



RMIT UNIVERSITY

PROPOSAL

**Application for the T.J Effeney Award**

*Jack S. Bryant*

School of Engineering, Melbourne, Australia

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# 1 Background

I'm an enthusiastic final-year electrical engineering student with a passion and genuine interest in power systems. This fervor has led to perpetuated achievement over the course of my undergraduate degree, demonstrated by receipt of a New Colombo Plan Scholarship in 2016 from the Department of Foreign Affairs and Trade (DFAT), highlighting my position as one of the top 100 undergraduate students in Australia, as well as an API Bursary in 2015. Such achievements have been highlighted in interviews by *Small World Stories* in 2018 as well as an article in the April 2017 issue of *Engineers Australia's create* magazine. I have a broad range of industry experience as an Electrician and Undergraduate Electrical Engineer, where I have worked within areas including rail, power generation, oil & gas, manufacturing and technical consulting. In these roles I have led projects, supervised colleagues and communicated with a broad range of people from tradespeople to executives. I have lived and studied/worked in Australia, the United Kingdom, Singapore and Papua New Guinea demonstrating my resilience and adaptability. Moreover, I spent seven years living regionally in Gladstone, Queensland where I completed high school and an electrical apprenticeship before working as a tradesperson at Gladstone Power Station. I believe that my technical aptitude coupled with my affable personality and ability to adapt to new environments (both geographical and professional), makes me an ideal candidate for the T.J Effeney award. Directed by my love of power systems and driving change, I recently examined the impact of Frequency Control Ancillary Services (FCAS) rules on Australian power system dynamic stability as part of my Honours research project - a hot topic - with my recent related LinkedIn post garnering over 10,000 views and 145 likes in 10 days. This work is in response to evidenced deterioration in National Electricity Market (NEM) frequency control [1]–[5], as well as my desire to drive change within this area, providing benefits to generators and consumers alike. As someone who strives to make a positive impact upon the world, and who continually seeks opportunities to further develop my skills and knowledge, I am applying for the T.J Effeney Award having developed a comprehensive study program encompassing academia and industry.

## 2 Proposal Details

### 2.1 Work Outline/Scope

I propose to conduct work with Ian Hiskens, Vennema Professor of Engineering at the University of Michigan, Ann Arbor [6] and undertake short-term placements within local industry to allow me to further develop a broad range of professional and personal skills/qualities over a 16-week period. I have discussed possible opportunities with Professor Hiskens, an international power systems expert, which are detailed below amongst other opportunities.

- Project 1: Development of a research project investigating Australian grid frequency control.
- Project 2: A research project which addresses issues that arise in the implementation of aggregate control of large numbers of residential loads.

- Collaboration with other power system research groups within the US supported by Professor Hiskens.
- Short-term work experience at ITC - the largest independent electricity transmission company in the US, operating across Michigan and parts of Iowa, Minnesota, Illinois, Missouri, Kansas and Oklahoma.
- Short-term work experience at MISO (Mid-continent Independent System Operator) which operates one of the world’s largest real-time energy markets, headquartered in Carmel, Indiana.
- Disseminate issues, challenges, learnings/recommendations and open questions resulting from the work detailed above to power systems experts in China/Hong Kong, such as Professor David Hill of the University of Hong Kong and Associate Professor Yi Tang of Southeast University, Nanjing, China on the return leg of the journey from the US.
- Present findings across Australia to a broad range of stakeholders. Proposed presentations/events include: a South Australian event held in conjunction with the Electric Energy Society of Australia (EESA) and API, an event in New South Wales held in conjunction with the University of Sydney and Engineers Australia, an event in Queensland held by the API and a Victorian event held in Melbourne in conjunction with the Electrical College Branch Victoria (Engineers Australia).

## 2.2 Itemised Cost Allocation

Approximate costs are shown within Table 1.

Table 1: Approximate cost in Australian Dollars (AUD)

| Description                         | Cost                        |
|-------------------------------------|-----------------------------|
| Flights: Melbourne-Detroit (Return) | \$4,000 <sup>1</sup>        |
| Accommodation: Ann Arbor, MI        | \$6,500 <sup>2</sup>        |
| Accommodation: Carmel, IN           | \$2,100 <sup>3</sup>        |
| Other Applicable Travel Expenses    | \$6,600 <sup>4</sup>        |
| Comprehensive Travel Insurance      | \$800                       |
| <b>Total Cost (AUD)</b>             | <b>\$20,000<sup>5</sup></b> |

<sup>1</sup> Dates are subject to confirmation. Therefore, every effort has been made to provide average prices for flights and accommodation.

<sup>2</sup> As Ann Arbor is a college town, accommodation costs have been based upon an average rental price of 1500 USD (2156 AUD) per month owing to the fact that short-term accommodation is typically difficult to find, particularly during university semesters [7].

<sup>3</sup> Accommodation costs in Carmel, IN are assumed to be around 150 AUD per night neglecting yearly price fluctuations [8].

<sup>4</sup> Other applicable travel expenses include travel and accommodation to other universities/research groups within the US and China/Hong Kong based upon the project work detailed above as well as costs associated with events held across Australia to disseminate findings/information.

<sup>5</sup> A foreign exchange rate of 1 AUD = 0.6957 USD has been used for costing, based upon ANZ’s current rate offered as of 6th November 2018 [9].

### **2.3 Proposed Dates/Timeline**

Dates are subject to confirmation and will be based upon Professor Hiskens' availability. The proposed timeline is 16 weeks in total. This will allow adequate time to undertake sufficient research and work experience so as to maximise personal development and to disseminate findings/knowledge.

## **3 Broadening of My Knowledge and Skills in the Energy Sector**

The proposal presents a broad training program which allows for further development of specialist power systems knowledge within an academic setting with a world-leading researcher, whilst also allowing for exposure to industry within another country. Undertaking this research will broaden my power systems knowledge, specifically in the areas of renewable energy integration, distributed generation, primary and secondary frequency control as well as power system dynamics and analysis. Such topics are fundamental for the continual progression of Australia's power system as it faces challenges in regards to frequency control, as well as increasing investment in renewable energy sources and associated technologies. Additionally, working within organisations in the Midwest will allow me to facilitate a gap analysis whilst further developing my skills in the area of power system operation, planning and markets. From this experience, I will be able to bring these experiences back to Australia and disseminate information and findings to academia, industry and students to continue to drive change within this space.

## **4 Increase in Personal Network of Contacts**

The breadth of the proposal provides a plethora of opportunities to develop a greater range of personal contacts. Professor Hiskens frequently collaborates with researchers from other universities within the US and around the world, as well as a range of utilities and laboratories across the US. This will allow me to network with a broad range of people, to raise awareness of the Australian power system and its challenges, as well as the great work of the Australian Power Institute (API) in encouraging and supporting students' careers within the power industry through its fantastic bursary program, as well as professionals with masterclasses and workshops held throughout the year. Short-term work with other power system research groups across the US will further ensure a broad range of new contacts are developed. Moreover, collaboration with groups within China/Hong Kong will further increase my personal network of contacts. Such possibilities include Professor David Hill of the University of Hong Kong, as well as the research group at Southeast University in China, which has strong links to RMIT University, Melbourne. Additionally, upon return to Australia, hosting a range of events across Australia in conjunction with universities, the API and Engineers Australia to disseminate findings will allow me to further develop my personal network, whilst providing opportunities to develop new synergies between those in Australia and the US/China/Hong Kong to build upon the work detailed within this proposal. Overall, meeting a broad range of people will not only provide me with future opportunities, but it will also allow me to possibly foster new relationships between those within Australia and overseas.

## 5 Knowledge Sharing with Other Students and Broader API Bursary Cohort

It is anticipated that communication of knowledge gained from the award would be provided in numerous ways such as:

- Short and sharp presentations/discussions at annual API events.
- A recorded presentation through the Victorian Branch of Engineers Australia's Electrical College, which would allow for dissemination of findings and knowledge to students, API bursary recipients as well as the broader community of professional engineers.
- Presentations/power systems events held in conjunction with Engineers Australia, universities and the API across South Australia, New South Wales and Queensland in addition to the Victorian event detailed above to allow for dissemination of knowledge and development of networks.
- Posts/articles on LinkedIn - based upon my most recent post regarding my Honours Thesis project (10,500+ views and 140+ likes) - this will also highlight findings to a broad range of people and also market the great work of the Australian Power Institute (API) in encouraging and supporting the next generation of Australian power engineers.
- Interviews with media e.g. Engineers Australia *create* magazine etc.
- Presentation or video for school students documenting my exciting engineering experiences to date including Singapore, Papua New Guinea, and now...perhaps the US! This is designed to encourage interest in careers in STEM by showcasing the breadth of opportunities available.

## 6 References

- [1] DiGSILENT Pacific, 'Review of frequency control performance in the NEM under normal operating conditions', DiGSILENT Pacific, Tech. Rep., 2017.
- [2] K. Summers, R. Jennings and J. Peters, 'Lessons learnt from the Australian frequency control ancillary service market', in *16th International Workshop on Large-Scale Integration of Wind Power into Power Systems*, 2017.
- [3] Engineers Australia, 'Frequency control frameworks review', Engineers Australia, Tech. Rep., 2018.
- [4] AEMC, 'Final report: Frequency control frameworks review', AEMC, Tech. Rep., 2018.
- [5] AEMO, 'Preliminary report - Queensland and South Australia system separation on 25 August 2018', AEMO, Tech. Rep., 2018.
- [6] I. Hiskens. (Mar. 2018). Ian A Hiskens - Venemma Professor of Engineering, [Online]. Available: <http://web.eecs.umich.edu/~hiskens/>.
- [7] Rent Cafe. (Oct. 2018). Ann Arbor, MI rental market trends, [Online]. Available: <https://www.rentcafe.com/average-rent-market-trends/us/mi/ann-arbor/>.
- [8] Trip Advisor. (Nov. 2018). Carmel accommodation and places to stay, [Online]. Available: [https://www.tripadvisor.com.au/Hotels-g36990-Carmel\\_Hamilton\\_County\\_Indiana-Hotels.html](https://www.tripadvisor.com.au/Hotels-g36990-Carmel_Hamilton_County_Indiana-Hotels.html).
- [9] Australia and New Zealand Banking Group Limited. (Nov. 2018). Currency exchange rates, [Online]. Available: <https://www.anz.com.au/personal/travel-international/foreign-exchange-rates/>.