resources required and/or available to implement the program (financial and personnel) including any new faculty appointments**

The BC government recently announced (January 16, 2018) a total of 440 new student seats for the SEE program including 120 graduate student seats. As the SEE program is mounted, new faculty will be hired for teaching the SEE courses, and for developing the state-of-art laboratories for research in the areas of clean technologies and sustainable energy. The space for the SEE graduate program will be in the newly-built SEE building in Surrey. This is a new program, with new faculty, and new student spaces, and therefore is not expected to impact, reduce, or eliminate any other programs or resources with SFU and the new teaching bandwidth will be supplied by the hiring of new faculty specifically for this program. The Faculty of Applied Sciences plans to implement a graduated hiring plan of 22 new faculty and 16 new (8 administrative and 8 technical, respectively) staff in conjunction with mounting and deployment of SEE undergraduate and graduate programs. Following is the approximate timeline for expected faculty hires:

2018/19 Fiscal year: 6 new faculty positions
2019/20 Fiscal year: 8 new faculty positions
2020/21 Fiscal year: 4 new faculty positions
2021/22 Fiscal year: 4 new faculty positions

c) Faculty member's teaching/supervision

In order to provide the expertise needed to cover required teaching areas, it is anticipated that incoming faculty will be balanced across the broad areas of thermo-fluids, electrical engineering and power systems, bio-process and renewable energy systems, advanced materials, mechanical design and manufacturing. In order to support and supervise graduate research in harmony with anticipated SEE research foci, it is further expected that faculty members will have research agendas relating to smart cities, clean transportation and sustainable manufacturing.

d) Proposed tuition and other program fees including a justification

Tuition will be charged on a per-term basis, consistent with SFU's schedule of fees for regular (research based) graduate programs.

PART C: Appendices

Appendix 1 Calendar entry

Appendix 2 New courses

Appendix 3 Letters of support

Appendix 4 Details of program steering committee

Appendix 5 Abbreviated curriculum vitae for faculty

Sustainable Energy Engineering

Master of Applied Science

Description of Program

The Master of Applied Science (MASc) in Sustainable Energy Engineering (SEE), offered through the Faculty of Applied Sciences, is a research-intensive program that has a primary emphasis on the MASc thesis. The program aims to offer a unique ecosystem for advanced research in sustainable energy engineering. Through training in formal coursework and hands-on research, SEE graduates will be capable of working with integrity to invent, improve, design and deploy sustainable clean energy technologies addressing the clean energy needs for now and the future. Candidates will develop a strong aptitude for research and exceptional quantitative, analytical, and design skills in areas such as sustainable harvesting, conversion, storage, distribution, utilization, transition, and management of energy and environmental resources.

Admission Requirements

Admission is competitive. Applicants must satisfy the University admission requirements as stated in Graduate General Regulation 1.3 in the SFU Calendar, and have the following:

- An undergraduate (bachelor's) degree in electrical engineering, computer engineering, mechanical engineering, engineering science, mechatronic systems engineering or a related field;
- Submitted evidence of capability to undertake substantial original research;
- Identified a faculty member as a senior supervisor.

Program Requirements

This program consists of course work (12 units) and a thesis (18 units) for a minimum of 30 units. Students who lack the necessary background knowledge may, at the discretion of the supervisor or the supervisory committee, be asked to complete additional courses beyond the program requirements in order to broaden the students' preparation for undertaking thesis work.

Students must complete
SEE 896 (0): MASc Research Seminar*

and three of (with a minimum of two SEE courses)
SEE 820 (3) Materials Design for Energy Systems
SEE 821 (3) Membranes and Filtration
SEE 850 (3) Energy Storage Systems
SEE 891 (3) Directed Studies
SEE 893 (3) Special Topics I
SEE 894 (3) Special Topics II
SEE 895 (3) Special Topics III
MSE 722 - Fuel Cell Systems (3)
MSE 780 - Manufacturing Systems (3)
MSE 821 - Advanced Conduction Heat Transfer (3)
MSE 822 - Advanced Convection Heat Transfer (3)
ENSC 801 - Linear System Theory (3)
ENSC 802 - Stochastic Systems (3)
ENSC 810 - Statistical Signal Processing (3)
ENSC 833 - Network Protocols and Performance (3)
ENSC 835 - Communication Networks (3)
ENSC 854 - Integrated Microsensors and Actuators (3)

and one three unit graduate elective course in consultation with the senior supervisor

and a thesis
SEE 898 – MASc Thesis (18)

*Students must enroll in this course every term

Program Length

Students are expected to complete the program requirements within six terms.

Academic Requirements within the Graduate General Regulations

All graduate students must satisfy the academic requirements that are specified in the graduate general regulations, as well as the specific requirements for the program in which they are enrolled.

SFU SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Sustainable Energy Engineering Program

Appendix 2: New Courses

August 2018

Faculty of Applied Sciences

New Courses

- SEE 820 (3) Materials Design for Energy Systems
- SEE 821 (3) Membranes and Filtration
- SEE 850 (3) Energy Storage Systems
- SEE 891 (3) Directed Studies
- SEE 893 (3) Special Topics I
- SEE 894 (3) Special Topics II
- SEE 895 (3) Special Topics III
- SEE 896 (0) MASc Research Seminar
- SEE 898 (18) MASc Thesis

SFU GRADUATE AND POSTDOCTORAL STUDIES

New Graduate Course Proposal

Course Subject (eg. PSYC) SEE	Number (eg. 810) 820	Units (eg. 4) 3

Course title (max. 100 characters)

Materials Design for Energy Systems

Short title (for enrollment/transcript - max. 30 characters) Matls Desgn for Energy Systems

Course description for SFU Calendar (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description)

Modern engineering materials design for energy system applications. Predictive modelling and design implications applied to energy systems. Advanced theoretical and experimental investigations will be discussed to understand the methodologies for design of materials and machinery to be applied to the energy conversion.

Rationale for introduction of this course

This course represents a core graduate level technical offering in Sustainable Energy Engineering, in conjunction with the proposed SEE MASc and PhD programmes.

Term of initial offering (eg. Fall 2019) Fall 2019	Course delivery (eg. 3 hrs/week for 13 weeks) 3 hrs/week for 13 weeks
Frequency of offerings/year 1 time/year	Estimated enrollment per offering 20

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

Prerequisite and/or Corequisite Recommended: SEE 222. Corequisite: SEE 896 or SEE 897.

Criminal record check required? ☐ Yes if yes is selected, add this as prerequisite | Additional course fees? ☐ Yes ☑ No

Campus where course will be taught ☐ Burnaby ☑ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components * ☑ Lecture ☐ Seminar ☐ Lab ☐ Independent ☐ Capstone ☐ _____

Grading Basis ☑ Letter grades ☐ Satisfactory/ Unsatisfactory ☐ In Progress / Complete

Repeat for credit? ☐ Yes ☑ No	Total repeats allowed? _____	Repeat within a term? ☐ Yes ☑ No
Required course? ☐ Yes ☑ No	Final exam required? ☑ Yes ☐ No	Capstone course? ☐ Yes ☑ No

Combined with a undergrad course? ☐ Yes ☑ No If yes, identify which undergraduate course and the additional course requirements for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course Faculty/instructors will be hired prior to the first offering of the course. It is anticipated that current FAS faculty members will not teach SEE courses.
Additional faculty members, space, and/or specialized equipment required in order to offer this course None

CONTACT PERSON

Academic Unit / Program	Name (typically, Graduate Program Chair)	Email
Faculty of Applied Sciences	Kevin Oldknow	koldknow@sfu.ca

ACADEMIC UNIT APPROVAL

A course outline must be included.

Non-departmentalized faculties need not sign

Graduate Program Committee	Signature	Date
Department Chair KEVIN OLDKNOW	**Signature**	**Date** AUG 7th, 2018

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee	Signature	Date
M. F. Beg		08/07/'18

A library review will be conducted. If additional funds are necessary, DGS will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee	Signature	Date
Jeff Derksen		SEP 24 2018

ADMINISTRATIVE SECTION (for DGS office only)
Library Check: SEP 06 2018
Course Attribute:
Course Attribute Value:
Instruction Mode:
Attendance Type:

If different from regular units:
Academic Progress Units:
Financial Aid Progress Units:

Sustainable Energy Engineering

SEE 820 (3) Materials Design for Energy Systems

Units: 3

Course Description

Engineering material design including composite materials has been increasingly used in modern energy applications such as battery, fuel cell, and oil & gas industries. This course aims to give an advanced understanding of modern engineering material design for energy system applications and an appreciation of predictive modelling and design implications when designed materials are applied to energy systems. So this course gives students a graduate-level introduction to the materials engineering that underpins the design of energy systems. Advanced theoretical and experimental investigations will be discussed to understand the methodologies for design of materials and machinery to be applied to the energy conversion.

Pre-requisites

Recommended: SEE 222 (Engineering Materials for Energy Systems)

Resources / References

Handbook of Battery Materials, 2011 Wiley
Materials for Fuel Cells, 2008, Woodhead Publishing

Plus additional readings given by instructor

Intended Learning Outcomes

1. Students will learn to apply advanced science such as the materials science and engineering that underpins the design of energy systems.
2. Students will learn to integrate understanding of the scientific and engineering methodologies for design of materials and machinery to be applied to the energy conversion.
3. Students will understand to apply and integrate knowledge from each of the material engineering elements of the applications to solve materials selection and design problems.
4. Students will possess the skills and techniques necessary for modern materials engineering practice in energy systems.
5. Students will be knowledgeable of contemporary issues relevant to sustainable energy engineering by optimal material selection.

Subjects & Topics

1. Design and Fabrication of Electrochemical Energy Storage
2. Design Materials for Battery Systems
3. Design Polymer Electrolyte Materials for Battery and Super-capacitors
4. Failure Analysis of Fuel Cell Materials
5. Material Designs for Solar Energy Conversion
6. Material Design for Thermoelectric System
7. Nano Materials Design for Energy System.

Course Format

- 3 hours/week of lectures
- Problem sets & tutorials – material design assignments
- Real world project - interpret a real world's engineering material selection problem in the context of energy engineering as a project and write a report.
- Mid-term Exam
- Final Exam

Grading

- Problem sets (15%)
- Project report (20%)
- Midterm (25%)
- Final exam (40%)

SFU GRADUATE AND POSTDOCTORAL STUDIES

New Graduate Course Proposal

Course Subject (eg. PSYC) SEE	Number (eg. 810) 821	Units (eg. 4) 3

Course title (max. 100 characters)
Membranes and Filtration

Short title (for enrollment/transcript - max. 30 characters) Membranes and Filtration

Course description for SFU Calendar (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description)

Water usage and global water shortages; principles of membrane separation including microfiltration, ultrafiltration, nanofiltration and reverse osmosis; physico-chemical criteria for separations and membrane materials; basic mass transport in mixed solute systems; polarization and fouling; prediction of membrane performance; operational issues, limitations, energy requirements and system configurations.

Rationale for introduction of this course

This course represents a core graduate level technical offering in Sustainable Energy Engineering, in conjunction with the proposed SEE MASc and PhD programmes.

Term of initial offering (eg. Fall 2019) Fall 2019	Course delivery (eg. 3 hrs/week for 13 weeks) 3 hrs/week for 13 weeks
Frequency of offerings/year 1 time/year	Estimated enrollment per offering 20

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

Prerequisite and/or Corequisite Recommended: SEE 224 and SEE 225. Co-requisite: SEE 896 or SEE 897.

Criminal record check required? ☐ Yes if yes is selected, add this as prerequisite

Additional course fees? ☐ Yes ☑ No

Campus where course will be taught ☐ Burnaby ☑ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components * ☑ Lecture ☐ Seminar ☐ Lab ☐ Independent ☐ Capstone ☐ _____

Grading Basis ☑ Letter grades ☐ Satisfactory/ Unsatisfactory ☐ In Progress / Complete

Repeat for credit? ☐ Yes ☑ No	Total repeats allowed? _____	Repeat within a term? ☐ Yes ☑ No
Required course? ☐ Yes ☑ No	Final exam required? ☑ Yes ☐ No	Capstone course? ☐ Yes ☑ No

Combined with a undergrad course? ☐ Yes ☑ No If yes, identify which undergraduate course and the additional course requirements for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course Faculty/instructors will be hired prior to the first offering of the course. It is anticipated that current FAS faculty members will not teach SEE courses.
Additional faculty members, space, and/or specialized equipment required in order to offer this course None

CONTACT PERSON

Academic Unit / Program	Name (typically, Graduate Program Chair)	Email
Faculty of Applied Sciences	Kevin Oldknow	koldknow@sfu.ca

ACADEMIC UNIT APPROVAL

A course outline must be included.

Non-departmentalized faculties need not sign

Graduate Program Committee	Signature	Date
Department Chair KEVIN OLDKNOW	**Signature**	**Date** AUG 7th, 2018

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee	Signature	Date
M-F. Beg		08/07/18

A library review will be conducted. If additional funds are necessary, DGS will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee	Signature	Date
Jeff Derksen		SEP 24 2018

ADMINISTRATIVE SECTION (for DGS office only)
Library Check: SEP 06 2018
Course Attribute:
Course Attribute Value:
Instruction Mode:
Attendance Type:

If different from regular units:
Academic Progress Units:
Financial Aid Progress Units:

Sustainable Energy Engineering

SEE 821 (3) Membranes and Filtration

Units: 3

Course Description

Separation and filtration are important and energy intensive processes used in industry as well as in the supply of clean water. The course covers: water usage and global water shortages; principles of membrane separation including microfiltration, ultrafiltration, nanofiltration and reverse osmosis; physico-chemical criteria for separations and membrane materials; basic mass transport in mixed solute systems; polarization and fouling; prediction of membrane performance; operational issues, limitations, energy requirements and system configurations.

Pre-requisites

Basic knowledge of transport phenomena and thermodynamics

Recommended: SEE 224 (Thermodynamics for Energy Engineering) and SEE 225 (Fluid Mechanics)

Resources / References

Membrane Technology and Applications, Third Edition
Richard W. Baker
John Wiley & Sons, 2012
Print ISBN:9780470743720
Online ISBN:9781118359686

Membrane and Desalination Technologies, Handbook of Environ. Eng. Series, Vol 13
Lawrence K. Wang, Jiaping Paul Chen, and Yung-Tse Hung (Editors)
Humana Press, 2010
PRINT ISBN: 9781588299406
EBOOK ISBN: 9781597452786

Principles of Water Treatment
Kerry J. Howe, David W. Hand, John C. Crittenden, R. Rhodes Trussell, George Tchobanoglous
John Wiley & Sons, 2012
PRINT ISBN: 9780470405383
EBOOK ISBN: 9781118309674

Intended Learning Outcomes

1. Identify filtration requirements for different streams.
2. Describe different types of membranes and filtration materials and systems.
3. Understand the physico-chemical processes and limitations in membrane separation and filtration processes.
4. Apply knowledge and predictive models to compare and assess performance in terms of cost, efficiency, energy requirements and lifetimes/fouling for various applications.

Subjects & Topics

1. Introduction: global water needs and resources; membrane processes; advantages, limitations and range of applications
2. Fundamentals: function of membranes; membrane processes; transport mechanism
3. Overview of materials and structures of synthetic membranes
4. Fluxes and driving forces in membrane separation processes: mass transport; membrane separation capability; chemical and electrochemical equilibrium in membrane processes; osmotic equilibrium, osmotic pressure, osmosis, and reverse osmosis.
5. Membrane processes: microfiltration; ultrafiltration; reverse osmosis; gas separation
6. System considerations: system design; fouling; energy requirements.

Course Format

- 3 hours/week of lectures
- Term paper: students will perform a literature review of a pre-approved application area of membrane and filtration processes with a focus on a critical assessment including one or more of: design, performance, techno-economics.

Grading

- Midterm examination: 20%
- Final Examination: 50%
- Term paper: 30%

SFU GRADUATE AND POSTDOCTORAL STUDIES

New Graduate Course Proposal

Course Subject (eg. PSYC) SEE	Number (eg. 810) 850	Units (eg. 4) 3

Course title (max. 100 characters)

Energy Storage Systems

Short title (for enrollment/transcript - max. 30 characters) Energy Storage Systems

Course description for SFU Calendar (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description)

Electrochemical, mechanical and thermal energy storage techniques; integration for stationary and mobile applications; design tradeoffs to understand environmental impacts, cost, reliability, and efficiency.

Rationale for introduction of this course

This course represents a core graduate level technical offering in Sustainable Energy Engineering, in conjunction with the proposed SEE MASc and PhD programmes.

Term of initial offering (eg. Fall 2019) Fall 2019	Course delivery (eg. 3 hrs/week for 13 weeks) 3 hrs/week for 13 weeks
Frequency of offerings/year 1 time/year	Estimated enrollment per offering 20

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

Prerequisite and/or Corequisite Recommended: SEE 224 and SEE 230. Co-requisite: SEE 896 or SEE 897.

Criminal record check required? ☐ Yes if yes is selected, add this as prerequisite | Additional course fees? ☐ Yes ☑ No

Campus where course will be taught ☐ Burnaby ☑ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components * ☑ Lecture ☐ Seminar ☐ Lab ☐ Independent ☐ Capstone ☐ _____

Grading Basis ☑ Letter grades ☐ Satisfactory/ Unsatisfactory ☐ In Progress / Complete

Repeat for credit? ☐ Yes ☑ No	Total repeats allowed? _____	Repeat within a term? ☐ Yes ☑ No
Required course? ☐ Yes ☑ No	Final exam required? ☑ Yes ☐ No	Capstone course? ☐ Yes ☑ No

Combined with a undergrad course? ☐ Yes ☑ No If yes, identify which undergraduate course and the additional course requirements for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course Faculty/instructors will be hired prior to the first offering of the course. It is anticipated that current FAS faculty members will not teach SEE courses.
Additional faculty members, space, and/or specialized equipment required in order to offer this course None

CONTACT PERSON

Academic Unit / Program	Name (typically Graduate Program Chair)	Email
Faculty of Applied Sciences	Kevin Oldknow	koldknow@sfu.ca

ACADEMIC UNIT APPROVAL

A course outline must be included.

Non-departmentalized faculties need not sign

Graduate Program Committee	Signature	Date
Department Chair KEVIN OLDKNOW	Signature	Date Aug 7th, 2018

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee	Signature	Date
M.F. Beg		08/07/'18

A library review will be conducted. If additional funds are necessary, DGS will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee	Signature	Date
Jeff Derksen		SEP 24 2018

ADMINISTRATIVE SECTION (for DGS office only)

Library check: SEP 06 2018

Course Attribute:

Course Attribute Value:

Instruction Mode:

Attendance Type:

If different from regular units:

Academic Progress Units:

Financial Aid Progress Units:

Sustainable Energy Engineering

SEE 850 (3) Energy Storage Systems

Units: 3

Course Description

The growth in renewable energy generation together with the expanding electrification of transport require energy storage solutions to meet a range of challenges including variability and mobility. Topics covered include: electrochemical, mechanical and thermal energy storage techniques; integration for stationary and mobile applications; design tradeoffs to understand environmental impacts, cost, reliability, and efficiency.

Pre-requisites

Recommended: SEE 224 (Thermodynamics for Energy Engineering) and SEE 230 (Electrical Circuits)

Resources / References

Energy Storage-Fundamentals, Materials and Applications
Robert Huggins
Springer, Cham, 2016
Print ISBN: 978-3-319-21238-8
Online ISBN: 978-3-319-21239-5

Electric Energy Storage System. In: Electric Energy Storage Systems
Komarnicki P., Lombardi P., Styczynski Z.
Springer, Berlin, 2017
Print ISBN: 978-3-662-53274-4
Online ISBN: 978-3-662-53275-1

Thermal Energy Storage Using Phase Change Materials
Amy S. Fleischer
Springer, Cham, 2015
Print ISBN: 978-3-319-20921-0
Online ISBN: 978-3-319-20922-7

Intended Learning Outcomes

1. Compare and contrast methods of energy storage management in terms of cost, size, weight, reliability, efficiency and lifetimes.
2. Describe the energy storage need of stationary and mobile systems, both present and future.

3. Define the advantages and disadvantages of storage integration in various energy systems and settings, e.g. residential, remote community, public transportation, microgrids.
4. Analyze the impact of energy storage on system performance, system efficiency, and the environment.

Subjects & Topics

1. Intro to energy storage
2. Energy storage criteria: energy; power; size; economics
3. Electrochemical energy storage: batteries; fuel cells; flow batteries; ultra-capacitors,
4. Mechanical energy storage: pumped hydro; compressed gas; flywheel
5. Thermal energy storage: sensible heat, latent heat, and thermochemical storage
6. Other storage option: hydrogen; power to gas; smart grids
7. System considerations; environmental impacts.

Course Format

- 3 hours/week of lectures, discussions, presentations over 13 week term.
- Students will perform a cases study to apply and integrate the concepts.

Grading

- Case study including presentation and technical report: 50%
- Midterm examination: 15%
- Final Examination: 35%

SFU GRADUATE AND POSTDOCTORAL STUDIES

New Graduate Course Proposal

Course Subject (eg. PSYC) SEE	Number (eg. 810) 891	Units (eg. 4) 3

Course title (max. 100 characters)
Directed Studies

Short title (for enrollment/transcript - max. 30 characters) Directed Studies

Course description for SFU Calendar (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description)
Directed Study in Sustainable Energy Engineering

Rationale for introduction of this course
This course will provide the mechanism for graduate students to register for a directed study in partial fulfillment of the requirements toward their degree.

Term of initial offering (eg. Fall 2019) Fall 2019	Course delivery (eg. 3 hrs/week for 13 weeks) 3 hrs/week for 13 weeks
Frequency of offerings/year 3 times/year	Estimated enrollment per offering 10

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

Prerequisite and/or Corequisite Co-requisite: SEE 896 or SEE 897

Criminal record check required? ☐ Yes if yes is selected, add this as prerequisite
Additional course fees? ☐ Yes ☑ No

Campus where course will be taught ☐ Burnaby ☑ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components * ☐ Lecture ☐ Seminar ☐ Lab ☑ Independent ☐ Capstone ☐ _____

Grading Basis ☑ Letter grades ☐ Satisfactory/ Unsatisfactory ☐ In Progress / Complete

Repeat for credit? ☐ Yes ☑ No	Total repeats allowed? _____	Repeat within a term? ☐ Yes ☑ No
Required course? ☐ Yes ☑ No	Final exam required? ☐ Yes ☑ No	Capstone course? ☐ Yes ☑ No

Combined with a undergrad course? ☐ Yes ☑ No If yes, identify which undergraduate course and the additional course requirements for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course Faculty/instructors will be hired prior to the first offering of the course. It is anticipated that current FAS faculty members will not teach SEE courses.
Additional faculty members, space, and/or specialized equipment required in order to offer this course None

CONTACT PERSON

Academic Unit / Program	Name (typically, Graduate Program Chair)	Email
Faculty of Applied Sciences	Kevin Oldknow	koldknow@sfu.ca

ACADEMIC UNIT APPROVAL

A course outline must be included.

Non-departmentalized faculties need not sign

Graduate Program Committee	Signature	Date
Department Chair KEVIN OLDKNOW	Signature	Date Aug 7th, 2018

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee	Signature	Date
M. F. Boy		08/07/'18

A library review will be conducted. If additional funds are necessary, DGS will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee	Signature	Date
Jeff Derksen		SEP 24 2018

ADMINISTRATIVE SECTION (for DGS office only)
Library Check: SEP 06 2018
Course Attribute: _____
Course Attribute Value: _____
Instruction Mode: _____
Attendance Type: _____

If different from regular units:
Academic Progress Units: _____
Financial Aid Progress Units: _____

SFU GRADUATE AND POSTDOCTORAL STUDIES

New Graduate Course Proposal

Course Subject (eg. PSYC) SEE	Number (eg. 810) 893	Units (eg. 4) 3

Course title (max. 100 characters)
Special Topics I

Short title (for enrollment/transcript - max. 30 characters) Special Topics I

Course description for SFU Calendar (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description)
Special Topics in Sustainable Energy Engineering

Rationale for introduction of this course
At the SEE M.A.Sc. and Ph.D. programs are mounted and corresponding faculty hired, graduate courses will initially be offered as special topics and subsequently regularized

Term of initial offering (eg. Fall 2019) Fall 2019	Course delivery (eg. 3 hrs/week for 13 weeks) 3 hrs/week for 13 weeks
Frequency of offerings/year 3 times/year	Estimated enrollment per offering 20

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

Prerequisite and/or Corequisite Co-requisite: SEE 896 or SEE 897

Criminal record check required? ☐ Yes if yes is selected, add this as prerequisite
Additional course fees? ☐ Yes ☑ No

Campus where course will be taught ☐ Burnaby ☑ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components * ☐ Lecture ☑ Seminar ☐ Lab ☐ Independent ☐ Capstone ☐ _____

Grading Basis ☑ Letter grades ☐ Satisfactory/ Unsatisfactory ☐ In Progress / Complete

Repeat for credit? ☐ Yes ☑ No	Total repeats allowed? 9	Repeat within a term? ☐ Yes ☑ No
Required course? ☐ Yes ☑ No	Final exam required? ☑ Yes ☐ No	Capstone course? ☐ Yes ☑ No

Combined with a undergrad course? ☐ Yes ☑ No If yes, identify which undergraduate course and the additional course requirements for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course Faculty/instructors will be hired prior to the first offering of the course. It is anticipated that current FAS faculty members will not teach SEE courses.
Additional faculty members, space, and/or specialized equipment required in order to offer this course None

CONTACT PERSON

Academic Unit / Program	Name (typically, Graduate Program Chair)	Email
Faculty of Applied Sciences	Kevin Oldknow	koldknow@sfu.ca

ACADEMIC UNIT APPROVAL

A course outline must be included.

Non-departmentalized faculties need not sign

Graduate Program Committee	Signature	Date
Department Chair KEVIN OLDKNOW	Signature	Date AUG 9TH, 2018

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee	Signature	Date
M. F. Bag		08/07/'18

A library review will be conducted. If additional funds are necessary, DGS will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee	Signature	Date
Jeff Derksen		SEP 24 2018

ADMINISTRATIVE SECTION (for DGS office only)
Library Check: SEP 06 2018
Course Attribute:
Course Attribute Value:
Instruction Mode:
Attendance Type:

If different from regular units:
Academic Progress Units:
Financial Aid Progress Units:

SFU GRADUATE AND POSTDOCTORAL STUDIES

New Graduate Course Proposal

Course Subject (eg. PSYC) SEE	Number (eg. 810) 894	Units (eg. 4) 3

Course title (max. 100 characters)
Special Topics II

Short title (for enrollment/transcript - max. 30 characters) Special Topics II

Course description for SFU Calendar (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description)
Special Topics in Sustainable Energy Engineering

Rationale for introduction of this course
At the SEE M.A.Sc. and Ph.D. programs are mounted and corresponding faculty hired, graduate courses will initially be offered as special topics and subsequently regularized

Term of initial offering (eg. Fall 2019) Fall 2019	Course delivery (eg. 3 hrs/week for 13 weeks) 3 hrs/week for 13 weeks
Frequency of offerings/year 3 times/year	Estimated enrollment per offering 20

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

Prerequisite and/or Corequisite Co-requisite: SEE 896 or SEE 897

Criminal record check required? ☐ Yes if yes is selected, add this as prerequisite
Additional course fees? ☐ Yes ☑ No

Campus where course will be taught ☐ Burnaby ☑ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components * ☐ Lecture ☑ Seminar ☐ Lab ☐ Independent ☐ Capstone ☐ _____

Grading Basis ☑ Letter grades ☐ Satisfactory/ Unsatisfactory ☐ In Progress / Complete

Repeat for credit? ☐ Yes ☑ No	Total repeats allowed? 9	Repeat within a term? ☐ Yes ☑ No
Required course? ☐ Yes ☑ No	Final exam required? ☑ Yes ☐ No	Capstone course? ☐ Yes ☑ No

Combined with a undergrad course? ☐ Yes ☑ No If yes, identify which undergraduate course and the additional course requirements for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course Faculty/instructors will be hired prior to the first offering of the course. It is anticipated that current FAS faculty members will not teach SEE courses.
Additional faculty members, space, and/or specialized equipment required in order to offer this course None

CONTACT PERSON

Academic Unit / Program	Name (typically, Graduate Program Chair)	Email
Faculty of Applied Sciences	Kevin Oldknow	koldknow@sfu.ca

ACADEMIC UNIT APPROVAL

A course outline must be included.

Non-departmentalized faculties need not sign

Graduate Program Committee	Signature	Date
Department Chair KEVIN OLDKNOW	Signature	Date AUG 7th, 2018

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee	Signature	Date
M. F. Berg		08/07/'18

A library review will be conducted. If additional funds are necessary, DGS will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee	Signature	Date
Jeff Derksen		SEP 24 2018

ADMINISTRATIVE SECTION (for DGS office only)

Library Check: SEP 06 2018

Course Attribute: _____

Course Attribute Value: _____

Instruction Mode: _____

Attendance Type: _____

If different from regular units:

Academic Progress Units: _____

Financial Aid Progress Units: _____

SFU GRADUATE AND POSTDOCTORAL STUDIES

New Graduate Course Proposal

Course Subject (eg. PSYC) SEE	Number (eg. 810) 895	Units (eg. 4) 3

Course title (max. 100 characters)
Special Topics III

Short title (for enrollment/transcript - max. 30 characters) Special Topics III

Course description for SFU Calendar (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description)
Special Topics in Sustainable Energy Engineering

Rationale for introduction of this course
At the SEE M.A.Sc. and Ph.D. programs are mounted and corresponding faculty hired, graduate courses will initially be offered as special topics and subsequently regularized

Term of initial offering (eg. Fall 2019) Fall 2019	Course delivery (eg. 3 hrs/week for 13 weeks) 3 hrs/week for 13 weeks
Frequency of offerings/year 3 times/year	Estimated enrollment per offering 20

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

Prerequisite and/or Corequisite Co-requisite: SEE 896 or SEE 897

Criminal record check required? ☐ Yes if yes is selected, add this as prerequisite | Additional course fees? ☐ Yes ☑ No

Campus where course will be taught ☐ Burnaby ☑ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components * ☐ Lecture ☑ Seminar ☐ Lab ☐ Independent ☐ Capstone ☐ _____

Grading Basis ☑ Letter grades ☐ Satisfactory/ Unsatisfactory ☐ In Progress / Complete

Repeat for credit? ☐ Yes ☑ No	Total repeats allowed? 9	Repeat within a term? ☐ Yes ☑ No
Required course? ☐ Yes ☑ No	Final exam required? ☑ Yes ☐ No	Capstone course? ☐ Yes ☑ No

Combined with a undergrad course? ☐ Yes ☑ No If yes, identify which undergraduate course and the additional course requirements for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course Faculty/instructors will be hired prior to the first offering of the course. It is anticipated that current FAS faculty members will not teach SEE courses.
Additional faculty members, space, and/or specialized equipment required in order to offer this course None

CONTACT PERSON

Academic Unit / Program	Name (typically, Graduate Program Chair)	Email
Faculty of Applied Sciences	Kevin Oldknow	koldknow@sfu.ca

ACADEMIC UNIT APPROVAL

A course outline must be included.

Non-departmentalized faculties need not sign

Graduate Program Committee	Signature	Date
Department Chair KEVIN OLDKNOW	Signature	Date Nov 7th, 2018

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee	Signature	Date
M-F-Beg		08/07/'18

A library review will be conducted. If additional funds are necessary, DGS will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee	Signature	Date
Jeff Derksen		SEP 24 2018

ADMINISTRATIVE SECTION (for DGS office only)
Library Check: SEP 06 2018
Course Attribute:
Course Attribute Value:
Instruction Mode:
Attendance Type:

If different from regular units:
Academic Progress Units:
Financial Aid Progress Units:

SFU GRADUATE AND POSTDOCTORAL STUDIES

New Graduate Course Proposal

Course Subject (eg. PSYC) SEE	Number (eg. 810) 896	Units (eg. 4) 0

Course title (max. 100 characters)
MASc Research Seminar

Short title (for enrollment/transcript - max. 30 characters) MASc Research Seminar

Course description for SFU Calendar (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description)

Presentation and discussion of research topics and progress in seminar and publication formats. MASc students must enroll in SEE 896 during every term during which they are registered, until all program requirements have been met.

Rationale for introduction of this course

This course is intended to develop presentation, writing and feedback skills, and to give students in the program an opportunity to build a sense of community and disseminate their work to fellow students and faculty members on a regular basis. Guest seminars will also expose students to key societal, academic and industrial topics salient to a graduate education in Sustainable Energy Engineering. Students will receive a letter grade in each term for the duration of their studies.

Term of initial offering (eg. Fall 2019) Fall 2019	Course delivery (eg. 3 hrs/week for 13 weeks) 3 hrs/week for 13 weeks
Frequency of offerings/year 3 times/year	Estimated enrollment per offering 30

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

Prerequisite and/or Corequisite

Criminal record check required? ☐ Yes if yes is selected, add this as prerequisite

Additional course fees? ☐ Yes ☑ No

Campus where course will be taught ☐ Burnaby ☑ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components * ☐ Lecture ☑ Seminar ☐ Lab ☐ Independent ☐ Capstone ☐ _____

Grading Basis ☑ Letter grades ☐ Satisfactory/ Unsatisfactory ☐ In Progress / Complete

Repeat for credit? ☑ Yes ☐ No	Total repeats allowed? 15	Repeat within a term? ☐ Yes ☑ No
Required course? ☑ Yes ☐ No	Final exam required? ☐ Yes ☑ No	Capstone course? ☐ Yes ☑ No

Combined with a undergrad course? ☐ Yes ☑ No If yes, identify which undergraduate course and the additional course requirements for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course Faculty/instructors will be hired prior to the first offering of the course. It is anticipated that current FAS faculty members will not teach SEE courses.
Additional faculty members, space, and/or specialized equipment required in order to offer this course None

CONTACT PERSON

Academic Unit / Program	Name (typically, Graduate Program Chair)	Email
Faculty of Applied Sciences	Kevin Oldknow	koldknow@sfu.ca

ACADEMIC UNIT APPROVAL

A course outline must be included.

Non-departmentalized faculties need not sign

Graduate Program Committee	Signature	Date
Department Chair KEVIN OLDKNOW	**Signature**	**Date** AUG 7th, 2018

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee	Signature	Date
M. F. Berg		08/07/'18

A library review will be conducted. If additional funds are necessary, DGS will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee	Signature	Date
Jeff Derksen		SEP 24 2018

ADMINISTRATIVE SECTION (for DGS office only)
Library Check: SEP 06 2018
Course Attribute:
Course Attribute Value:
Instruction Mode:
Attendance Type:

If different from regular units:
Academic Progress Units: 6
Financial Aid Progress Units: 6

Sustainable Energy Engineering

SEE 896 (0) M.A.Sc. Research Seminar

Credits: 0

Course Description

Presentation and discussion of research topics and progress in seminar and publication formats. MASc students must enroll in SEE 896 during every term during which they are registered, for the duration of their program (i.e. until the student has met all program requirements).

Intended Learning Outcomes

1. Develop and present a research presentation, provide an effective description of the student's research topic and progress thus far.
2. Provide constructive, analytical and empowering feedback to peers on presentations.
3. Prepare a written description of the student's research topic and progress thus far, in article format and using an appropriate writing style.
4. Provide constructive, analytical and empowering feedback to peers on writing samples.

Subjects and Topics

1. Writing processes, form, format
2. Academic/technical writing conventions
3. Critical and creative thinking
4. Referencing conventions and research strategies
5. Writing styles
6. Graphics and punctuation
7. Oral presentations
8. Presentation slide development
9. Providing constructive, analytical and empowering feedback
10. Teamwork skills and professionalism/responsibility

Course Format

- The class will meet regularly during the semester (nominally three hours per week for 13 weeks). These sessions will be divided into regularly scheduled seminar days, and writing and presentation workshops.

- On seminar days, students will make seminar-style presentations to colleagues, faculty and staff members. Each student can expect to deliver one presentation per term, based on a schedule that is announced at the beginning of the term. When not themselves presenting, students are expected to attend their peers' presentations and prepare constructive, analytical and empowering feedback (using a form provided). Guest speakers will be invited on occasion to discuss topics relating to Sustainable Energy Engineering.

- On writing and presentation workshop days, guidance and instruction will be provided covering the topic areas listed above. Student will additionally work on revisions to their written assignments and provide feedback to peers on samples of their writing.

Grading Scheme:

The following grading scheme will be used to establish a grade for each student at the end of each term.

- Research Paper: 35%
- Feedback given to peers on their written work: 15%
- Presentation: 35%
- Feedback given to peers on their presentations: 15%

SFU GRADUATE AND POSTDOCTORAL STUDIES

New Graduate Course Proposal

Course Subject (eg. PSYC) SEE	Number (eg. 810) 898	Units (eg. 4) 18

Course title (max. 100 characters)
MASc Thesis

Short title (for enrollment/transcript - max. 30 characters) MASc Thesis

Course description for SFU Calendar (course descriptions should be brief and should never begin with phrases such as "This course will..." or "The purpose of this course is..." If the grading basis is satisfactory/unsatisfactory include this in the description)
MASc Thesis

Rationale for introduction of this course

Term of initial offering (eg. Fall 2019) Fall 2019	Course delivery (eg. 3 hrs/week for 13 weeks) n/a
Frequency of offerings/year Spring, Summer, Fall	Estimated enrollment per offering 30

Equivalent courses (courses that replicates the content of this course to such an extent that students should not receive credit for both courses)

Prerequisite and/or Corequisite Co-requisite: SEE 896 (0) Research Seminar

Criminal record check required? ☐ Yes if yes is selected, add this as prerequisite | Additional course fees? ☐ Yes ☑ No

Campus where course will be taught ☐ Burnaby ☑ Surrey ☐ Vancouver ☐ Great Northern Way ☐ Off campus

Course Components * ☐ Lecture ☐ Seminar ☐ Lab ☐ Independent ☑ Capstone ☐ _____

Grading Basis ☐ Letter grades ☐ Satisfactory/ Unsatisfactory ☑ In Progress / Complete

Repeat for credit? ☑ Yes ☐ No	Total repeats allowed? 9	Repeat within a term? ☐ Yes ☑ No
Required course? ☑ Yes ☐ No	Final exam required? ☐ Yes ☑ No	Capstone course? ☑ Yes ☐ No

Combined with a undergrad course? ☐ Yes ☑ No If yes, identify which undergraduate course and the additional course requirements for graduate students:

* See important definitions on the curriculum website.

RESOURCES

If additional resources are required to offer this course, provide information on the source(s) of those additional resources.

Faculty member(s) who will normally teach this course
Faculty/instructors will be hired prior to the first offering of the course.
Additional faculty members, space, and/or specialized equipment required in order to offer this course
None

CONTACT PERSON

Academic Unit / Program	Name (typically, Graduate Program Chair)	Email
Faculty of Applied Sciences	Kevin Oldknow	koldknow@sfu.ca

ACADEMIC UNIT APPROVAL

A course outline must be included.

Non-departmentalized faculties need not sign

Graduate Program Committee	Signature	Date
Department Chair	**Signature**	**Date**
KEVIN OLDKNOW		AUG 7th, 2018

FACULTY APPROVAL

The course form and outline must be sent by FGSC to the chairs of each FGSC (fgsc-list@sfu.ca) to check for an overlap in content

Overlap check done? ☑ YES

This approval indicates that all the necessary course content and overlap concerns have been resolved. The Faculty/Academic Unit commits to providing the necessary resources.

Faculty Graduate Studies Committee	Signature	Date
M-F. Bey		08/07/'18

A library review will be conducted. If additional funds are necessary, DGS will contact the academic unit prior to SGSC.

SENATE GRADUATE STUDIES COMMITTEE APPROVAL

Senate Graduate Studies Committee	Signature	Date
Jeff Derksen		SEP 24 2018

ADMINISTRATIVE SECTION (for GPS office only)

Library Check: SEP 06 2018

Course Attributes: GCAP

Course Attribute Value: Thesis

Instruction Mode:

Attendance Type:

If different from regular units:

Academic Progress Units:

Financial Aid Progress Units:

SFU SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Sustainable Energy Engineering Program

Appendix 3: Letters of Support

University of British Columbia Faculty of Applied Science
University of Victoria Institute for Integrated Energy Systems
Surrey Board of Trade
Simba Technologies
Ballard Power Systems
Association of Professional Engineers & Geoscientists of BC
Downtown Surrey Business Improvement Association
Alpha Technologies
Powertech Labs
City of Surrey Mayor

August 2018
Faculty of Applied Sciences

THE UNIVERSITY OF BRITISH COLUMBIA

Faculty of Applied Science
Office of the Dean
5000 - 2332 Main Mall
Vancouver, BC Canada V6T 1Z4

Phone 604 822 6413
www.apsc.ubc.ca

June 13, 2018

Professor Eugene Fiume
Dean, Faculty of Applied Science
Simon Fraser University
8888 University Drive
Burnaby, BC V5A 1S6

Dear Eugene,

As you know, British Columbia currently graduates less than half the number of Masters- and PhD-level engineers as compared to our peer provinces, Ontario and Quebec. The opportunity to increase the number of graduate students in engineering programs across all of British Columbia has been a shared goal of all our institutions, and is critical to the future of the Province. Thus, I am writing to express my support for the proposed graduate programs in Sustainable Energy Engineering (SEE) at Simon Fraser University.

By building on SFU's existing collaborations with industry and local government, and by leveraging SFU's strengths in energy systems, mechatronics, wireless communications, and big data analytics, the proposed SEE programs will provide students with research and employment opportunities in areas such as smart cities and zero emissions buildings, clean transportation, and sustainable manufacturing. With specialized knowledge and research skills that are directly relevant to the BC cleantech industry, SEE students will enrich the talent pool for one of the fastest-growing sectors of the BC economy.

On behalf of the University of British Columbia's Faculty of Applied Science—which itself provides strong graduate training in clean technology, smart cities, and sustainable transportation—I look forward to welcoming the proposed SEE programs into the engineering educational landscape and to even greater collaboration between our institutions. Indeed, it is only by working together that we can help BC realize its potential to be a global leader in cleantech innovation.

Once again, I enthusiastically support the proposed graduate programs in Sustainable Energy Engineering at SFU and wish you success in implementing them.

Sincerely,

James Olson, PhD, P.Eng., FCAE
Dean, Faculty of Applied Science

University of Victoria | Institute for Integrated Energy Systems

Ned Djilali, PhD, P.Eng., FRSC
Professor & Canada Research Chair

June 10, 2018

Dr. Kevin Oldknow, P.Eng.
Associate Dean, Faculty of Applied Sciences
Director, Sustainable Energy Engineering Program
Simon Fraser University

Re: Proposed Sustainable Energy Engineering program

Dear Dr. Oldknow,

The proposed graduate program in Sustainable Energy Engineering is a welcome addition to the training and education of highly qualified personnel for British Columbia and Canada. This program will produce engineering graduates with advanced knowledge and specialized research skills in clean energy systems, combining in-depth knowledge of energy technologies with a broad understanding of the techno-economic and social aspects of energy systems. These are the types of graduates in demand by organizations in both the public and private energy sectors locally and globally engaged in the growing green economy. This program will breed specialists and research engineers with strong grounding in foundational topics in energy engineering, and with the ability to integrate the social, environmental and economic aspects of sustainability in research aimed at developing new solutions. Holistic energy systems training has been limited so far to a few small graduate programs around the world, and additional training capacity is urgently needed within BC, Canada and globally to meet the challenges of deploying sustainable energy solutions adapted to diverse geographic, socio-economic and policy environments.

The MASc and PhD programs strengths include partnerships and expanding collaboration with the cleantech industry cluster in the South Fraser Region; the unique ties with the City of Surrey and its progressive sustainability agenda; and the planned recruitment of faculty with research foci in key areas of smart cities, clean transportation and sustainable manufacturing, complemented by two high visibility research chairs (Canada Research Chair in Sustainable Energy Systems Modelling and Industrial Research Chair in Energy Systems for Smart Cities).

With the continuing progress in the development and cost reduction of "clean", "green" and renewable energy technologies and the global drive to meet challenging emissions and climate change targets, new opportunities are arising in the transportation, building, and process and manufacturing sectors. The ability to achieve these target and capitalize on the opportunities will depend to a large extent on the availability of specialist combining research skills to chart innovative and economically viable solutions and the knowledge and skill sets required to work in interdisciplinary teams that can promote and facilitate adoption of these solutions by Society. The SEE graduate program is aimed at producing such specialists, and will represent a valuable addition to the existing engineering graduate programs to support innovation and sustainability in British Columbia and across Canada.

Sincerely,

Ned Djilali, PhD PEng FCAE FRSC
Canada Research Chair and Professor of Mechanical Engineering

University of Victoria/IESVic, PO Box 1700, STN CSC, Victoria, BC V8W 2Y2 CANADA
Tel: (250) 721 6034 Fax: (250) 721 6323 Email: ndjilali@uvic.ca www.iesvic.uvic.ca

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May 3, 2018

To Whom It May Concern:

Re: Letter of Support for Simon Fraser University's (SFU) Application for a New Engineering Building at the Surrey Campus

SFU's vision is to be the leading engaged university defined by its dynamic integration of innovative education, cutting-edge research, and far-reaching community engagement. Their campuses in Surrey, Vancouver, and Burnaby are within a one-hour commute of fifty percent of BC's population.

SFU recently announced SFU Innovates, a comprehensive strategy that builds on a long history of success in mobilizing knowledge and commercializing technologies. SFU's innovation programs foster an entrepreneurial culture that transforms ideas and discoveries into companies, products and services. Academic programs that integrate entrepreneurship training and mentorship programs that assist students in developing business skills and new ventures, and business acceleration programs supplement networking and funding programs that link SFU innovators with investors, industry, markets and governments.

This project will build a new 5 floor Engineering Research Building at the Surrey campus to accommodate a new program in sustainable energy and environmental engineering as well as support Mechatronics research. The new building will house 320 undergraduate engineering students and 120 graduate students in engineering and computing science. Over eighteen research faculty will be hired which will greatly expand the research capacity to address challenges in the energy, hydrogen, clean-tech, electricity, and LNG sectors. The programs will build on SFU's current research strengths in fuel cell technologies and alternative energy.

In the field of alternative energy, Canada Research Chair in Alternative Energy Conversion Systems, Dr. Majid Bahrami, was awarded Canada's Top 25 for 2016. Dr. Bahrami's research into the design, prototyping and integration of energy-efficient systems is focused on reducing the environmental impacts of a number of industries, including the automotive, manufacturing, micro-electronics and food sectors. He has fostered highly successful industry collaborations, receiving more than $8M for research from various agencies and industry.

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The new building will also allow SFU to accommodate an expansion of research for the successful School of Mechatronics and create research and testing labs that will benefit industry. Mechatronics embeds courses on entrepreneurship and business in the curriculum and offers a double degree program with Business. Members of the Faculty work closely with industry and their track record of industrial research grants is among the largest at SFU. A proposed centre in design and manufacturing will enhance industrial interaction and services activities and space will also be dedicated to students commercializing their research through the Technology Entrepreneurship@SFU program to foster product collaborations between third and fourth-year business and applied sciences students.

The accelerated construction process is enabled by the commitment of the City of Surrey and its 12 year partnership with SFU. The land is being sold to SFU and development and construction permits will be fast-tracked. The City of Surrey has contributed funding for an industrial research chair in energy and recognizes that this building continues SFU's role in revitalizing the new Surrey City Centre and in fueling the local economy. Clean-tech and med-tech (through Innovation Boulevard), are priorities for the City's economic development strategy.

The SBOT represents 2,100 members and has over 8,000 business contacts with over 50,000 employees. The purpose of this organization, on behalf of its members, is to advocate at all levels of government, facilitate networking opportunities, and provide cost-saving benefits and marketing opportunities. We are a not-for-profit organization with a common goal of furthering the interests of businesses in our region. We have demonstrated, through our projects and initiatives, a commitment to enhancing the local economy.

This project expands purpose-built space for advanced research, lab work and innovation and commercialization activities. Benefits include:

- Direct construction jobs.
- Reduction of health and safety risks of faculty and students.

101-14439 103 Avenue, Surrey, BC V3R 1M1 | 604.581.7130 | info@surreyboardoftrade.com | boardoftrade.com

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- This project is needed to meet the increasing enrollment demand from the fast-growing university-aged population in the south Fraser Valley and for engineers. BC has the highest labour market demand for engineers in Canada but seriously lags behind peer provinces in the percentage of engineering graduates per-capita. The technology sector growth has been suppressed due to a lack of engineering talent according to the BC Technology Industries Association.
- This project will accommodate growth and labour market demand driven capacity created by the need for sustainable energy solutions in industries, such as clean-tech, construction/building, natural resources, remediation, utilities and transportation.
- SFU Surrey is the only research university in the South Fraser region. The project provides the opportunity for industry-based collaborations for which SFU and SFU Surrey have a strong reputation. The programs offered in this building will provide the training and education required to meet BC's labour market needs and maintain a competitive economy.
- The expansion of Surrey's campus buildings and academic programs will support the institution's vision for the integration of innovative education, cutting edge research and far-reaching community engagement. SFU Surrey has been a living example of what it means to be an "engaged university".
- A new SFU building in Surrey Centre will support expansion of the campus within the City of Surrey's revitalized downtown and expand opportunities for community partnerships through use of the 400-seat lecture theatre.

The SBOT acknowledges the importance of SFU's work to make a difference in the community and supports their application for a new Engineering Building to accommodate a new program in sustainable energy and environmental engineering as well as support Mechatronics research.

Sincerely,

Anita Huberman
H. Captain (Navy)
Chief Executive Officer

101-14439 103 Avenue, Surrey BC V3R 1M1 | 604.581.7130 | info@surreyboardoftrade.com | boardoftrade.com

May 3, 2016

To whom it may concern:

Re: SFU Proposed Sustainable Energy and Environmental Engineering Program

I am writing this letter in conjunction with Amyn Rajan, CEO of Simba Technologies, to show our support for the expansion of SFU's Surrey campus. This proposed expansion would see the installation of a new engineering building to increase student training spaces, as well as research, development and design labs.

Simba Technologies is a Vancouver software company that provides advanced analytical data access through its software, support and professional services. We partner with leading software companies around the globe to ensure we develop robust, commercial-grade analytics software solutions.

As a member of the local high-tech profession, we are a strong advocate for improving education in British Columbia. Amyn and Simba Technologies have donated more than $1 million to support student scholarships around the province aimed at improving diversity, and ensuring research and development remain at world-class levels in B.C.

We believe SFU's proposed Sustainable Energy and Environmental Engineering Program (SE3P) would train the next-generation of engineers who incorporate a new spirit of innovation into their work.

It is our understanding the new building in Surrey would enable 320 new undergraduate student spaces and 120 graduate student spaces in the SE3P program. It would also allow the School of Mechatronic Systems Engineering to expand their research program into a custom-built space in the new building and provide new design studios to support its Technology Entrepreneurship@SFU program.

B.C. needs to offer cutting-edge technology engineering education to stay ahead of advances and to compete on the world stage.

Currently, Simba is in an accelerated growth period and in a little more than a year we have doubled our staff complement from 75, to over 150 employees. The only limitation to our growth, and our ability to further entrench the world-wide data connectivity marketplace to British Columbia and Canada, is our access to skilled, educated and qualified employees. We rely heavily on SFU to help meet our recruitment demands.

This project will meet the increasing enrollment demand from the fast-growing university-aged population in the south Fraser Valley and for engineers. B.C. has one of the highest labour market demand for engineers in Canada but seriously lags behind peer provinces in the percentage of engineering graduates per capita.

As a member of the technology sector in Vancouver, we can speak to how growth in our company has been suppressed due to a lack of talent. A project of this magnitude can help alleviate the issues that B.C. is facing in terms of talent shortages.

If you wish to hear directly from me, I would be more than pleased to speak to you directly about the possible impacts of SFU's Surrey campus expansion.

Sincerely,

Kelly Rainsforth
Director Human Resources

per Amyn Rajan
CEO

BALLARD®

Ballard Power Systems
9000 Glenlyon Parkway
Burnaby, BC V5J 5J8
Canada

Tel: 604-454-0900
Fax: 604-412-4700
www.ballard.com

May 4, 2016

To whom it may concern,

I am writing to express my strong support for the proposed expansion of SFU's Surrey campus with a new engineering building which will house expanded research facilities and student training spaces.

As a member of industry working in fuel cell production, Ballard has collaborated with SFU's School of Mechatronic Systems Engineering for eight years. Our areas of collaboration include research involving polymer electrolyte membrane (PEM) fuel cells used to run transportation vehicles and other motive applications, such as heavy-duty transit buses and fork lifts, as well as to power stationary systems. SFU and Ballard have received multi-year funding through the NSERC Automotive Partnership Canada program and this collaboration has enabled us to do innovative research together with faculty members and highly trained graduate students. We also hire SFU co-op students and post-doctoral fellows and provide training to them in fuel cell research and development. Overall, our collaboration with SFU involves more than four faculty members, and several dozen graduate students and undergraduate students.

This partnership is extremely valuable to Ballard as it enables us to tap into significant expertise and innovative and novel ideas at the university to broaden our capabilities. For instance, through close collaboration with Ballard, SFU has developed a unique understanding of an important lifecycle mechanism for PEM fuel cell operation, which will support an improved ability to design fuel cells to achieve outstanding durability. This will directly support achieving full commercial competitiveness with incumbent technologies for fuel cell powered buses in the near- to mid-term.

We see tremendous benefit in expanding SFU's Surrey campus and introducing a program dedicated to sustainable energy and environmental engineering. This type of innovative program would serve companies such as Ballard very well in terms of developing a greater pool of talent to draw upon in the alternative industry sector. We have already hired engineers from SFU, drawn mostly from our collaborative efforts. We have an ongoing need for skilled fuel cell/clean energy engineers and find it difficult to find those with the appropriate background. An expansion of the SFU engineering program will support our future needs in this area.

The new building will support a new sustainable energy and environmental engineering program, allow for an additional 120 graduate students and house mechatronics research being done today in Surrey's Central City mall building. It will also enable the hiring of more than 18 research faculty to expand the research capacity in the energy, hydrogen, clean-tech, electricity, and LNG sectors.

I am in full support of this expansion and believe it could bring tremendous benefit to engineering training and help to propel B.C. to a leadership position in research and development in the alternative energy sector. At Ballard we operate in a highly competitive sector and need to stay on the leading edge of our market – education and training is a key component to this and we believe the direction that SFU is taking with its new program is exactly what is needed at this time.

Sincerely,

Kevin Colbow

Dr. Kevin Colbow
Vice President, Technology & Product Development

Tel.: 604-412-3187
Email: kevin.colbow@ballard.com

Professional Engineers
and Geoscientists of BC

Building progress through innovation every day

200 - 4010 Regent Street, Burnaby, BC V5C 6N2
T. 604-430-8035 | F. 604-430-8085 | 1-888-430-8035
www.apeg.bc.ca

May 4, 2016

Dr. Joanne Curry
Vice-President, External Relations
Simon Fraser University
Strand Hall
8888 University Drive
Burnaby, B.C. V5A 1S6

Re: Proposed New Building for Sustainable Energy and Environmental Engineering Program

Dear Dr. Curry,

I am pleased to provide my support in principle for the proposed expansion of SFU's Surrey campus to house the proposed new Sustainable Energy and Environmental engineering program ('SE3P'), aimed at meeting an important need in the province – that of educating future engineers capable of developing new technologies to help to meet Canada's goals for a green economy.

I understand that once fully operational, the proposed new engineering program will add 320 undergraduate student spaces and 120 graduate spaces at SFU's Surrey campus; and that the new five-floor engineering building will include custom-built space for research and state-of-the-art engineering training to house a the SE3P program.

It is important to the Association that all those who wish to become academically qualified to practice engineering in British Columbia have access to quality learning spaces. It is my understanding that the proposed new facilities will do just that for the SE3P program.

My experience has been that SFU has an excellent record of meeting Engineers Canada's accreditation standards for undergraduate programs in its current Engineering Science and Mechatronic Systems Engineering programs. I look forward to the development of the proposed new SE3P undergraduate program and to SFU's working towards the accreditation of program by Engineers Canada's Accreditation Board.

Sincerely yours,

Gillian Pichler, P. Eng.
Director, Registration
Association of Professional Engineers & Geoscientists of BC

cc: Ann English, P.Eng. Chief Executive Officer and Registrar, APEGBC
Tony Chong, P.Eng. Chief Regulatory Officer and Deputy Registrar, APEGBC

downtown SURREY
business improvement association

#330-10362 King George Blvd. Surrey BC V3T 2W5
P 604.580.2321
F 604.580.6321

May 4, 2016

Support for a new Sustainable Energy and Environmental Engineering Building in S rrey Simon Fraser University (SFU) Campus

This submission is made on behalf of the Downtown Surrey Business Improvement Association.

The Downtown Surrey Business Improvement Association operates within Surrey City Centre and is comprised of 1300 businesses and property owners representing total property taxes paid of over $14 million. Our territory encompasses 60 blocks centered on King George Boulevard from 96 Avenue with additional businesses to the south surrounding Surrey Memorial Hospital, to 112 Avenue in the north. Our mission is to facilitate business improvement, community economic development, business revitalization and enhancement in what is designed and intended to be the downtown core of the City of Surrey. Our goal is to assist in building a vibrant, safe, and liveable downtown where people can invest, work, live, learn and play. Surrey City Centre is growing and evolving and we are proud to be part of this exciting change.

In the core of our Downtown, is the Surrey Simon Fraser University Campus, a leader in engaged learning, research and innovation. The demographic case for the new Sustainable Energy and Environmental Engineering Building in Surrey; South of the Fraser is well documented. There is an urgent requirement for expansion in a region that is home to over 19% of British Columbia's population and BC's largest school district. Simon Fraser University Surrey has surpassed its enrollment targets and the entrance grades required are continuing to rise. One of the main goals was to increase Surrey's lower transition rates and this has been accomplished with a 10% increase in Surrey School District students moving on to post-secondary education. However, we are concerned that the lack of university spaces and availability is beginning to have a negative impact on the aspirations of BC's future workforce who are unable to enter the program of their choice. Referring to the Conference Board of Canada, British Columbia is losing up to $4.7B in GDP and 616M in tax revenues annually because too few residents have the education and skills needed for businesses to innovate and grow.

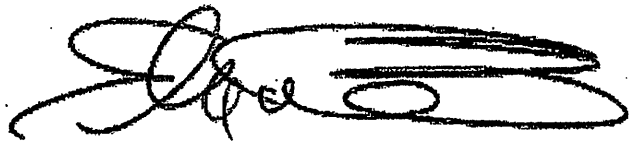
In addition to meeting future labour market needs, the City Centre businesses believe that the growth of Surrey's campus would act as a catalyst for economic development and would be excellent investment for our downtown core. Simon Fraser University's establishment in 2002 has helped to define Surrey's City Centre and fueled new growth. Further expansion in engineering, health programs and research will draw other research and community partners to the area and involve commercialization of space; will support local industries and new companies by providing access to student entrepreneurs, graduates and faculty expertise in areas of high labour market demand; and the region will benefit from spin-off companies. It will have a direct economic impact on our area coupled with the potential to advance

Canada's climate change and sustainability goals. The foundation on innovation and entrepreneurship, in today's world is education.

Many studies have cited that entrepreneurial students attending university develop into very successful businesspeople, which has been the documented case at Simon Fraser University. The university entrepreneur often will foster the relationships and develop their future companies within that specific community. The give back and role of growth they facilitate within the community is multi-faceted. They broaden the tax base with their spin off companies, employ local residents, serve as coaches, judge business plan competitions and serve on advisory boards for small business owners and work with local high school students on special initiatives. The SFU Surrey expansion plan is the bridge of innovation and entrepreneurship facilitating the possibilities for our future start-ups south of the Fraser.

Overall, this creates a win for education, a win for business and a big win for our youth and leaders of tomorrow; which in turn, benefits all the communities south of the Fraser.

Yours truly,
Downtown Surrey Business Improvement Association



Elizabeth Model
CEO
/em
elizabeth@downtownsurreybia.com

Alpha Technologies Ltd.

Feb 3, 2017

To Whom It May Concern:

Re: Support for Expansion of SFU's Surrey Campus to introduce a new Sustainable Energy Engineering (SEE) Building

I am pleased to write this letter on behalf of Alpha Technologies Ltd., Burnaby, BC to confirm our support for the expansion of a sustainable Energy Engineering Building immediately adjacent to SFU's existing Surrey Campus.

Alpha Technologies Ltd., a member of The Alpha Group, is an established leader in the design, manufacture, service and installation of powering solutions for the Telecom, CATV, Traffic, Security, Industrial, and Renewable Energy industries. Alpha builds on over 40 years of experience to develop solutions that resolve customers' unique powering challenges around the world. With over 500 employees, Alpha is one of the top high-tech employers in the province of British Columbia.

The Kaiser Foundation for Higher Education is a philanthropic organization created by Alpha Technologies' founder Mr. Fred Kaiser to support higher education in the areas of Power Electronics and Sustainable Energy technologies. The Fred Kaiser Foundation for Higher Education, has made several strategic investments in B.C. education through substantial donations to UBC, SFU, and BCIT. The goal of the Foundation is to advance the development of knowledge and talent in the focus fields of study to prepare the next generation for the knowledge-based economy and a sustainable global environment.

Alpha Technologies is committed to being a strong partner to the SFU research team, and has a track record of collaborating successfully with academic research programs. The area of renewable power and smart energy has experienced an exponential growth for the last decade and presents a significant economic opportunity for Canada. Our industry requires a steady stream of job-ready and well-trained engineers and entrepreneurs, who can ideally be productive on the first day of their employment. SFU's proposed undergraduate and graduate programs have the potential to train tomorrow's engineers to become national and international leaders in developing engineering solutions for a sustainable world. Once the program is at full capacity, the SEE program is expected to accommodate more than 300 full-time equivalent undergraduate students.

I firmly believe that the SEE program will accommodate growth and demand for skilled labour in pursuing technical careers in areas such as alternative energy systems, energy storage, smart cities, clean transportation and sustainable manufacturing.

7700 Riverfront Gate, Burnaby, BC. V5J 5M4, Canada
www.alpha.ca

Alpha Technologies Ltd.

Cutting-edge engineering education is the key in allowing BC based companies to compete with the best in the world. As a member of the technology sector in Vancouver, I can speak to how growth in my own company has been hampered due to a lack of local talent. Alpha Technologies has recruited power conversion engineers from around the world due to the limited number students that are graduating from local BC universities. A program of this magnitude can help alleviate some of the issues that B.C. is facing in terms of talent shortages. I would be more than pleased to speak to you directly about the possible impacts of SFU's Surrey campus expansion.

Sincerely,

Victor Goncalves, P.Eng, FEC
Chief Technology Officer
Alpha Technologies, Ltd.

7700 Riverfront Gate, Burnaby, BC. V5J 5M4, Canada
www.alpha.ca

Powertech

POWERTECH LABS INC.
12388 - 88th Avenue • Surrey • British Columbia • Canada • V3W 7R7
Phone 604.590.7500 • Fax 888.590.6501 • www.powertechlabs.com

February 7, 2017

To whom it may concern

Powertech is pleased to support SFU's Surrey campus expansion that will accommodate new student training spaces and custom-built research and development space.

Powertech Labs, BC Hydro's clean energy subsidiary, is one of the largest testing and research laboratories in North America, situated in Surrey, British Columbia. Our 11-acre facility offers 15 different primary testing labs for a one-stop-shop approach to managing utility generation, transmission and distribution power systems. Our clients include utilities and energy companies from around the world. Through our physical labs, we house a broad range of scientists, engineers, and technical specialists; we are a magnet for all market participants many of whom actually spend time with our staff in our laboratories as their products are being tested.

Our collaboration with Simon Fraser University began with a Letter of Intent signed with SFU, and the City of Surrey in 2010 to advance sustainability through clean energy initiatives. Since that time, Powertech is pleased to collaborate with SFU's School of Mechatronics and to have established shared space in our Surrey Campus for fuel cell researchers from SFU allowing them to first-hand see how our researchers are developing leading technologies to reduce environmental footprint and improve system performance. We are also working closely with SFU and the City of Surrey to establish a jointly sponsored chair in Smart Energy Systems.

We are fully aware that for a university's engineering programs to meet special requirements there is a need to maintain a high level of research capabilities. Currently, not all research and development labs at SFU's Surrey campus are able to accommodate equipment needs, such as fume hoods and wet lab space. With this new building, SFU could take a leading position in training Canada's future sustainability engineers.

There is a great demand for engineers who are well-versed in incorporating sustainability into their engineering and design solutions and we find that we usually will have to go outside the province if not outside Canada to find the right skills. It would benefit Powertech and many others in the sector if B.C. was able to expand engineering education, particularly in the sustainability area.

SFU's proposed Sustainable Energy Engineering (SEE) Program would be a strategic win for both SFU and Powertech Labs. It will train next-generation of engineers who are able to work with today's challenges and enabling local economic development across BC and Canada.

Powertech fully supports the expansion in Surrey and we hope that our important educational partner (and neighbor) sees this new building and program come to fruition in the coming years.

Yours truly,

Raymond Lings
President & CEO
Powertech Labs

CITY OF SURREY

OFFICE OF THE MAYOR

June 19, 2018

Andrew Petter
President and Vice-Chancellor
Simon Fraser University
8888 University Drive
Burnaby, BC
V5A 1S6

Dear Dr. Petter:

On behalf of Surrey City Council, I am pleased to provide this letter of support for Simon Fraser University's (SFU) new Sustainable Energy Engineering (SEE) program. This program, a first of its kind in Western Canada, aligns strongly with the City's objective to empower our youth as global, clean technology leaders through collaboration, entrepreneurship and innovation.

Surrey is one of the fastest growing cities in Canada and our young and talented population require advanced skills and training through graduate programs in order to fill industry skills gaps. University graduate level research will enable the City of Surrey to foster leaders in sustainable energy systems and clean technology increasing economic competiveness across the region. The SEE program will serve to strengthen both the City's and SFU's common objective of promoting vibrant, healthy communities.

SFU remains a key partner for Surrey, and our two organizations have a longstanding history of partnerships since SFU's arrival in City Centre over 10 years ago. We are proud to have invested in an Industrial Research Chair with SFU for clean energy in smart cities and are excited to see SFU pursuing a smart cities track as part of the SEE program.

I am delighted to support Simon Fraser University's Sustainable Energy Engineering program as a unique initiative that will encourage entrepreneurial development, attract investment, and create jobs in our City. Thank you in advance for your thoughtful consideration of this opportunity.

Sincerely,

Linda Hepner

Linda Hepner
Mayor
City of Surrey

SURREY
CITY OF PARKS

P 604 591 4126 MAYOR@SURREY.CA
13450-104 AVENUE SURREY BRITISH COLUMBIA CANADA V3T 1V8

WWW.SURREY.CA

SFU SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Sustainable Energy Engineering Program

Appendix 4: Program Steering Committee

August 2018

Faculty of Applied Sciences

Program Steering Committee

As the Sustainable Energy Engineering initiative (including undergraduate and graduate programs) is mounted at SFU, a Steering Committee and an Advisory Committee will be established.

Governance of the Sustainable Energy Engineering undergraduate and graduate programs will rest in the Program Director and Steering Committee, which will comprise full-time faculty members of SFU. The Chair of the Steering Committee will normally be the Director. In addition to the Chair, five faculty members will initially (prior to program launch) be appointed to the Steering Committee by the Dean of Applied Sciences upon the advice of the Director of the Program and other interested parties, and with due regard to the mix of disciplinary perspectives needed to maintain and develop the program. During the first three years of Program operation this will increase to a total of seven faculty members in addition to the Chair. Once the Steering Committee has reached its full complement of eight faculty members (including the Chair), the distribution of these members will be as follows:

a. At least two research faculty members (Assistant Professor, Associate Professor or Professor)

b. At least two teaching faculty members (Lecturer, Senior Lecturer or University Lecturer)

c. At least one female faculty member

The Advisory Committee will include external representatives and various invited members from academia, industry and the community, and will provide advice to the Director and Steering Committee in areas including research foci, faculty hiring priorities and the development of new academic programming such as course-based and professional masters programs.

For the purpose of developing this Full Program Proposal, an ad-hoc Advisory Committee was formed with the following membership; abbreviated CVs are provided on the following pages. The Committee participated actively in program design and revisions.

Dr. Majid Bahrami, P.Eng.
Professor, School of Mechatronic Systems Engineering, Simon Fraser University
Canada Research Chair in Alternative Energy Conversion Systems

Dr. Faisal Beg, P.Eng.
Professor, School of Engineering Science, Simon Fraser University
Associate Dean, Faculty of Applied Sciences, Simon Fraser University

Dr. Ned Djilali, P.Eng. (chair)
Professor, Department of Mechanical Engineering, University of Victoria
Canada Research Chair in Energy System Design and Computational Modelling

Dr. Michael Eikerling
Professor and Graduate Program Chair, Department of Chemistry, Simon Fraser University
Joint Affiliation with the NRC Institute for Fuel Cell Innovation

Dr. Woo Soo Kim, P.Eng.
Associate Professor, School of Mechatronic Systems Engineering, Simon Fraser University

Dr. Mehrdad Moallem, P.Eng.
Professor and Graduate Program Chair, School of Mechatronic Systems Engineering

Abbreviated Curriculum Vitae of Professor Majid Bahrami

Professor, P.Eng., CRC, Fellow ASME, member ECS, AIAA
School of Mechatronic Systems Engineering
Faculty of Applied Science
Simon Fraser University

http://www.sfu.ca/~mbahrami/

Education

- PDF, Microelectronics Heat Transfer Lab., U of Waterloo, Canada 2004-2006
- PhD, Mechanical Eng., University of Waterloo, Canada 2000-2004
- M.A.Sc., Mechanical Eng., Amir Kabir U of Technology, Tehran, Iran 1992–1995
- B.Sc., Mechanical Eng., Sharif U of Technology, Tehran, Iran 1988–1992

Work Experience

- Professor, Simon Fraser University, Mechatronic Systems Engineering 2015
- Co-founder and CEO, Watergenics Inc., Vancouver, Canada 2015-2018
- Canada Research Chair, Alternative Energy Conversion Systems, Simon Fraser University, Canada 2014-2019
- Co-founder and CTO, Matergenics Engineering, Vancouver, Canada 2013-2015
- Associate Professor, Simon Fraser University, Canada 2011-2015
- Assistant Professor, Simon Fraser University, Canada 2008-2011
- Adjunct Professor, University of Victoria, Mechanical Engineering, Canada 2008-2011
- Assistant Professor, University of Victoria, Mechanical Engineering, Canada 2006-2008
- Postdoctoral Fellow, University of Waterloo, Mechanical Engineering, Canada 2004-2006
- Research Assistant, University of Waterloo, Mechanical Engineering, Canada 2000-2004
- Thermal Engineer, Keeprite Refrigeration, Ontario, Canada 1999-2000
- Thermal Engineer, Tavhieh (Formerly Chrysler) HVAC Systems, Tehran, Iran 1995-2000
- Instructor/Lecturer (part-time), Satari University, Tehran, Iran 1995-1997

Research Keywords: Sustainable air conditioning systems, heat transfer, fluid flow, sorption technology, atmospheric water harvesting, energy recovery systems, graphite heat exchangers, thermal energy storage, thermal management of lithium-ion batteries, transport phenomena in porous media and micro/nano-structured materials, PEM fuel cells, microelectronics cooling, membrane systems, microfluidics, super-insulators, analytical modeling, experimental validation.

Industrial Collaborators: Automotive Fuel Cell Coorp. (AFCC), Alpha Technologies, Ballard Power Systems, Delta-Q, Mercedes Benz, Corvus Energy, Saputo, Innergex, Terrella Energy Systems, Cool-It, Greenlight Innovation, Analytic Systems, City of Surrey, Argus Control Systems, B-W Global, Cadex.

Research Projects and Funding (selected partial list; total funds awarded + $12M)

Putting Waste-Heat to Work: Sustainable Potable Water, Air Conditioning, and Thermal Energy Storage	NSERC Discovery Grant- Induvial	$58,000/yr	2017-2022
Passive Cooling Solution for Higher Power Battery Charger	NSERC, BC Ministry of Energy and Mines	$76,000	2016-2020
Loschmidt Cell Gas Diffusivity Measurement System for Micro/Nano-structured Porous Media	NSERC RTI	$109,777	2016
Materials for Enhanced Energy Technologies	NSERC CREATE	$275,000	2015-2021
NSERC Energy Storage Technology Network	NSERC SPG-N	$40,000/yr	2015-2020
Green Cooling Solutions for High Power Electronics	NSERC CRD & Alpha	$65,000/yr	2013-2018
Green Sustainable Air Conditioning and Refrigeration Systems for Service Vehicles	Automotive Partnership Canada	$592,475	2012-2016
Bulk and Interfacial Transport Properties of Porous Fuel Cell Materials	NSERC CRD & AFCC	$150,000	2014-2019

Academic Supervision, Service (Partial list)

- Trained more than 120 highly qualified personnel (HQP) who have gone on to successful careers in academia and industry including three professors
- Developed leading a multi-national research initiative supported by the Canadian Queen Elizabeth II Diamond Jubilee Scholarships - Advanced Scholars on sustainable energy, potable water, and crops for doctoral and postdoctoral scholars from developing low-income countries
- Development 6 undergraduate, 4 graduate courses, 3 teaching laboratories
- Served on numerous academic committees, organized several conference sessions
- Served on NSERC Discovery Grant review panel, Qatar National Fund, and Belgium IWT

Publications, Awards, Outreach (Partial list)

- Established the world-class Laboratory for Alternative Energy Conversion (LAEC) and has attracted >$12M of research funding as a principal investigator (2010 - 2018)
- Published 6 patents, 139 peer-reviewed articles in prestigious journals, 152 conference papers/presentations at highly ranked venues, with h-index of 32 and his i10-index of 78 (Google Scholar, April 2018)
- Fellow of the American Society of Mechanical Engineers (ASME) 2016
- Won the 2017 Mohammed bin Rashid al Maktoum Global Water Award, the UAE Water Foundation for innovative research and development in sustainable water technology
- Received Canada "Clean50" Awards two consecutive years, 2016 and 2017
- Given numerous public, invited talks and interviews on national and international radio/TV, including CBC, Global News, CNN

Mirza Faisal Beg

B-Tech. (Honors), **MS, Ph.D., P.Eng.**
Professor, School of Engineering Science
Simon Fraser University, Burnaby, BC Canada
http://www.ensc.sfu.ca/~mfbeg

Positions and Employment

2015 -	Associate Dean, Research and Graduate studies, Faculty of Applied Science, Simon Fraser University
2014 -	Professor, School of Engineering Science, Simon Fraser University
2013 -	Associate Member, Division of Neurology, Faculty of Medicine, University of British Columbia
2009 - 2014	Associate Professor (with tenure), Engineering Science, Simon Fraser Univ.
2008 -	Adjunct Professor, School of Applied Mathematics, Simon Fraser University
2008 -	Adjunct Professor, School of Biomedical Physiology and Kinesiology, Simon Fraser University
2003 - 2009	Assistant Professor, School of Engineering Science, Simon Fraser University

Education and Training

Doctor of Philosophy (1997 – 2003)
The Johns Hopkins University School of Medicine
Doctoral program in Biomedical Engineering

- Thesis: Computational Anatomy - Metrics on Flows of Diffeomorphisms for Image and Landmark Matching
- Mentor: Professor Michael I. Miller

Master of Science (1994 – 1997)
Boston University, School of Biomedical Engineering
Graduate program in Biomedical Engineering

- Thesis: Effects of aging on motor unit firing behavior
- Mentor: Professor Carlo J. De Luca

Bachelor of Technology (with Honors) (1989 – 1993)
Indian Institute of Technology, Kharagpur, Department of Electrical Engineering
Undergraduate option in Instrumentation Engineering

- Thesis: H-infinity based proportional, integral and derivative controllers for feedback control
- Mentor: Professor Kanti B. Dutta

Awards and Honors

2015	**'Excellence in Research'** Award, Faculty of Applied Science, Simon Fraser University (given to one Professor in the faculty of approximately 110)
2012	**Meritorious Achievement award**, Association of Professional Engineers and Geoscientists of British Columbia (given to one Engineer in the province of BC each year)

2011 **'Excellence in Teaching'** Award, Faculty of Applied Science, Simon Fraser University (given to one Professor in the faculty of approximately 110)
2008 - 2014 Career Investigator, Michael Smith Foundation for Health Research, BC

Research Funding

The primary sources of my funding have been NSERC (discovery grants), CHRP (collaborative health research program, NSERC and CIHR), Michael Smith Foundation of Health Research (MSFHR), Alzheimer Association of Canada and Pacific Alzheimer Research Foundation of British Columbia.

Contract/Grant: Operating Grant **Awarded:** 2014 **Period:** 2018 – 2021
Project Title: OCTSurfer - Advanced Imaging and Integrated Image Analysis Platform for 3D Optical Coherence Tomography Images of the Eye
Funding: CHRP **Type:** External
Annual: 275k **Total:** 850k
Involvement: Principal Investigator

Contract/Grant: Operating Grant **Awarded:** 2014 **Period:** 2014 – 2017
Project Title: Novel Retinal Biomarkers for Alzheimer's Disease
Funding: Brain Canada - MIRI **Type:** External
Annual: 500k **Total:** 1500k
Involvement: Principal Investigator

Contract/Grant: Operating Grant **Awarded:** 2014 **Period:** 2014 – 2017
Project Title: CBRAIN: Canadian Brain Research And Informatics Platform
Funding: Brain Canada – Platform Grant **Type:** External
Annual: 1000k **Total:** 3000k
Involvement: Co-PI with Principal Investigator Dr. Alan Evans (McGill University)

Contract/Grant: Operating Grant – Accelerator Supplement **Awarded:** 2014
Period: 2014 – 2017
Project Title: Brains behind the Eyes: Interpreting medical images
Funding: National Science & Engineering Research Council (NSERC) **Type:** External
Annual: 40k **Total:** 120k

Contract/Grant: Operating Grant **Awarded:** 2014 **Period:** 2014 – 2019
Project Title: Brains behind the Eyes: Interpreting medical images
Funding: National Science & Engineering Research Council (NSERC) **Type:** External
Annual: 50k **Total:** 250k

Journal Publications – 66, Conference Publications – 60

Invited Talks/Seminars/Symposia Presentations – 41 (2008-2018)

Prof. Nedjib (Ned) Djilali, FCAE, FRSC
Department of Mechanical Engineering & Institute for Integrated Energy Systems
University of Victoria
www.uvic.ca/estp

Education/Training
Doctorate, Mechanical Engineering (Fluid Mechanics), University of British Columbia, 1987
Master's, Aerodynamics, Fluid and Structural Mechanics, Imperial College of Science, Technology and Medicine, 1979
Bachelor, Aeronautical Engineering, University of Hertfordshire, 1977

Employment/Affiliations
Professor, Mechanical Engineering, UVic, 1999-present
Canada Research Chair, Advanced Energy Systems Design & Computational Modeling, Tier 1, UVic, 2005-2019
Adjunct Professor, Mechatronics Engineering, SFU, part-time, non-tenure track, 2010-2016
Interim Director, Pacific Institute for Climate Solutions (PICS), UVic, 2008-2009
Executive Director, Institute for Integrated Energy Systems, UVic, 2002-2007
Professor in Residence, Angstrom Power Inc., 2004-2005
Associate Dean, Engineering, UVic, 2000-2002
Associate Professor, Mechanical Engineering, UVic, 1994-1999
Assistant Professor, Mechanical Engineering, UVic, 1991-1994
Staff Specialist, Advanced Aerodynamics Department, Bombardier Aerospace, Montreal, 1989-1990
Post-Doctoral Fellow & Research Associate, Mechanical Engineering, UBC, 1987-1989

Bio
Dr. Djilali's research focuses on transport phenomena (fluid flow, heat, mass and charge transport) and energy systems integration and analysis. The applications of this research have ranged from aerodynamics and zero-emission cars, to electrochemical energy conversion and water purification. He has established an internationally recognized laboratory in the areas of fuel cell technology and energy systems integration. Many graduates trained in his lab have become leaders in academia and industry.

As Director of the Institute for Integrated Energy Systems (2001-07), he spearheaded a significant expansion of sustainable energy research activities by engaging industrial partners and researchers from many disciplines to investigate issues around integration of fuel cells, hydrogen and renewable energy. Dr. Djilali was closely involved in the development of the BC Hydrogen & Fuel Cell Industry Strategy and co-authored a report for the Premier's Technology Council; he served on the NRC Fuel Cell Program Advisory Board and on the Hydrogen Highway Steering Committee; he has testified in front of a standing committee of the Senate of Canada and lectured on Parliament Hill on sustainable energy systems. He also played a lead role in the Wind Energy Strategic Network (WESNET) and in the NSERC H_2CAN Strategic Research Network. As Interim Director (2009) and Chair of the Program Committee, he led the Pacific Institute for Climate Solutions (PICS) during its inception phase and continued subsequently to play an active role in promoting interdisciplinary research across science, technology, economics and social sciences to inform policy development.

Awards (Selected)
- Outstanding Engineering Teacher Award (1992 and 1993), Engineering Institute of Canada (Vancouver Island Chapter)
- High Level Research Fellowship (1998), Ministry of Education, Research & Technology, France

- Ludwig Mond Prize (1998), Institution of Mechanical Engineers (UK)
- Fellow, Canadian Society for Mechanical Engineering (2003)
- Fellow, Canadian Academy of Engineering (2010)
- Honorary Professorship, Tianjin University (2013)
- Fellow, Royal Society of Canada (2013)
- Highly Cited Researcher, Thomson Reuters (2014 & 2015)
- Jules Stachiewicz Medal, Canadian Society for Mechanical Engineering (CSME) (2017)
- David H. Turpin Gold Medal, University of Victoria (2018)

Publications/Patents

Book Chapters	*Journal Papers*	*Keynote/Plenary Lectures*	*Conference Papers/Abst.*	*Patents*	*Reports*
18	180	35	215	14	64

Google Scholar: ~11,000 citations; H-index = 55

Research Funding (last 4 years):

1. *NSERC CREATE,* Materials for enhanced energy technologies. PI: R Gordon. $11,650,000, 2015-2021.
2. *PICS,* Transportation futures for British Columbia-Transport Mode Electrification. PI: N. Djilali. $370,000, 2015-2020.
3. *CRD (Capital Regional District) & Green Municipal Fund,* Zero Emission Fleet Initiative Pilot Project. PI: N. Djilali, $93,000, 2017-2019.
4. *Batelle/PNNL,* Load Modelling for Smart Grid Simulations. $26,000, 2014-2015
5. *CRC,* Advanced energy systems design and computational modeling. $1,400,000, 2012-2019.
6. *NSERC Automotive Partnership Canada (APC),* Catalysis research for polymer electrolyte fuel cell (CaRPE-FC). PI: S Holdcroft. Partners: 20 academics from 8 universities, 4 SMEs, and industry association, and 3 government departments. $5,250,000, 2012-2017.
7. *MITACS Accelerate PDF Fellowship* and *Matergenics Engineering Ltd.,* Development of new modeling tools for cathodic protection of galvanized structures. $110,000, 2015-2017.
8. *NSERC Discovery,* Transport phenomena in fuel cells. $350,000, 2011-2016; $290,000, 2016-2021
9. *University of Victoria CRC Research Support.* $177,000, 2007-2015.
10. *NSERC APC,* Development of next generation heavy duty (bus) fuel cells with enhanced durability. Co-PIs: E Kjeang, S Holdcroft, 5 others (M Eikerling, G Wang, F Golnaraghi), Partners: Ballard, UVic. $11,887,171, 2011-2015.

Collaboration

Dr. Djilali has established industrial collaborations with the following companies: Automotive Fuel Cell Coop. (AFCC), Atomic Energy Canada (AECL), Angstrom Power Inc., ASL Environmental Sciences, Ballard Power Systems Inc., CFDRC, Greenlight Power Technologies and Toyota Motor Corp.

Dr. Djilali current academic collaborations include: SFU, UBC, Pacific Northwest National Lab (US), Tianjin University (China), Chongqing University (China), International Institute for Applied Systems Analysis (Austria)

CURRICULUM VITAE ◆ PROF. DR. MICHAEL H. EIKERLING ◆ MARCH 2018

PERSONAL DATA

DATE AND PLACE OF BIRTH: January 23, 1969, in Paderborn, Germany
CITIZENSHIP: German citizen; permanent resident of Canada

HOME AFFILIATION

Department of Chemistry at Simon Fraser University
8888 University Drive, Burnaby, BC, V5A 1S6, Canada
ph.: +1 778 782 4463
email: meikerl@sfu.ca

DEGREES

Doctorate (Ph.D.) in Theoretical Chemical Physics, TU München, Germany
Supervisors: Prof. Dr. U. Stimming and Prof. Dr. A. Kornyshev 1999

Physik-Diplom in Theoretical Solid State Physics, RWTH Aachen, Germany
Supervisor: Prof. Dr. H. Capellmann 1995

ACADEMIC RESEARCH AND EMPLOYMENT HISTORY

Department of Chemistry, SFU	**Professor**	**09/2012 – present**
Department of Physics, SFU	**Associate Member**	**07/2004 – present**
Inst. für Theor. Physik II, HHU Düsseldorf	Visiting Professor	09/2016 – 08/2017
NRC Institute, Vancouver	Secondment (50%)	05/2003 – 08/2013
Department of Chemistry, SFU	Associate Professor (tenure)	09/2009 – 08/2012
Department of Chemistry, SFU	Assistant Professor	05/2003 – 08/2009
Department of Physics, TU München	Research Associate	02/2002 – 04/2003
MST-11, Los Alamos National Laboratory	Postdoctoral Fellow	09/2000 – 01/2002
IWV 3, FZ Jülich	Postdoctoral Fellow	11/1998 – 09/2000
IEV 3, FZ Jülich	Research Assoc. (Ph.D. student)	11/1995 – 10/1998

RESEARCH OVERVIEW

MAIN AREAS OF EXPERTISE:

- Theoretical chemical physics and physical electrochemistry
- Theoretical and computational electrocatalysis
- Modeling and simulation of heterogeneous media: soft matter, interfaces, and nanomaterials
- Electrochemical energy science

PUBLICATIONS:

- Journal articles: 116 published, 6 accepted/in press, 3 under review
- Book chapters: 7 published, 1 in press
- Textbook on physics of fuel cells: published in 2014 (CRC Press, with A. Kulikovsky)
- Citations (Web of Science): > 3500 (without self-citations), h-index = 35
- 8 articles cited > 100 times, 5 articles cited > 200 times

CONFERENCE CONTRIBUTIONS AND SEMINARS:

- > 75 invited (16 keynote, 5 plenary); 21 contributed; > 50 seminars (acad. institutions or industry)

SUPERVISION:

- 19 postdocs (14 completed), 16 Ph.D. students (8 completed), 4 M.Sc. students (3 completed)

RESEARCH FUNDING:

- Secured for my research: $5M (individual: $2M, collaboration: $3); total secured: $18M

SELECTED COLLABORATION PROGRAMS AND PARTNERSHIPS

- *National Research Council of Canada, Institute for Fuel Cell Innovation (NRC, 2003-2013):* responsible for physicochemical theory and materials modelling; lead scientist of NRC-Nissan program.
- NSERC Automotive Partnership Canada (APC) network on *Catalysis Research for Polymer Electrolyte Fuel Cell (CaRPE-FC, 2012-2017):* theme leader for electrocatalysis and nanomaterials design; lead scientist for physical theory and materials modeling; member of steering committees.
- NSERC Discovery Frontiers program *Engineered Nickel Catalysts for Electrochemical Clean Energy (2015-2019):* lead scientist for theory, modeling, and simulation.
- *German-Canadian Collaboration Program in Fuel Cell Science* (2008-2012: PEM-Ca-D; 2012-2016: GECKO; since 2016: DEKADE): initiator and Canadian coordinator of multi-institutional collaboration.
- *Automotive Fuel Cell Cooperation Corp.:* molecular modeling of self-organization in electrochemical materials; method development, parametric studies, and implementation of data management tools.
- *Greenlight Innovation, Inc.:* development and implementation of modeling-based tools for intelligent diagnostics of renewable energy systems; 1 patent filed.
- *Ballard Power Systems, Inc.; Nissan Motor Corp.; Cool-It Hiway Services, Inc.:* development and implementation of particle-based physical-statistical models of electrode degradation.

MAJOR ADMINISTRATIVE ROLES

• **Chair** of Departmental Graduate Studies Committee	since 1/2018
• **Chair** of Departmental Graduate Studies Committee	5/2015 – 8/2016
• **Appointed Member** of the International Advisory Board of the European Fuel Cell Forum (EFCF)	since 2017
• Member of **Technical Steering Committee** of Hydrogen South Africa (HySA) catalysis	since 2013
• Member of **Scientific Steering Committee** and **Technology Analysis Committee** of pan-Canadian fuel cell network (CaRPE-FC)	2012-2017
• **Chair** of Physical Electrochemistry Division of the International Society of Electrochemistry	2013-2016
• **Chair** of Canada Section of the Electrochemical Society	2014-2016

AWARDS AND PRIZES

• **2017 Alexander Kuznetsov Prize for Theoretical Electrochemistry** of the ISE	**2017**
• Award from Norwegian Centre for International Cooperation	2012
• Provincial Research Fellowship in Fuel Cell Technology, British Columbia Innovation Council,	2003-2006

EDITORIAL ROLES	**Editorial Board Member** of journal "Electroacatalysis", Springer. **Editorial Board Member** of journal "Scientific Reports", NPG.
ORGANIZATION OF CONFERENCES, SYMPOSIA, AND WORKSHOPS (MAJOR EVENTS)	**Lead-organizer** of symposium *Advances in Theory and Modeling of Electrochemical Systems,* 68th AGM of the ISE, Providence, RI 8/2017 **Lead-organizer** of symposium *Attention: Theory only!* 67th AGM of the ISE, The Hague, The Netherlands 8/2016 **Lead-organizer** of symposium on *Interfacial Electrochemistry and Electrocatalysis from Molecular Perspective* at Pacifichem, Honolulu, HI 12/2015

Dr. WOO SOO KIM, P.Eng

Associate Professor in the School of Mechatronic Systems Engineering,
Simon Fraser University

Employment History

2016 Sept. - Current	Associate Professor, School of Mechatronic Systems Engineering, Faculty of Applied Sciences, *Simon Fraser University.*
2018 Jan. – 2018 Mar.	Visiting Professor, *EMPA- Swiss Federal Laboratory of Materials Engineering in ETH Domain*, Zurich in Switzerland.
2017 May – 2017 Oct.	Visiting Professor & Brain Pool Fellow, Department of Material Science and Engineering, *Seoul National University* in South Korea.
2010 Sept. – 2016 Aug.	Assistant Professor, School of Mechatronic Systems Engineering, Faculty of Applied Sciences, *Simon Fraser University.*
2009 Jan. - 2010 Aug.	Senior Research Staff Scientist, *Xerox Research Centre of Canada,* Toronto in Canada
2001 Dec. - 2002 Dec.	Visiting Research Staff, *Fraunhofer Institute of Silica Research* at Wuerzburg in Germany.

Educational Background

2009 PostDoc	*Massachusetts Institute of Technology (MIT)*, Department of Materials Science and Engineering, USA "Silver Nanoparticle Self-Assembly for Plasmonic Applications."
2006 Ph.D.	*Korea Advanced Institute of Science and Technology (KAIST)*, Department of Materials Science and Engineering, South Korea "Nano Imprint Lithography with Surface Functionalized Sol-gel Hybrid Polymer toward Mechanically Durable Stamp Applications."
2003 M.Sc.	*Korea Advanced Institute of Science and Technology (KAIST)*, Department of Materials Science and Engineering, South Korea "Soft Lithography of Sol-gel Hybrid Polymers for Photonic Applications."
2001 B.Sc.	*Yonsei University*, Department of Materials Engineering, South Korea

Awards, Honors and Scholarships

2016	**Title:** *International Short Visit Award 2018*, Award: $12,000, **Type:** Research, **Organization:** Swiss National Science Foundation
2010	**Title:** *Brain Pool Fellowship*: $25,000, **Type:** Research, **Organization:** National Research Foundation of South Korea
2016	**Title:** *Hanwha Advanced Material Award 2016*, Award: $13,000, **Type:** Research, **Organization:** Hanwha Corporation's New Faculty Award
2010	**Title:** *Wendy McDonald* Endowed Research Fellow Award: $5,000, **Type:** Research, **Organization:** Simon Fraser University
2009	**Title:** The first prize of *Quadrant Award 2007*: €15,000, **Type:** Research, **Organization:** ETH Zurich, **Details:** International PhD thesis competition in Polymeric and Composite Materials and Manufacturing Field held in ETH Zurich in Switzerland

Research Objectives

Over the past eight years as a Principle Investigator in Simon Fraser University, I have established a strong and flourishing research program in Additive Manufacturing of Printed Electronics. I have created a new SFU's Additive Manufacturing Laboratory, which quickly became an interdisciplinary research training platform with a substantial critical mass of research personnel. Additive manufacturing is an emerging field that integrates the aspects of nanotechnology, material science, and mechatronics to design novel materials and manufacturing of Internet-of-Things devices and their systems. My laboratory is equipped with the necessary facilities to generate transformative technological advances.

Publications & Patents: 1 book chapter, 51 refereed journal publications, 22 US patents, and 17 refereed conference proceedings have been published as a corresponding author.

Conferences, Workshops and Presentations: 32 invited talks from 2010, and 5 interviews with media such as Maclean, New Scientist, and YTN broadcasting were given so far.

Research/Project Funding – Received: Total external funding received as PI: $1,530,300 in total (from 2010 September to 2018 January) including NSERC DAS Award, two NSERC CRD, and international funds from S. Korea.

Supervision of Highly Qualified Personnel

Here is a summary for past HQP training in my lab: 1) Supervised one PDF, one PhD student, ten MSc students, and nine international visiting students to completion, 2) Currently supervise five PhD students and one MSc student, 3) Supervised 55 research Coop students, and 12 Undergraduate students by Capstone Design Projects, 4) Participated in 48 thesis examination for 30 PhD theses and 18 MSc thesis since 2010.

Active Service to the Academic Community

- **Referee of Grant Proposal:** proposals such as,

  NSERC Discovery grant in 2013-2018, NSERC Collaborative Research and Development (CRD) grant, NSERC Strategic Partnership grant, NSERC Idea to Innovations (I2I) grant, Canada Foundation for Innovation grant

- **Evaluation Committee of Grant Proposals:** Member of NSERC Engineering RTI Grants Selection Committee in 2017 and 2018.

- **Conference Session Organizer:**

  - Presider of the Next-generation nano-lithography session of Polymer Materials Science and Engineering, *ACS 2012 National meeting* in San Diego, USA, March 2012.

  - One of four Symposium BM4 organizers for Material Research Society's Fall Conference in Boston, 2016.

- **Award Committee Member:**

- The 14th IEEE international conference on Nanotechnology in Toronto, August 2014.

CURRICULUM VITAE

Mehrdad Moallem, Ph.D., P.Eng.
School of Mechatronic Systems Engineering
Faculty of Applied Sciences
Simon Fraser University, Surrey, BC, Canada

Date: June 2018
Email: mmoallem@sfu.ca
Phone: 778.782.8156

Field(s) of Specialization: Electrical Engineering, Mechatronics, Control Systems, Robotics and Automation

Current Research Areas/Topics: Control Applications including: Control and Automation for Sustainable Energy Systems; Mechatronics, and Robotics; Real-time and Embedded Control; Control of Power Electronics Systems.

Career History

Dr. Moallem has more than twenty years of experience in multi-disciplinary areas related to control systems, real-time and embedded computing, electronic systems, and mechatronics. He has collaborated in the form of R&D and technology transfer activities with several companies and research institutions including Bombardier Inc., Mirabel, QC, and the Canadian Space Agency (1996-1998); Duke University, Durham, NC, USA (1998-1999); National Research Council of Canada, London, ON (2000-2007); the Canadian Surgical Technologies and Advanced Robotics, London, ON (2002-2007); Unity Integration Corporation, Vancouver, BC (2010-now); Future Vehicle Technologies, Maple-Ridge, BC (2010-present); and InteLuma Energy Systems, Vancouver, BC (2012-2015); and Rocky Mountain Bicycles, North Vancouver, BC (2013-present). Dr. Mopallem has served on the editorial board of major conferences and journals such as the American Control Conference, IEEE Transactions on Mechatronics, and Elsevier journal of Mechatronics. His expertise in control, power electronics, embedded computing, and mechatronic engineering will be relevant to the proposed CRD project.

Dates	Rank and Position	Department	Institution
09/2012-onward	Professor	School of Engineering Science, Mechatronic Systems Engineering	Simon Fraser University, Surrey, BC, Canada
06/2007-09/2012	Associate Professor	School of Engineering Science, Mechatronic Systems Engineering	Simon Fraser University, Surrey, BC, Canada
09/2007-09/2009	Adjunct Research Professor	Electrical & Computer Engineering	The University of Western Ontario, London, ON, Canada
07/2006-06/2007	Associate Professor	Electrical & Computer Engineering	The University of Western Ontario, London, ON, Canada
08/1999-06/2005	Assistant Professor	Electrical & Computer Engineering	The University of Western Ontario
2002-2007	Associate Scientist (affiliation)	Canadian Surgical Technologies and Advanced Robotics (CSTAR) group	Lawson Health Research Institute (UWO Hospital)
1998-1999	R&D Engineer	Free-Electron Laser Laboratory	Duke University, NC, USA
1997-1998	Postdoctoral fellow	Electrical & Computer Engineering	Concordia University, Montreal, Canada

Academic Qualifications

B.Sc.	Shiraz University, Shiraz, Iran	Electrical & Electronic	1986
M.Sc.	Sharif University of Technology, Tehran, Iran	Engineering	1988
Ph.D.	Concordia University, Montreal, QC, Canada	Electronic Engineering Electrical & Computer Engineering	1997

Number of Postgraduate Students Supervised

Program	Status	Senior Supervisor	Joint Supervision
Ph.D.	Graduated	27	17
	Ongoing	10	5
Master of Applied Science	Graduated	26	15
	Ongoing	4	4

Achievements/Awards:

- University Professor (Simon Fraser University, 2015-2020): Recognition of senior scholars of distinction who are active participants in all aspects of their discipline and hold the rank of Professor.
- Attraction of research funds (industry/government) in excess of $10M over the career
- Technical Editor of major conferences and journals including the *American Control Conference* (2001-2016), *IEEE/ASME Transactions on Mechatronics* (2012-2015), *IFAC journal of Mechatronics (2016-onward), International Journal of Intelligent Robotics and Applications, Springer* (in process).

Number of Publications:

Publication	Quantity
Journals	75
Books	4
Referred Conferences	105
Patents	2
Book Chapters	7
h-index	36
i10-index	94

Recent Publications

- K. Seifi, M. Moallem, "An Adaptive PR Controller for Synchronizing Grid-connected Inverters," *IEEE Transactions on Industrial Electronics,* accepted, April 2018.
- S.H. Kamali, M. Moallem, S. Arzanpour, "Realization of an Energy-efficient Adjustable Mechatronic Spring," *IEEE/ASME Transactions on Mechatronics*, accepted, May 2018.
- S. F. Tolue, M. Moallem, "Multivariable Sliding-mode Extremum Seeking Control with Application to MPPT of an Alternator-based Energy Conversion System," *IEEE Tran. on Industrial Electronics,* Vol. 64, No. 8, pp. 6383-6391, 2017.
- Z. Shariari, R. Leewe, M. Moallem, K. Fong, "Automated Tuning of Resonance Frequency in an RF Cavity Resonator," IEEE/ASME Transactions on Mechatronics, Volume: 23, Issue: 1, pp. 311-320, 2018.
- G. Boscarino, M. Moallem, "Daylighting Control and Simulation for LED-based Energy-efficient Lighting Systems," *IEEE Transactions on Industrial Informatics,* Vol 12, No. 1, pp. 301-309, Feb 2016.
- J. Amini, M. Moallem, "A Fault-Diagnosis and Fault-Tolerant Control Scheme for Flying Capacitor Multilevel Inverters," *IEEE Transactions on Industrial Electronics,* Vol. 64, No. 3, pp. 1818-1826, 2017.

SFU SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

Sustainable Energy Engineering Program

Appendix 5: Abbreviated curriculum vitae for faculty

August 2018

Faculty of Applied Sciences

Abbreviated curriculum vitae for faculty

Because this program will be delivered by new faculty who are leaders in the field of Sustainable Energy Engineering, an advisory committee will be struck (as noted in Appendix 4) to include experts in varying aspects of the discipline.

Members will include specialists in the environment, energy, and social policy from within the University, discipline appropriate industry leaders, and government representatives, to advise on program development, personnel hiring, and recruitment of students into the program.

The following Inaugural Director for the program has been appointed, with abbreviated CV provided on the following pages.

Dr. Kevin Oldknow, P.Eng.
Inaugural Director, Sustainable Energy Engineering Program
Associate Dean, Faculty of Applied Sciences, Simon Fraser University
Senior Lecturer, School of Mechatronic Systems Engineering

Dr. Kevin Oldknow, P.Eng.
Abbreviated Curriculum Vitae

Employment History at Academic Institutions

May 2018 - Present	Director, Sustainable Energy Engineering Program, SFU
January 2017 - Present	Associate Dean, Undergraduate Studies, Applied Sciences, SFU
September 2016 - Present	Senior Lecturer, Mechatronic Systems Engineering, SFU
September 2015 - Present	Faculty Teaching Fellow, Applied Sciences, SFU
August 2012 - August 2016	Lecturer, Mechatronic Systems Engineering, SFU
January 2011 - April 2011	Adjunct Professor, Mechanical Engineering, UBC
September 2009 - December 2009	Sessional Lecturer, Mechanical Engineering, UBC
September 2007 - December 2007	Sessional Lecturer, Mechanical Engineering, UBC

Other Employment History

September 2012 - June 2016	Principal Engineer, Wheel / Rail Interface L.B. Foster Rail Technologies
May 2011 - August 2012	Vice President, Technology and Business Development LB Foster Friction Management
January 2009 - May 2011	Corporate Vice President, Friction Management Portec Rail Group, Corporate Division
September 2007 - December 2008	Vice President, Applications and Operations Portec Rail Group, Kelsan Technologies Division
September 2005 - August 2007	Manager, Friction Control Technology Portec Rail Group, Kelsan Technologies Division
February 2005 - September 2005	Group Leader, Field Applications Portec Rail Group, Kelsan Technologies Division
June 2004 - February 2005	Field Application Engineer Portec Rail Group, Kelsan Technologies Division
September 2000 - May 2004	Product Development Consultant, Cameleon Controls
August 1996 - April 1998	Technical Project Manager, Procter & Gamble

Educational Background

2004 Ph.D.	Mechanical Engineering, University of British Columbia
2000 M.A.Sc.	Mechanical Engineering, University of British Columbia
1996 B.A.Sc	Engineering Physics, University of British Columbia, Canada

Teaching History

MSE 102 - Applied Science, Technology and Society (2013-2016), SFU

MSE 300 - The Business of Engineering, I (2013-2017), SFU

MSE 352 - Digital Logic and Microcontrollers (2012), SFU

MSE 380 - Dynamic Systems Modelling and Simulation (2012-2014, 2016), SFU

MSE 403 - Technology Entrepreneurship I (2015, 2016), SFU

MSE 404 - Technology Entrepreneurship II (2015, 2016), SFU

MSE 480/780 - Manufacturing Systems (2013-2018), SFU

MSE 481 - Industrial Control Systems (2013, 2015-2016), SFU

MSE 884 - Advanced Dynamics (2013), SFU

MSE 900 - Engineering in the Canadian Context (2015), SFU

MECH 365 - Machine Dynamics and Vibrations (2003), UBC

MECH 506 - Linear Vibrations (2007, 2009), UBC

MECH 464/563 - Industrial Robotics (2011), UBC

Selected Works

Neal, V., Oldknow, K., Edgar, J., Bajic, I., Trautman, M. and Moallem, M. (2018) A New Program in Sustainable Energy Engineering - Balancing subject matter with transformative pedagogies to produce Global Citizens, Proceedings of the 9th Conference on Engineering Education for Sustainable Development, June 3-6, 2018, Glassboro, New Jersey, 8pp

Stock, R., Elvidge, D,. Oldknow, K. and Eadie, D.T. (2017) Wheel and rail life extension with on-board TOR friction control, Proceedings of the International Heavy Haul Association 2017 Conference, Cape Town, 8pp.

Oldknow, K., Cotter, J., Eadie, D., Elvidge, D., Kennedy, W., Weitzel, L., Nedunoori, S., Peters, J., Replogle, J., Ronasi, H. and Stevens, R. (2015) Inertial Tractive Effort as an Explanatory Variable in the Analysis of Locomotive Fuel Savings, Proceedings of the International Heavy Haul Association Conference (IHHA 2015), Perth, Australia, June 21-24, 2015

Oldknow, K., Eadie, D. and Stock, R. (2013) The influence of precipitation and friction control agents on forces at the wheel / rail interface in heavy haul, Journal of Rail and Rapid Transit 227,1, 8pp

VanderMarel, J. Eadie, D.T., Oldknow, K. and Iwnicki, S. (2012) A Predictive Model of Energy Savings from Top of Rail Friction Control, Proceedings of the 9th International Conference on Contact Mechanics and Wear of Rail / Wheel Systems (CM2012), Chengdu, China

Oldknow, K. and Eadie, D. (2010) Top of Rail Friction Control as a Means to Mitigate Damaging Lateral Loads due to Overbalanced Operation of Heavy Axle Load Freight Traffic in Shared High Speed Rail Corridors, Proceedings of the 2010 Joint Rail Conference JRC2010-36010, April 27-29, 2010, Urbana, Illinois, USA, 9pp.

Roney, M., Bell, S., Paradise, S., Oldknow, K. and Igwemezie, J. (2010) Implementation of distributed power and friction control to minimize the stress state and maximize velocity in Canadian Pacific's heavy haul / heavy grade train operations, Journal of Rail and Rapid Transit September 1, 2010 vol. 224 no. 5 465-471

Eadie, D., Elvidge, D., Oldknow, K., Stock, R., Pointner, P., Kalousek, J. and Klauser, P. (2008) The Effects of Top of Rail Friction Modifier on Wear and Rolling Contact Fatigue: Full Scale Rail Wheel Test Rig Evaluation, Analysis and Modelling, Wear 265, pp. 1222-1230

Eadie, D., Oldknow, K., Maglalang, L., Makowsky, T., Reiff, R., Sroba, P. and Powell, W. (2006) Implementation of Wayside Top of Rail Friction Control on North American Heavy Haul Freight Railways, Proceedings of the 7th World Congress on Railway Research (WCRR2006), Montreal, Quebec, 10pp.

Oldknow, K. and Yellowley, I. (2004) FPGA based servo control and three-dimensional dynamic interpolation, IEEE/ASME Transactions on Mechatronics, 10, 1, 98-110

Oldknow, K. and Yellowley, I. (2003) Implementation and validation of 3-dimensional dynamic interpolation using an FPGA based controller, International Journal of Machine tools and Manufacture, 43, 937-945

Oldknow, K. and Yellowley, I. (2002) Three-dimensional dynamic interpolation using state line based control architectures, International Journal of Machine Tools and Manufacture, 42, 1627-1641

Oldknow, K. and Yellowley, I. (2001) The design, implementation and validation of a system for the dynamic reconfiguration of open architecture machine tool controls, International Journal of Machine Tools and Manufacture, 41, 795-808