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SUMMARY

Eight years of professional and academic, experimental and analytical research of renewable energy systems, electric propulsion systems, and energy modeling. Research and development focus is placed on sustainable and efficient energy generation, storage, and conversion mechanisms.

Distinct areas of renewable energy expertise:

- Transportation
- Residential
- Commercial/industrial
- Electricity generation and transmission

Key capabilities:

- Experiment design and execution
- Analytical modeling and analysis
- Project proposal, management, reporting, and presentation

EDUCATION

PhD – Mechanical Engineering (ongoing)

2006 – present

Dalhousie University, Halifax NS

Thesis title: A Hybrid Energy Model and Greenhouse Gas Emissions Model of the Canadian Housing Stock

Summary: Development of a detailed energy and GHG emissions model of the housing sector that incorporates the strengths of distinctly different modeling techniques. The model has the capability of assessing both the applicability and impact of renewable energy and alternative energy technologies and systems.

MASc – Mechanical Engineering

2004 – 2006

Dalhousie University, Halifax NS

Thesis title: An Experimental Investigation of Photovoltaic Powered Permanent Magnet Brushless DC Electric Motors for Solar Pumping

Summary: Experimental study and design of the control, electromagnetic, and thermodynamic characteristics of an integrated high-efficiency motor and pump for use with solar domestic hot water systems. This research identified optimal characteristics for a unit that is now in commercialization stages.

BSc – Mechanical Engineering

2000 – 2004

California Polytechnic State University, San Luis Obispo CA

Senior project title: Solar Decathlon PV System Design – A study of a Photovoltaic System for an Off-Grid Home

Course emphasis: Coursework and projects were selected based on the involvement of renewable energy and mechatronics.

PROFESSIONAL EXPERIENCE

DHS Engineering, Halifax NS

2004 – present

Position: Vice President, Engineer for mechanical and electrical projects

Summary: Responsible for small to medium sized (\$10k – \$100k) engineering projects including identification, proposal, material/measurement acquisition, engineering R&D, management of technicians, reporting, and customer presentation.

Projects (selected):

- Performance and life cycle testing of energy storage units for electric and hybrid vehicle applications
- Development of battery charge and state-of-charge algorithms for OEMs
- Experimental and analytical battery pack design – electrical, thermal, and structural design
- Analytical modeling of vehicle energy consumption characteristics and requirements
- High-speed hydrogen combustion research (experimental and analytical)
- Photovoltaic DC/DC converter designs
- Three phase commercial energy analysis and commercial battery production process analysis

In-Stream Engineering, Halifax NS

2008 – present

Position: Vice President, Engineer for mechanical and electrical projects

Summary: Consulting in the modeling, design, and implementation of in-stream water turbines. Recently proposed two distinct development and modeling projects with regard to the Fundy Basin to NS Dept. of Energy and Offshore Energy Environmental Research Association.

Colchester-Cumberland Wind Field, Tatamagouche NS

2006 – present

Position: Treasurer, Engineer for mechanical and electrical projects

Summary: Management and development of megawatt class distributed wind energy projects.

Responsibilities (selected):

- Business plan, investor identification, liaison to major government entities
- Detailed wind energy analysis including multiple meteorological tower equipment installations (50 m height), monitoring, analysis, and presentation of commercial wind data
- Project proposals and negotiations with Nova Scotia Power

Energy Control Systems Engineering, Monrovia CA

2001 – 2004

Position: Independent Contractor as a Technician/Engineer

Summary: Technician work developing and wiring control and power harnesses, and interconnecting sensor and datalogging equipment for testing batteries. This included mechanical developments and structural items that required significant machining. Also, preliminary engineering analysis for thermal and structural components.

Projects (selected):

- Electric vehicle and hybrid electric vehicle battery pack testing
- Thermal analysis of OEM hybrid battery packs
- Retrofitting full-performance battery electric vehicles

TEACHING EXPERIENCE

Part-time lecturer, Department of Mechanical Engineering

2008 – 2009

Dalhousie University, Halifax NS

Summary: Responsible for all facets of teaching Thermodynamics (ENGI 2800) and Mechanics-Dynamics (ENGI 2400) as well as managing T/As. Responsible for supervising a senior year design project team “Tiger Shark – Underwater Remotely Operated Vehicle”.

Seminar presentations – Heat Transfer

2008

Dalhousie University, Halifax NS

- Several presentations on a variety of practical heat transfer applications with a focus on design optimization and significance of energy use and efficiency.
- Term project development, administration, support, and grading – “Finite difference analysis of in-floor heating systems”

Seminar presentations – Renewable Energy

2007

Dalhousie University, Halifax NS

- Several presentations on a variety of wind turbine technologies and site considerations
- Term project development, administration, support, and grading – “Wind, solar-thermal, tidal and geothermal systems”
- Organization of renewable energy field trips for 20 students
 - Inside viewing of control and components of a 600 kW commercial wind turbine in NS
 - Facility review of a 20 MW tidal water turbine in Annapolis Royal, NS
 - Facility review of a solar thermal panel manufacturing facility in NS

PERSONAL RESEARCH

- Personally installed, instrumented, and monitored two residential solar thermal domestic hot water systems over a four year period. These systems use the solar powered brushless DC motor developed during the MASc research project. The impact of insulation and temperature sensor placement was investigated and found to be of significance for correct implementation of the motor control strategy. (2006 – 2009)
- Instrumented and monitored a residential air-to-air heat pump system for one year. It was found that the coefficient of heating performance does not decrease with outdoor temperature as substantially as consumer literature would indicate. In addition the control algorithm of setback thermostats were monitored and an improved algorithm was developed to save auxiliary electricity. (2008 – 2009)
- Discharge, charge, and regenerative braking, power and energy consumption characteristics of highway capable electric vehicles (cars and pickup trucks) are monitored and compared to conventional vehicles (i.e. internal combustion engine) through everyday use for many thousands of kilometres per year. Electric drivetrains were found to typically outperform conventional drivetrains that have nearly twice the peak power rating. Energy consumption of an electric vehicle was found to be only 25% of a conventional vehicle (electrical energy versus gasoline energy). (1998 – 2009)
- Visited and toured over a dozen different commercial wind turbine fields. Met with landowners, developers, managers, and maintenance technicians and discussed the power and energy output, equipment reliability and robustness, ease of installation, and implications upon nearby dwellings. Two new technology direct-drive wind turbine manufacturers were found to have significant

problems with their equipment in the Nova Scotia climate. Most nearby landowners were found to be accepting of the wind installations and those in opposition were usually inexperienced or uneducated regarding wind turbines. (2006 – 2009)

COMMITTEE, GROUP, AND VOLUNTEER ACTIVITIES

- Member of the Board of Directors of the Canadian Chapter of the International Building Performance Simulation Association (2008 – 2009)
- Member of the Board of Directors of the community based wind energy company Colchester-Cumberland Wind Field (2007 – 2009)
- Chair of the organizing committee – 2008 Mechanical Engineering Research Conference, Halifax NS
- Member of the scientific committee of eSim 2010 (Winnipeg)
- Member of the scientific committee of Building Simulation 2009 (Glasgow)
- Member of the technical review committee of CANCAM 2009 (Halifax)
- Member of the PV array design team for Cal Poly Solar Decathlon house (2004)
- Lead coordinator of the Hi-Mountain Dual Sport, a 400 participant on/off road motorcycle event in central California (2003 – 2004)
- Supporting team member to ‘White Lighting’ streamliner, the current FIA sanctioned Electric Land Speed Record Holder – 245 MPH (394 km/h) [Class A VIII 3], Dempsey’s World Record Associates. This included two race trips to the Bonneville Salt Flats (2000)
- Navigator of a GM EV1 (Gen 2) electric vehicle of the 2000 American Tour de Sol hosted by Northeast Sustainable Energy Association (NESEA). The course ran from New York to Washington DC. (2000)
- Seminar to a 10th grade class – “Energy Consumption and renewables – Vehicle focus” (2009)
- Science project judge to a 4th grade class – “Rube Goldberg Machines” (2009)

MEMBERSHIP IN PROFESSIONAL AND ACADEMIC ASSOCIATIONS

- Electric Mobility Canada (EMC)
- International Building Performance Simulation Association (IBPSA)
- Solar Buildings Research Network (SBRN)
- Society of Automotive Engineers (SAE)
- Solar Energy Society of Canada Inc. (SESCI)

AWARDS

- IBPSA-Canada Student travel grant to Building Simulation 2009, Glasgow, Scotland. (2009)
- IBPSA-Canada Student travel grant to eSim 2008, Quebec City, Quebec. (2008)
- Dalhousie University Faculty of Graduate Studies Scholarship (2006 – 2009)
- Reid Scholarship (2006 – 2008)
- Bruce and Dorothea Rossetti Scholarship (2005 – 2009)
- Medjuck Scholarship (2005 – 2009)

PUBLICATIONS

Peer reviewed journal articles

Swan LG & Ugursal VI (2009). Modeling of end-use energy consumption in the residential sector: a review of modeling techniques. *Journal of Renewable and Sustainable Energy Reviews* 13(8), pp. 1819–1835.

Swan LG, Ugursal VI & Beausoleil-Morrison I (2009). A database of house descriptions representative of the Canadian housing stock for coupling to building energy performance simulation. *Journal of Building Performance Simulation* 2(2), pp. 75–84.

Journal articles under review

Swan LG, Allen PL (2009). Integrated solar pump design incorporating a brushless DC motor for use in a solar heating system. Submitted to *Renewable Energy*.

Peer reviewed conference papers

Swan LG, Ugursal VI & Beausoleil-Morrison I (2009). Implementation of a Canadian residential energy end-use model for assessing new technology impacts. *Proceedings of the IBPSA Building Simulation 2009*, July 27–31, Glasgow, Scotland, pp. 1429–1436.

Swan LG, Ugursal VI & Beausoleil-Morrison I (2009). A model for evaluating the thermal effects of windows on the Canadian housing stock. *Proceedings of the Canadian Solar Buildings Conference*, June 25–26, Toronto, pp. 392–400.

Swan LG, Ugursal VI & Beausoleil-Morrison I (2008). A new hybrid end-use energy and emissions model of the Canadian housing stock. *Proceedings of the Canadian Solar Buildings Conference*, August 20–22, Fredericton, Canada. pp. 109–116.

Swan LG, Ugursal VI & Beausoleil-Morrison I (2008). A new hybrid end-use energy and emissions model of the Canadian housing stock. *Proceedings of the International Conference on Building Energy and Environment*, July 13–16, Dalian, China. pp. 1992–1999.

Swan LG, Ugursal VI & Beausoleil-Morrison I (2008). Canadian housing stock database for building energy simulation. *Proceedings of eSim 2008*, May 20–22, Quebec City, Canada. pp. 143-150.

Monograph

Swan LG (2008). An investigation of PV powered brushless DC motors for solar pumping. VDM Verlag Dr. Müller. Germany. 144 pages. ISBN-10: 3639066669. ISBN-13: 978-3639066661.