Dominic Davis

Curriculum Vitae

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DMWDavis

Experience

Aug 2023 – **Associate Research Scholar**, *Andlinger Center for Energy and the Environment, Princeton University*, Princeton NJ, USA.

Oct 2019 – Jun 2023 **Research Fellow**, *Melbourne Energy Institute, The University of Melbourne, School of Mechanical Engineering*, Melbourne, Australia.

- Researcher for the Net Zero Australia project – with particular contribution to: development of the energy system models for Australia; processing, analysis and clear presentation of the modelling outputs; analysis of transport, electricity, forestry, agriculture and bioenergy sectors; employment analysis; and preparation of numerous presentations, briefings and reports.
- Research on decarbonisation pathways for our energy & transport systems.
- Electricity market modelling and analysis of the importance of short-term renewable energy forecasting accuracy on technical and financial performance of electricity systems.
- Technical Advisory Panel for the Australian Clean Energy Regulator, advising on development of a robust and practical methodology for its proposed Guarantee of Origin scheme for hydrogen and derived products.
- Development of detailed models of electricity and transport system operation to optimise investment decisions required to meet decarbonisation targets at least cost.
- Teaching a Master's level course, Analysing Energy Systems (ENGR90029) – topics including basic energy/mass balances and thermodynamics.
- Supervision of Master's and Ph.D. students.

Mar 2019 – Jul 2019 **Postdoctoral researcher**, *Centre for Energy Technology, The University of Adelaide, School of Mechanical Engineering*, Adelaide, Australia.

- Design and operation of experiments to heat particles in a small-scale solar receiver rig with simulated solar thermal energy.

Education

2015–2019 **Ph.D. in Mechanical Engineering**, *Centre for Energy Technology, School of Mechanical Engineering, The University of Adelaide*.
Thesis: Characterising the Performance of Vortex-Based Solar Thermal Particle Receiver-Reactors

2009–2014 **Bachelor of Engineering (Mechanical & Aerospace)**, *The University of Adelaide*.

2010–2013 **Diploma of Languages (German)**, *The University of Adelaide*.

Publications

- **Davis, D,** Pascale, A, Vecchi, A, Bharadwaj, B, Jones, R, Strawhorn, T, Tabatabaei, M, Lopez Peralta, M, Zhang, Y, Beiraghi, J, Kiri, U, Vosshage, Finch, B, Batterham, R, Bolt, R, Brear, M, Cullen, B, Domansky, K, Eckard, R, Greig, C, Keenan, R, Smart, S 2023, 'Modelling Summary Report', *Net Zero Australia*, netzeroaustralia.net.au/final-modelling-results/.
  - Final modelling results, link.
  - Modelling summary report, link.
  - Methods, Assumptions, Scenarios & Sensitivities, link.
  - Downscaling – Transport sector energy transition, link.
  - Downscaling – The role of forestry in enhancing the Australian land CO2 sink, link.
  - Downscaling – Bioenergy systems, link.
  - Downscaling – Employment impacts, link.
  - Downscaling – Net-zero transitions, Australian communities, the land and sea, link.

Peer-reviewed journal articles

- **Davis, D,** Brear, MJ 2022, 'Decarbonising Australia's National Electricity Market and the role of firm, low-carbon technologies', *Journal of Cleaner Production*, vol. 373, 133757, 10.1016/j.jclepro.2022.133757.
- Zhang, Y, **Davis, D,** Brear, MJ 2022, 'The role of hydrogen in decarbonizing a coupled energy system', *Journal of Cleaner Production*, vol. 346, 131082, 10.1016/j.jclepro.2022.131082.
- Zhang, Y, **Davis, D,** Brear, MJ 2023, 'Least-cost pathways to net-zero, coupled energy systems: A case study in Australia', *Journal of Cleaner Production*, vol. 392, 136266, 10.1016/j.jclepro.2023.136266.
- Naemi, M, **Davis, D,** Brear, MJ 2022, 'Optimisation and analysis of battery storage integrated into a wind power plant participating in a wholesale electricity market with energy and ancillary services', *Journal of Cleaner Production*, vol. 373, 133909, 10.1016/j.jclepro.2022.133909.
- **Davis, D,** Müller, F, Saw, WL, Steinfeld, A & Nathan, GJ 2017, 'Solar-driven alumina calcination for CO_2 mitigation and improved product quality', *Green Chemistry*, vol. 19, no. 13, pp. 2992–3005, open access: 10.1039/c7gc00585g.
- **Davis, D,** Jafarian, M, Chinnici, A, Saw, WL & Nathan, GJ 2019, 'Thermal performance of vortex-based solar particle receivers for sensible heating', *Solar Energy*, vol. 177, pp. 163–177, 10.1016/j.solener.2018.10.086.
- **Davis, D,** Troiano, M, Chinnici, A, Saw, WL, Lau, T, Solimene, R, Salatino, P & Nathan, GJ 2019, 'Particle residence time distributions in a vortex-based solar particle receiver-reactor: an experimental, numerical and theoretical study', *Chemical Engineering Science*, vol. 214, 115421, 10.1016/j.ces.2019.115421.
- **Davis, D,** Troiano, M, Chinnici, A, Saw, WL, Lau, T, Solimene, R, Salatino, P & Nathan, GJ 2019, 'Particle residence time distributions in a vortex-based solar particle receiver-reactor: the influence of receiver tilt angle', *Solar Energy*, vol. 190, pp. 126–138, 10.1016/j.solener.2019.07.078.
- Chinnici, A, **Davis, D,** Lau, TCW, Ang, D, Troiano, M, Saw, WL, Tian, ZF, Solimene, R, Salatino, P & Nathan, GJ 2022, 'Measured global thermal performance of a directly irradiated suspension-flow solar particle receiver with an open aperture', *Solar Energy*, vol. 231, pp. 185–193, 10.1016/j.solener.2021.11.012.

Conference presentations

- 'The electricity system benefits of improved, short-term wind generation forecasts', presentation at **MEI Symposium 21**, Melbourne Energy Institute, Melbourne, December 2021.
- 'Decarbonising Australia's National Electricity Market using Firm, Low-Carbon Technologies', paper presented at **MIT A + B, Applied Energy Symposium**, MIT, Boston, August 2020, Youtube link.
- 'The Effect of Receiver Tilt Angle on Particle Residence Time Distributions in a Vortex-Based Solar Particle Receiver', poster presented at the **24th SolarPACES Conference**, Casablanca, Morocco, October 2018, ResearchGate link.
- 'Particle Residence Time Distributions in a Solar Vortex Receiver', paper presented at the **Asia Pacific Solar Research Conference**, *Australian PV Institute*, Melbourne, Australia, December 2017, ResearchGate link.
- 'Assessment of the Thermal Performance of Solar Expanding Vortex Receiver', paper presented at the **Asia Pacific Solar Research Conference**, *Australian PV Institute*, Canberra, Australia, November/December 2016.
- 'Solar Driven Calcination of Alumina in a Solar Vortex Reactor', paper presented at the **High Temperature Processing Symposium**, High Temperature Processing Group, *Swinburne University of Technology*, Melbourne, Australia, February 2016.

Ph.D.

Title *Characterising the Performance of Vortex-Based Solar Thermal Particle Receiver-Reactors*

Supervisors Prof. Graham 'Gus' Nathan, Dr. Woei Saw & Dr. Alfonso Chinnici

Description My Ph.D. investigated vortex-based solar thermal particle receivers, to provide new understanding of the mechanisms that control their performance. This particle technology has the potential to provide renewable power generation from solar thermal energy with inherent energy storage capability, as well as potential for application to energy-intensive industrial processes by providing high temperature renewable process heat to reacting particles. As part of my research I developed experimental methods and performed systematic experimental analysis of solar thermal mineral processing of alumina at (at temperatures over 1000°C) and the influence of key operational parameters on particle residence time distributions within a solar thermal receiver. I also developed a numerical heat transfer model of a solar thermal receiver to systematically assess the sensitivity of thermal performance to key parameters.