

Douglas S Henderson B.Sc., Ph.D., C.Eng., MIET, FHEA
Curriculum Vitae

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Contact details

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EDUCATION

Royal High School, Edinburgh, 1970 - 1975

8 - SCE "O" Grades: Arithmetic, Mathematics, English, French, Physics,
Chemistry, Applied Mechanics and Engineering Drawing.
5 - SCE "Highers": English, Mathematics, Physics, Chemistry and Engineering
Drawing.

The University of Edinburgh, 1975 - 1979

B.Sc. Hons. (2.1) Engineering Science, - Electronic and Electrical Engineering.

The University of Edinburgh, 1992

Award of a Doctor of Philosophy on the subject of "A Three Phase Electronic
Load Governor for Micro Hydro Generation"

IEE Professional Development Scheme, 1980 - 1985

CEng MIEE.

EMPLOYMENT

Scottish Engineering Training Scheme.

Undergraduate Trainee 1976 - 1978
Graduate Trainee 1979 - 1980

Peebles Electrical Machines, NEI Peebles Ltd.

Project Engineer 1980 - 1984
Senior Project Engineer 1984 - 1985

Edinburgh Napier University

Lecturer 1986 – 2009
Senior Lecturer 2009 -

RESPONSIBILITIES AND DUTIES IN EMPLOYMENT

NEI Peebles Ltd

Initially as a Project Engineer, then latterly as a Senior Project Engineer, in the Systems Engineering department of Peebles Electrical Machines, Dr Henderson was responsible for turnkey projects in a wide range of disciplines including; hydro electric, steam turbine, gas turbine and diesel engine generation; rotating frequency converters; motor drives for the coal, copper, water and petrochemical industries. The individual unit rating of the rotating element of these projects varied from 500 kW to 16 MW. The associated distribution equipment would be at voltages from 415 V to 150 kV and included transformers, switchgear, HV/MV/LV systems, and protection and control systems.

The work performed included appraisal of clients technical requirements; preparation of technical specifications; liaison with clients and sub-contractors on a consultative basis; electrical power systems analysis; evaluation of sub-contractors submissions and subsequent nomination for inclusion in tenders; and the preparation of tender documents and subsequent negotiation of contracts with clients. In addition to securing the technical integrity of tenders, Dr Henderson was responsible for all associated commercial aspects such as pricing, Conditions of Contract, insurance, finance, terms of payment and guarantees.

Edinburgh Napier University

Dr Henderson is a Senior Lecturer and School Director of Student Experience in the School of Engineering & the Built Environment and has taught electrical engineering at a variety of levels from 1st year HND and B.Eng. introductory Electrical Principles subjects through to 3rd and 4th year, Degree, Honours Degree and MSc Power Engineering subjects. A broad range of topics have been taught by Dr Henderson including circuits and systems, electromechanical energy conversion, electrical supply, power electronics, machines and drives, and power systems analysis.

Additional responsibilities as a lecturer, past and present, include;

- School timetabler from 1996 until 2008.
- Programme Leader for BEng Honours Electronic & Electrical Engineering Programme and the BEng Honours Electrical Engineering Programme.
- Project supervisor to Degree and Honours Degree students.
- Personal Development Tutor to Year 3 & 4 undergraduate students.
- PhD Research student and Teaching Company Associate student supervision.
- Research paper publication – including being part of the 2008 RAE application and delivery of papers at Conferences on a National and International basis.
- Consultancy work – including work for The Carbon Trust and 3 HI-Links Feasibility Studies.

RESEARCH AND OTHER SCHOLARLY ACTIVITIES.

EDTC Awards

Dr Henderson is currently working on two EDTC Feasibility Award Studies.

HI Links Feasibility Studies

Dr Henderson has recently been a successful partner in 3 separate HI- Links Feasibility Study grants.

These are;

- The feasibility of the use of hydroelectric generation for Guisachan Estate.
- The feasibility of using hydro to power a distillery on Barra.
- The feasibility of controlling mixed renewable energy generation technologies to power a distillery on Barra.

Work started on these projects in March 2008 and was completed in August 2008.

Teaching Company Scheme, 2001-2003

Dr Henderson was a co-supervisor of a Teaching Company Associate on a scheme with East of Scotland Water. The work programme began with a study of small hydro power plants in general and the plants currently operated by the company in particular. The design and operation of these plants was reviewed and best practices employed elsewhere analysed. All feasible design changes were then reviewed and their cost determined. Furthermore, the tariffs for selling and buying electricity were reviewed and systematically analysed. A model was developed which optimises the benefits to the company by comparing all practicable design changes with available tariffs.

The opportunities for the installation of additional small hydro plants was examined across the whole of the Company's infrastructure. A range of designs and their operation were considered, so that the company can maximise immediately the benefits associated with electricity tariffs offered by various electricity supply companies.

The second area of this work was to analyse all operations which use significant amount of energy and compare them with the best practices reported elsewhere. A general procedure for optimising energy efficiency of these operations was then developed.

Current Research Activity

- Recent completion of PhD as Joint Supervisor on the topic of Optimisation of Solar Air Heating Systems.
- Recent completion of PhD as Director of Studies and joint supervisor on the topic of Solar Water Heaters.
- Recent completion of PhD as Joint Supervisor on the topic of Solar Water Heaters.
- Joint supervisor of an PhD candidate on the topic of solar air drying of woodchip.
- Director of Studies and joint supervisor of a PhD candidate on the topic of the potential for solar energy generation in Libya.

PhD Examinations

Dr Henderson has been examiner at PhD level as follows;

Internal Examiner (Edinburgh Napier University)

Branislav Hredzak, Elimination of Torque Pulsations in a Direct Wheel Drive for an Electric Vehicle. June 1997.

William N Pearson, An Expert System for the Performance Control of Rotating Machinery, January 2001.

External Examiner

Edinburgh University, G Connor, The Externalities in Electricity Generation, November 2000.

Short Courses

A grant of 9,200 ECU was awarded in 1993 towards the development of a short course on the subject of The Use of Variable Speed Drives for Energy Efficiency. This funding was from the European Commission COMETT programme. The project, which had a turnover of 40,000 ECU in 15 months, brought together partners in Industry and the Universities. The partners involved were Napier University, ETSU and Heenan Drives in the UK, and the Politecnico di Torino and Sitra Automazione from Italy. The first course ran in Italy in May 1994 and the second course ran in the UK in November 1994. Dr Henderson was the principal applicant and joint co-ordinator for this project.

CONSULTING ACTIVITIES.

Dr Henderson has been retained on behalf of industrial clients to;

- prepare a Continuing Education Course on Electrical and Commercial Engineering of Appropriate Technology Micro Hydro Schemes in Nepal, 1987.
- advise on the operation of the micro hydro plant at Laurieston Hall, Dumfries, 1987.
- advise on a Pre-feasibility Study for the New Lanark Mills hydroelectric stations, 1989.
- prepare and deliver a Training Course on Power System Economics at John Brown Engineering, Clydebank, 1990.
- perform and report on a Feasibility Study for the Castle Moffat hydroelectric generating scheme for the Water Supply Services, 1990.
- perform Enquiry Assessment for NEI Peebles, 1991.
- assist with the Engineering associated with the Castle Moffat small hydroelectric generating scheme for the Water Supply Services, 1991 - 1993.
- assist NEI Peebles with the preparation of a tender on the 18MW Zisco Steel coal fired power station, 1992.
- prepare a tender for NEI Peebles for the 5MW Dolgarrog hydroelectric power station, 1992.
- assist Peebles Electric with the tender preparation for the 90MW Muela hydroelectric power station, 1993.
- assist Peebles Electric with the tender preparation for the Phase III, Indonesian Mini Hydro Power stations, (Wining, Wamena, Sampean Baru and Poigar), 1993.
- prepare a Feasibility Study for a small hydroelectric generating scheme for the water Supply Services, 1993.
- provide advice on induction generator operation for National Power, North Wales Hydro Group, 1994.
- pre-feasibility study for Privick Mill small hydroelectric project, 1996.

- act in an advisory role on small scale hydroelectric generation, as an Expert to DGXVII of the Commission of the European Communities, 1988 - 1997.
- Investigation into hydroelectric generation opportunities for the Craigencaft Farm Ecology Centre, Fife, 2000.
- pre-feasibility study for a small hydroelectric project, 2002 for East of Scotland Water.
- Technical Expert to The Carbon Trust (Northern Ireland) on a small hydro scheme for SEELB, October 2005.
- Technical Expert to The Carbon Trust (Northern Ireland) on four small hydro schemes for DRD Water Services, February 2006.
- Technical Expert to The Carbon Trust (Northern Ireland) on two small hydro schemes for the Environment and Heritage Service, October 2006.
- Technical Expert to The Carbon Trust (Northern Ireland) on a micro hydro scheme for Newtownabbey Borough Council, October 2006.
- Design and supervision of power cables for new machine supplies at Wyman Gordon, Livingston, June - September 2007.
- Technical Expert to The Carbon Trust (Northern Ireland) providing advice on a small hydroelectric scheme to the Colin Glen Trust, September - October 2007.
- Technical Expert to The Carbon Trust (Scotland) providing advice on the optimisation of a small hydroelectric scheme for Deanston Distillery, March 2008.
- Technical Expert to The Carbon Trust (Northern Ireland) providing advice on a small hydroelectric scheme to the Mooney Hotel Group, March 2008.

Dr Henderson is accredited under the Carbon Trust's Consultant Accreditation Scheme.

Dr Henderson appeared on the BBC News channel on 17th August 2009 as an expert providing information and comment on the accident at the Sayano-Shushenskaya hydroelectric power station in Siberia, Russia.

PROFESSIONAL BODY MEMBERSHIP.

Dr Henderson is a Member of the Institution of Engineering and Technology (formally IEE) and served on several Committees since 1987 including the IEE Scotland Power Section, professional group P10 on generation and the Power Divisional Board. Dr Henderson is a founder-member and Chairman of the organising committee for the IEE Residential Courses on Electrical Generators and Distributed Generation Systems. The course first ran in 1996 and was repeated in 1997, 1999, 2001, 2003 and in 2005. Dr Henderson is also a presenter at the Course. Dr Henderson chaired a more advanced level of the Course which ran in 1998 and the Distributed Generation Systems Course in 2000, 2002, 2004, 2006, 2007, 2008 and 2009.

Dr Henderson was a member of the International Hydropower Association (IHA), and served on its Permanent Committee for Education and Research as its Vice-Chairman.

Dr Henderson served on the Organising Committee of the first IEE/IMEchE International Conference, Power Station Maintenance - Profitability through reliability. Dr Henderson was a member of the UPEC Steering Committee from 1998 to 2000.

Dr Henderson is registered with the IET's Continuing Professional Development scheme.

COURSES AND CONFERENCES ATTENDED RECENTLY.

- Eurosun 2004, Freiburg, Germany, June 2004.
- Third Short Course on Distributed Generation Systems, IEE, Nottingham, UK, September 2004. (Chairman of organising committee and presenter).
- Seventh Short Course on Electrical Generators, IEE, Leicester, UK, September 2005. (Chairman of organising committee and presenter).
- Powering a Sustainable Scottish Economy, Industrial and Power Association, Edinburgh, October 2005.
- Fourth Short Course on Distributed Generation Systems, IET, Blythe, UK, September 2006. (Chairman of organising committee and presenter).
- Scotland and the Energy Challenge: What do we do now?, Edinburgh, October 2006.
- Fifth Short Course on Distributed Generation Systems, IET, Blythe, UK, September 2007. (Chairman of organising committee and presenter).
- BHA Annual Conference, Delivering the next generation, Birnam, Scotland October 2007.
- Practical Solutions to Scotland's Renewable Energy Challenges. Edinburgh, January 2008.
- The 1st International Conference of Institution of Engineering and Technology (IET) Brunei Darussalam Network, Brunei, May 2008.
- Hidroenergija 2008, On the Crossroads, Bled, Slovenia, June 2008.
- Sixth Short Course on Distributed Generation Systems, IET, Blyth, UK, September 2008. (Chairman of organising committee and presenter).
- BHA Annual Conference, Stepping into the Spotlight, Bristol, September 2008.
- Waterpower XVI, PennWell, Spokane, Washington, USA, July 2009.
- Seventh Short Course on Distributed Generation Systems, IET, Blyth, UK, September 2009. (Chairman of organising committee and presenter).
- ICEGES 2009, International Conference and Exhibition on Green Energy & Sustainability for Arid Region & Mediterranean Countries, Amman, Jordan November 2009
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PUBLICATIONS

1. Gair, S., Henderson, D.S., Macpherson, D.E., Wallace, A.R., and Whittington, H.W. 1987. "An integrated design approach for micro hydro generating equipment". Proceedings of the 22nd UPEC, Sunderland Polytechnic, UK.
2. Gair, S., Henderson, D.S., and Wallace, A.R. 1987. "Technical and economic considerations for small scale hydro-electric plant". Rural Energy Planning and Technology Assessment in Asian Countries, Beijing, China.
3. Henderson, D.S., Macpherson, D.E., and Whittaker, K. 1987. "Experiences with rural electrification in Papua New Guinea". Ibid.
4. Henderson, D.S., Wallace, A.R., and Whittington, H.W. 1987. "Rural electricity supplies". Ibid.
5. Henderson, D.S., Gair, S., and Macpherson, D.E. 1988. "Electronic Load Governing for small scale wind energy generating units". Proceedings of BWEA 10, London, UK.

6. Whittington, H.W., Wallace, A.R., and Henderson, D.S. 1988. "An economic analysis of capital costs in micro-hydro". Third International Conference on Small Hydro, Cancun, Mexico.
7. Macpherson, D.E., Whittington, H.W., Wallace, A.R., Gair, S., and Henderson, D.S. 1988. "Development of a prototype integrated generating unit for micro-hydro". Ibid.
8. Henderson, D.S., and Macpherson, D.E. 1988. "Electronic load governing for micro-hydro generating units". Proceedings of 23rd UPEC, Trent Polytechnic, UK.
9. Gair, S., Henderson, D.S., and Wallace, A.R. 1988. "A micro-hydro generating unit test cell". Ibid.
10. Wallace, A.R., Macpherson, D.E., and Henderson, D.S. 1988. "An integrated generating unit for micro-hydro electrification". Power India '88, New Delhi, India.
11. Wallace, A.R., Henderson, D.S., and Renton, M.W. 1988. "A review of small scale hydro power in Europe". Seminar on Small Hydro-electric Power Stations, Lisbon, Portugal.
12. Wallace, A.R., Henderson, D.S., and Whittington, H.W. 1989. "Capital cost modelling for micro-hydro appraisal". Waterpower '89, USA.
13. Wallace, A.R., Henderson, D.S., and Renton, M.W. 1989. "A review of small scale hydro power in Europe". Proceedings 24th UPEC, Belfast, UK.
14. Wallace, A.R., Henderson, D.S., and Whittington, H.W. 1989. "Capital cost modelling of small scale hydro schemes". Ibid.
15. Henderson, D.S. November 1989. "Electronic Load Governing for Micro Hydro Generation". Invited paper to the Royal Scottish Society of Arts (Science and Technology). Edinburgh.
16. Henderson, D.S., and Macpherson, D.E. 1990. "Development of a three phase, microprocessor based electronic load governor for micro-hydro generation". Proceedings 25th UPEC, Aberdeen, UK.
17. Henderson, D.S. 1990. "Development of a three phase, microprocessor based electronic load governor for micro-hydro generation". World Renewable Energy Congress, Reading, UK.
18. Henderson, D.S., and Macpherson, D.E. 1990. "Development of a three phase, microprocessor based electronic load governor for micro-hydro generation". Fourth International Conference on Small Hydro, Kuala Lumpur, Malaysia.
19. Henderson, D.S., 1992. "Performance Prediction for a Three Phase Electronic Load Governor for Micro Hydro Generation". Proceedings of 27th UPEC. Bath. UK.
20. Henderson, D.S. & Macpherson, D.E. May 1993. "Research on an Electronic Load Governor for Micro Hydro Generation". Journal of International Water Power & Dam Construction, Vol. 45 Number 5 pp 40-43.

21. Henderson, D.S. & Macpherson, D.E. September 1993. "Application of Solid State Switching Devices to Electronic Load Governing of Micro Hydro Generators". 5th European Conference on Power Electronics, Brighton, UK.
22. Henderson, D.S. October 1993. "Recent Developments of an Electronic Load Governor for Micro Hydroelectric Generation". Hydroenergia 93, Munich, Germany.
23. Henderson, D.S. November 1993. "Recent Developments of an Electronic Load Governor for Micro Hydroelectric Generation". IEE International Conference on Renewable Energy - Clean Power 2001, London, UK.
24. Henderson, D.S. July 1994. "Variable Speed Drives for Energy Efficiency - A COMETT Short Course". TEMPUS Workshop Proceedings, University of Miskolc, Hungary.
25. Henderson, D.S. October 1994. "A New Electronic Load Governor for Micro Hydroelectric Generation - Current Status and Future Developments". ESHA Info, No 11 - 1994, pp 34-36.
26. Henderson, D.S. June 1995. "Small Scale Hydro", Hydropower into the next Century, Barcelona, Spain.
27. Henderson, D.S. September 1995. "Small Scale Hydro - Undergraduate Teaching and the Integration of Research". Hydroenergia '95, Milan, Italy.
28. Henderson, D.S. "An Advanced Electronic Load Governor for Control of Micro Hydroelectric Generation". PEDES '96, New Delhi, India, January 1996.
29. Henderson, D.S. March 1996. "Synchronous or Induction Generators ? - The Choice for Small Scale Generation". Opportunities and Advances in International Power Generation, IEE International Conference, Durham, UK. ISBN 0 85296 655 5 pp 146-149.
30. Henderson, D.S. March 1996. "An Advanced ELG for Control of Small Scale Hydroelectric Generation". Opportunities and Advances in International Power Generation, IEE International Conference, Durham, UK. ISBN 0 85296 655 5 pp 172-175.
31. Henderson, D.S. April 1996 "Prototype Governor moves out of the laboratory". Hydro Review Worldwide. Vol 4, No 2, page 42.
32. Henderson, D.S. June 1996. "Small Scale Hydro". Discussion meeting on "Small is beautiful", IEE, London, UK.
33. Henderson, D.S. June 1996. "Variable Speed Electric Drives - characteristics and applications". Energy efficient and environmentally friendly drive systems, IEE Colloquium, London, UK.
34. Henderson, D.S. June 1997. "An Advanced Electronic Load Governor for Control of Micro Hydroelectric Generation". IEEE - PE-P04-EC-0-06-1997.
35. Henderson, D.S., Maclean, A. September 1997. "Application of an Innovative Electronic Load Governor". Hydropower into the next Century - II, Portoroz, Slovenia.

36. Henderson, D.S., Maclean, A. September 1997. "Application of an Innovative Electronic Load Governor at Ashfield Mill - A Case Study". *Hydroenergia '97*, Dublin, Eire.
37. Henderson, D.S. & Pearson, W. December 1997. "An improved control algorithm for an electronic load governor". *The Journal of Measurement & Control*, Volume 30 pp 293-296.
38. Henderson, D S, Lothian, K and Priest, J. "PC based monitoring and fault prediction for small hydroelectric plants". First IEE International Conference on Power Station Maintenance, Heriot-Watt University, Edinburgh, 30 March - 1 April 1998.
39. Henderson, D.S., Maclean, A "Control, protection and monitoring of a micro-hydro generating set". *The International Journal on Hydropower & Dams*, February 1998.
40. Henderson, D.S., Pearson, W. "Electronic Load Governor - Application of Derivative Control Action for Improving Transient Response". UPEC '98, Edinburgh Napier University, Edinburgh, UK, September 1998.
41. Henderson, D.S. "The Ashfield Mill Electronic Load Governor - Operational Results". UPEC '99, Leicester University, UK, September 1999.
42. Henderson, D.S. "The Ashfield Mill Electronic Load Governor - Operational Results". *Hydropower into the Next Century, Hydropower & Dams*, Gmunden, Austria, October 1999.
43. Pearson, W N., Armitage, A F., & Henderson, D S. "A Novel Method For The Performance Modelling Of A Gas Transmission Compressor", *Proceedings of ASME Turbo Expo 2002 June 3-6, 2002, Amsterdam, The Netherlands*. ISBN 0791836010
44. Grassie T., Odeh N., Henderson D., Muneer T. Slope Irradiance modelling for Scotland. *Eurosun 2004, Germany, June 2004*. ISBN 3980965635
45. Henderson D., Odeh N., Muneer T., Grassie T. Estimating the performance of a PV driven fan in a solar air heating system. *Eurosun 2004, Germany, June 2004*. ISBN 3980965619
46. N. Odeh, D. Henderson, T. Grassie, T. Muneer. A new method for estimating the optimum motor constant for PV-driven systems. *NorthSun 2005 Conference. June 2005*. ISBN 9955-9778-0-9
47. N. Odeh, T. Grassie, D. Henderson, T. Muneer. Comparative testing of PV-driven roof slate-based solar ventilation air preheating systems. *NorthSun 2005 Conference. June 2005*. ISBN 9955-9778-0-9
48. N. Odeh, T. Grassie, D. Henderson, T. Muneer. Modelling of flow rate in a photovoltaic-driven roof slate- based solar ventilation air preheating system. *Energy Conversion and Management Journal*, Volume 47, Issues 7-8, May 2006, Pages 909-925.

49. Henderson, D; Junaidi, H; Muneer, T; Grassie T; Currie, J. Study of stratification on a integrated collector Storage Solar Water Heater, 9th AIAA/ASME Joint Conference, June 2006. ISBN-13: 978-1-56347-815-4.
50. Grassie T; Junaidi, H; Muneer, T; Currie, J.; Henderson, D. Study of an innovative Built-in Storage (Integrated Collector Storage) Solar Water Heater for Scottish Weather Conditions. EURO SUN 2006, June 2006. ISBN 0 904963 73 1.
51. Henderson, D; Junaidi, H; Muneer, T; Grassie T; Currie, J. Experimental and CFD investigation of an ICSSWH at various inclinations". Renewable & Sustainable Energy Reviews. Volume 11, Issue 6 , August 2007, Pages 1087-1116.
52. Henderson, D. Generators and their control. Distributed Generation Systems, September 2007, IET, ISBN 978-0-86341-831-0.
53. Henderson, D. Economic and Planning Issues – An awareness. Distributed Generation Systems, September 2007, IET, ISBN 978-0-86341-831-0.
54. Junaidi, H.; Henderson, D.; Grassie, T.; Currie, J.; Muneer, T. Finite volume computational fluid dynamics package for solving convective heat transfer cases. International Journal of Mechanical Engineering Education, Volume 36, Number 2, April 2008, pp. 92-112. Manchester University Press
55. Henderson, D; The case for hydroelectric generation as an essential part of a sustainable energy mix. The 1st International Conference of Institution of Engineering and Technology (IET) Brunei Darussalam Network, May 2008, Brunei. (Invited paper).
56. Currie J.I, Garnier C, Muneer T, Grassie T, & Henderson D. "Modelling bulk water temperature in integrated collector storage systems" Building Service Engineering & Technology. Vol. 29, No. 3, pages 203-218, August 2008.
57. Henderson, D. Time to Lower the Barriers. BHA Conference 2008, Stepping into the Spotlight. Bristol, UK. September 2008.
58. A. Clemente, T. Grassie, D. Henderson and J. Kubie , Solar application for drying woodchip in Scotland. Eurosun 2008, Lisbon, Portugal. October 2008.
59. Aldali Y, Henderson D, Muneer T. Prospects for large-scale Solar Thermal electricity generation from the Libyan Desert: technical feasibility. Proceedings of ES2009, ASME, 3rd International Conference on Energy Sustainability, July 19-23, 2009, San Francisco, California, USA.
60. Henderson D, Aldali Y, Muneer T, Solar Thermal and Photovoltaic Electrical Generation an Libya, ICEGES 2009, International Conference and Exhibition on Green Energy & Sustainability for Arid Region & Mediterranean Countries, Amman, Jordan November 2009. (Invited Keynote Presentation).

Accepted papers