

## Executive Summaries

### 2009-2010 Bursary Vacation Placements in Queensland

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**STUDENT:** Lawrence Claire (QUT)

**COMPANY:** Powerlink Queensland

This report describes the experience of Lawrence Claire during his time as a vacation employment student at Powerlink Queensland during the 2009/2010 summer holidays. The employment was gained through the Australian Power Institute Bursary Program. Powerlink Queensland is the government owned corporation that plans, owns and operates the high voltage transmission network in Queensland.

Lawrence worked within the Main Grid Planning team, within the Network Development Business Unit. The Main Grid Planning Team is responsible for planning the expansion of the existing 330kV and 275kV transmission network.

Planning is performed with the aid of limit equations, which describe the maximum secure power transfer over the boundary between two zones in the network, as a function of certain variables. When power flow analysis predicts that the transfer over a certain boundary may exceed the maximum value set by the limit equation, then action is required. This may include one or more of the following:

- allowing the market dispatch system to constrain generation such that power transfers remain within capability;
- entering into Network Support Agreements with key generators such that power transfers remain within capability;
- investigating Network Demand Management solutions; or
- augmenting the transmission system.

The recommended solution depends of the relative costs of the options and must pass the Regulatory Investment Test for Transmission as defined in the National Electricity Rules.

Many of the limit equations are derived through an in house analysis program called VSCE. Lawrence was given the task of implementing the VSCE algorithm in a Python script using PSS<sup>®</sup>E, a load flow analysis software program. This task involved understanding the VSCE algorithm and the electrical engineering principals behind load flow analysis.

While working on this task, Lawrence became competent at programming in Python and using PSS<sup>®</sup>E. He has also learnt some generic software building and IT related skills, including debugging code and programming batch files, which were necessary to complete the task.

Lawrence was also given the opportunity to visit the South Pine Substation, which was a very interesting learning experience.

This period of vacation employment has given Lawrence a substantially greater technical and professional knowledge of high voltage electricity transmission and an understanding of some of the analysis techniques used to assess transmission capability.



**STUDENT:** Deanna Hood (QUT)

**COMPANY:** AEMO

Over the three-month course of employment at AEMO's outer Brisbane office, my technical understanding of a wide range of aspects of and relating to the power industry has increased.

The position in the Operations division was as a project officer in the Market Operations and Performance group.

My main tasks over the course of employment were PL/SQL-based data extraction and manipulation to perform a review on the Price Revisions procedures and provide supporting evidence to the variability of demand given particular temperatures, and educating colleagues about an updated scripting language and its applications.

My research, report writing, organisational and long-term planning skills have benefited immensely from the position and consequently I feel better equipped to undertake further study and employment in the engineering profession.

I would like to extend my sincerest gratitude to the Australian Power Institute Committee and Partners and AEMO for the opportunity presented over the 2009-10 summer in the Vacation Engineering Student Program.



**STUDENT:** Thomas Passaris (CQU)

**COMPANY:** Ergon Energy

**everything in our power**

During the 2009/2010 holiday period I was fortunate enough to receive vacation work at Ergon Energy in the Asset Management Protection and Communications Team. The area I focused on was communications, which was a dramatic change from directly focusing on power engineering, which I have experienced in the past at both university and in work placements.

The transition to communications within a power engineering company made me realise that I had overlooked aspects of electrical engineering, and previously I would take aspects of a system for granted. I identified this in my first project which was on transmitting a Windows Switching Operating System (WSOS) over a radio network using the DNP3 protocol.

This project took place as a feasibility study to identify if the DNP3 protocol could carry the WSOS signal to field Auto Reclosers (ACR). WSOS is used to gather detailed information and history from a recloser. The setup involved using the control part of the ACR, which comes as a product from the manufacturer of the ACR. Three of these units were used to simulate field reclosers, with an appropriate radio network established. A Supervisory Control and Data Acquisition (SCADA) system was continuously polled to the ACR units and once a SCADA connection was made, WSOS took over the link to the unit and its history was obtained.

In the end the project was highly successful, after a huge amount of problems solving, as it was deemed feasible to transmit WSOS of DNP3. I developed a huge amount of transferable knowledge in this project and now truly appreciate the integration between power systems and communications. Appropriate reporting was completed after the testing.

More directly related to power engineering, my next project focused on the upgrade of the supply arrangement to Ergon Energy's Operational Control Centre in Rockhampton (OCC(S)). At present it is possible to make the in service supply more redundant, which is very appropriate and important to the control centre. I took part in meetings with fellow employees, and made discussions with my supervisor about the matter.

A report was completed with various recommendations made for the supply arrangement. The report will be passed onto the necessary teams for the next phase of the project.

The final piece of work I took part in was developing a system for alarm management for the OCC(S) with my supervisor. There is such a considerable amount of alarms taking up space in the alarm list, and as such the control workers may become complacent. I have developed a document with a potential solution my supervisor created.

I have found this work placement extremely rewarding, and have learnt and developed a lot of skills unattainable at university. It was fantastic to be doing practical and hands on work which was directly related to subjects completed at university.



**STUDENT:** **Alexandra Price (UQ)**

**COMPANY:** **AEMO**

This report outlines my vacation employment with the Australian Electricity Market Operator (AEMO) in the market modeling department from November 2009 to February 2010.

For the duration of my employment, I was under the supervision of experienced engineers and had the opportunity to speak with engineers from other divisions within the planning department. I spent the majority of my employment updating the constraint database for the National Transmission Network Development Plan (NTNDP). I also completed smaller tasks associated with the National Transmission Statement (NTS), Minimum Reserve Levels (MRLs) and Midterm Projected Assessment of System Adequacy (MT PASA).

During my employment, I gained skills in accessing databases, using market simulation software, writing Excel macros, problem solving and report writing. Throughout my work experience, I gained a thorough understanding of how the National Electricity Market (NEM) operates, planning processes, management and the AEMO organisational structure.

Working in planning at AEMO after having undertaken placements at Powerlink and ENERGEX, I feel that I have a more complete picture of the flow of electricity from the generators through to the customers and the different modeling methods used at each level in the network. This experience has given me an appreciation of the complexity of the power engineering sector and has secured my choice in a power engineering career.

**STUDENT:** Damien Rua (UQ)

**COMPANY:** ENERGEX Ltd



In January and February of 2010 I spent five weeks working as an undergraduate electrical engineer for Energex in Brisbane. I was situated in the Network Demand Management department and worked on the Residential Targeted Initiatives (RTI) project, headed by Mark Paterson.

Currently Energex has a certain amount of load under control – that is, loads connected to off-peak tariffs (tariff 33) and loads connected to night tariffs (tariff 31). However, as the network shifts from its historic winter peak to a summer peak, the load under control will change. The main goal of the placement was to develop a model to forecast the amount of load Energex will have under control up to the year 2025.

The first model, LUCAA (Load Under Control Accounting for Attrition), accounted for the attrition of electric hot water systems. LUCAA was based on the average life of electric hot water systems and a growth rate of electric hot water system installations.

Building upon the first model, LUCAAS (Load Under Control Accounting for Attrition and Solar uptake) was made. LUCAAS incorporates the uptake of electrically boosted solar (non photovoltaic) hot water systems being placed under control.

It is thought that currently a very small percentage of electrically boosted solar hot water systems are being placed on a controllable tariff. Thus, a new model termed LUCAAS 2 was developed to incorporate 0% of currently installed solar hot water systems were on a controllable tariff. Using LUCAAS 2, if the amount of load under control is to remain constant, 15% of electrically boosted solar hot water systems will need to be connected to a controllable tariff.

Although short in time, this placement allowed me to experience project management and business modelling. Despite not being technical engineering, it was interesting to work in a different field.

In between creating the business model, I was fortunate enough to have multiple discussions with Eugene Kochnieff about many different technical design elements. Working with Eugene has reinforced the importance of thinking outside the box to solve engineering problems, and that a combination of simplicity and reliability is a beautiful thing.



**STUDENT:** Edward Burstinghaus  
(UQ)

**COMPANY:** Powerlink Queensland

During the months of November 2009 to February of 2010 I took a work placement in the Lines group of the Network Field Services business unit of Powerlink Queensland. Network Field Services (NFS) performs activities associated with construction, maintenance and repairs of the transmission network owned by Powerlink Queensland. The Lines group within NFS is responsible for the transmission line component of this work, within the Southern Region of the State. This report summarises the experience and knowledge which I gained during this time.

A major focus of the placement was to model sections of transmission lines and bare metallic objects which were situated nearby and calculate the potentials which would be induced in these objects due to steady state capacitive and inductive coupling. One project involved an unearthed fence which runs parallel to a transmission line for over a kilometre and was capacitively coupled to it. The other was concerned with inductive coupling between conductor which will be strung on one side of a series of towers and the energised conductors which were previously strung on the opposite side of the towers. The transmission line voltage in both cases is 275 kV.

These scenarios were simulated using a software package called CDEGS. Apart from the spatial coordinates of the relevant conductors, using this program required the input of several other variables and parameters which required power engineering knowledge to identify. For example the type, size and arrangement of conductors in steady state and fault conditions, the soil resistivity model and the electrical attributes of the type of material used to represent each of the objects in the environments modelled had to be entered correctly into the program for accurate results. I learnt a great deal regarding the factors which can increase capacitive or inductive coupling with metallic objects in the vicinity of transmission lines.

I also obtained considerable general knowledge concerning transmission line design and hardware during my work placement. I experienced a number of field trips, such as a substation tour, a trip to observe live insulator changing with hot sticks and a trip to measure and ground a capacitively coupled fence.

**STUDENT:** Matthew Dagg (QUT)

**COMPANY:** United Group Limited

During summer 2009 I had the pleasure of spending my vacation placement at United Group Limited, a leading provider of turn-key high-voltage substations. Within UGL I was situated in the Power Sector of their Infrastructure business unit, during which I spent the first part of my time working on-site at their South Pine Substation and the second half of which I spent working at their Spring Hill office.

While onsite I was tasked with assisting the electricians, mostly in pulling cables to a new yard being constructed. While this task may not sound too glamorous, it did give me a great position from which I could essentially see substation yard being built up around me and to get a real insight into the workings of a power orientated construction site. The staff also gave me several tours of different parts of the site and were always happy to explain what different parts of the substation and plant were and how everything works. This is a far better approach to learning than looking at a picture in a book at university and I believe I left with a far better understanding of the workings of substations.

My last few weeks with UGL were spent in the office, during which time I was majorly working under their Secondary Systems Engineer. To start out I was modifying and updating schematics for a substations protection system to allow a planned section to be interfaced with the existing older equipment. I then moved on to writing decommissioning instructions for some older parts of a substation planned for removal. Between these two major tasks I learnt a lot about reading and modifying schematics, cable schedules and connection schedules, among other things. I also learnt a great deal about substation secondary systems in general which will undoubtedly help me out in my further years of study. Overall this whole experience taught me a great deal about two different sides of a project and I am very appreciative of being able to undertake this opportunity.



**STUDENT:** Pavan Denduluri (QUT)

**COMPANY:** Tarong Energy

This report outlines my Vacation Work experience at Tarong Energy Corporation in 2010 as a 2nd year Mechanical Engineering student.

Tarong Energy Corporation TEC is a government owned organisation that owns and maintains three power stations amongst three newly acquired mining leases. Tarong and Tarong North are coal fired and Wivenhoe is a hydroelectric power generating plant, which are all located in the south east corner of Queensland, approximately 180km north-west of Brisbane.

Tarong North was recently purchased from Hitachi, a Japanese consortium, who until recently had 49% ownership of the plant.

Tarong has the capacity to generate 1400 MWh, Tarong North 443 MWh and Wivenhoe 620 MWh with a total capacity of 2463 MWh. This amount of power is never generated at once due to demand cycles and the functions and capabilities of each generator.

The power station plants employ over 300 staff whilst employing CBH as a permanent maintenance contractor on-site. The engineering division, in which I was employed, employs various skilled workers from Technical Officers (Fitter and Turners with Advanced Diplomas), Engineers of all disciplines with a RPEQ (Registered Practicing Engineer of Queensland) and Engineers registered with Engineers Australia (Australia's largest and most diverse body for engineers advancement and professional development).

Vacation Work for January 2010 was very enlightening as I had the opportunity to learn, under the guidance of dexterous employees within the engineering team, and apply knowledge recently attained during university studies. As a previous Vac-Work student at Tarong Power Station in 2009, I have had the privilege to work with the same friendly, helpful and informative Engineering Team in 2010.

It was also a bonus to see designs created during the 2009 placement come into fruition and were successfully used during the major HP and HIP steam turbine overhaul in April 2009 and will be used to compliment future turbine overhauls at Tarong Energy Corporation.



**STANWELL**  
CORPORATION LIMITED

**STUDENT:** Roland Jarrett (CQU)

**COMPANY:** Stanwell Corporation

Stanwell Corporation Ltd contributes more than 1600 MW of electricity to the nation grid from their portfolio of thermal, hydro and wind generation sites. My 2009/10 vacation placement was at the Stanwell Power Station near Rockhampton in Central Queensland. Stanwell Power Station is a 1400 MW black coal thermal power station and is one of the most highly automated stations of its type in Australia.

During my time at the station, I worked with Asset Management and also the G1 production team. I was fortunate to experience a range of work, including:

- Refurbishment of a Solar Tracking device
- Arc Flash and Protection research
- Flame Detector data collection and RM-IDD card testing
- Control System logic review

The jobs I was given and the experience I have gained at SPS have extended my technical knowledge and introduced me to some of the role of an electrical engineer in a power station. I found it satisfying to be able to apply learning I received from my university courses to practical problem solving. Working alongside electricians, technicians and engineers gave me an appreciation for the extensive knowledge that a lot of the personnel have developed about 'their' plant and the importance of consulting and collaborating widely when developing engineering solutions. I also gained a better appreciation of the need for risk management and a safety culture in environments such as the Stanwell Power Station.



**STUDENT:** Shane Jenkin (JCU)

**COMPANY:** Tarong Energy

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**STUDENT:** Kenny Lau (UQ)

**COMPANY:** Stanwell Corporation

During the summer of 2009, I undertook vacation placement at Stanwell Power Station (SPS). This experience served as my introduction to the power generation industry. My work was completed in the water chemistry team under the supervision of Keith Fullard, the plant Mechanical Engineering Superintendent and mentored by Brett Connor, SPS's station chemist. I also worked with Chris Cunningham (Projects Mech. Eng.) and Jiping Zhou (Process Optimisation Mech. Eng.).

The main project I was involved with was assisting in the planning & preparation for the replacement of the Wet Rack monitoring instrumentation panels located in Stanwell's two critical water chemistry monitoring rooms. My tasks included attaining and dimensioning a design proposal for the new layout of the piping & monitoring instrumentation for submission to the draftsman. I compiled a list of replacement and spare parts to be ordered in for the new Wet Racks design (approximate cost of \$50,000). I also helped compile the specific name and part number of each part to be ordered as well as copied and edited the format of the new instrument (KKS) tags.

Other smaller projects & tasks that I was involved with included:

- The investigation of the failures within the sodium hypochlorite piping system. This system utilizes expansion boxes with the capability to capture potential leakages. My role in this activity was to check the 21 expansion boxes around the Stanwell site for leaks, kinks in piping & adequate room for drainage and then mark the location and problem on a layout of the hypochlorite pipe system.
- Finding the optimum measurement time for the flame detectors (used in the boiler furnace); so as to collect the minimal amount of data that is accurate and valid to use in analysis.
- Compiling the monthly coal clinker composition data over the past few years and trending the clinker composition over time so that the quality of the coal supply could be assessed.
- Regularly assisting chemical technicians in collecting water samples from various dam sites around Stanwell.

My time at Stanwell allowed me the chance to learn from engineers, technicians and tradespeople and to take on responsibility by completing assigned projects. I also experienced the role of a mechanical engineer in a power station and an overview of how large projects are executed. I would definitely recommend vacation placement in a power station to any engineering student as it is an invaluable experience.



**STANWELL**  
CORPORATION LIMITED

**STUDENT:** Harrison Lee (QUT)

**COMPANY:** Stanwell Corporation

From January 2010 to February 2010, I participated in a 7-week work experience program organised by the Australia Power Institute at Stanwell Power Station, Rockhampton.

During this 7-week work placement, I was placed in the Project Team within the Assets Services department as a temporary employed vacation student under the supervision of Mr Michael Thom, a projects group superintendent who provided tremendous help and guidance.

I was assigned to three major tasks. These activities include:

- Ash Water Storage Supply Pipe Replacement.
- Slurry Mixing Tank Dust Removal.
- Side Induction and Various Health and Safety Trainings.

These activities have exposed me to various situations and enriched my experience, which I believe not only enhanced my study from Queensland University of Technology, but also inspired further career motivation. From this work placement, I also developed greater technical knowledge, better work ethic, problem solving skills, time management and personal confidence. I have also realised that I needed further improvements in area such as attention to detail. Overall the work experience has been reassuring to the career path as a power engineer.



**STUDENT:** Tianya Li (QUT)

**COMPANY:** AEMO

Through the Australian Power Institute (API) Power Engineering Bursary Program, I was fortunate to gain three months of vacation work experience with AEMO during the 09/10 summer holidays as a second year electrical engineering student. Placed in Network Models Section within the Planning Department, I worked as a student engineer under the supervision of Planning Specialist Engineer, Jennifer Crisp. I was assigned to work on a software testing and integration project called 'PSSE2Mudpack for OPDMS', receiving training and support from OPDMS Data Administrator, Scott Simmons. This report was written to demonstrate the quality of my work experience.

The aspect of the project I was involved in was on improving the maintainability of small signal models in OPDMS by phasing out legacy models using either P2M built-in models or the MD functionality. There were two stages to this legacy model replacement project. In stage1, P2M built-in models were tested to replace the PTI models. In stage2, MDs were written and tested to replace USER models.

I was given the responsibility of conducting software testing, troubleshooting, making changes to the database, checking and modifying large signal model diagrams, writing and debugging MD code, and keeping detailed documentations of testing procedures, progress, issues and results. I gained basic training in network modelling softwares (OPDMS, Mudpack), familiarity in using other softwares such as BeyondCompare and MS Visio, introductory knowledge on power system stability and control, skill in understanding modelling diagrams and code languages (MD, Flecs), and experience in software testing and debugging. I was privileged to attend a range of work planning meetings, several training presentations, a control centre tour and AEMO's first Christmas Party.

Overall, I found my work experience at AEMO valuable, rewarding, educational and enjoyable. AEMO gave me a very good impression as a potential employer. I was given meaningful, useful and important work that was not only valuable to the company, but also helped me to grow more in areas of patience, attention to detail, and problem solving, as I was entrusted with much responsibility. I obtained a high level national perspective of the power industry, insight to the indispensable role that AEMO plays in maintaining power system security and reliability, and understanding of the importance of power system stability studies as well as control system and generator modelling theory in the real world. It gave me more motivation to do well in my future control and modelling subjects at university and also helped to further consolidate my career choice as a power engineer.



**QUEENSLAND ALUMINA  
LIMITED**

**STUDENT:** Steven Lowry (CQU)

**COMPANY:** Queensland Alumina Limited

Queensland Alumina (QAL) Limited operate one of the largest alumina refineries in the world. A large part of successfully operating an industrial operation of this magnitude relies upon a safe and reliable electricity supply. In recent years the importance of protecting against Arc Flash events has become more relevant following a number of fatal incidents in industrial settings. The focus of my project during my twelve week placement with QAL was to model and analyse the energy produced from Arc Flash events on 415V distribution boards located within electrical substations within the plant. The findings of this study were presented in a folio and will be used in the production and of work and Personal Protective Equipment Policies for QAL staff when working “live” on the equipment in question.

**STUDENT:** Dylan McVeigh (QUT)

**COMPANY:** PB Power

With help provided from The Australian Power Institute (API), ten weeks of industrial experience has occurred with Parsons Brinckerhoff. PB is an international consultancy firm specialising in a broad range of engineering fields. Being placed under Malcolm Busby, with supervision by Russell Hamilton, the knowledge and experience gained at PB this vacation period has been very extensive. As the jobs undertaken by PB in this time have been broad and varied, I have been fortunate to see a wide range of applications of electrical engineering. Such projects that have occurred include:

- Victorian Desalination Plant protection design and tender processes.
- New substations in PNG and existing substation upgrades.
- Electrical infrastructure upgrades at mine sites.
- Pre-feasibility studies on transmission line to Mt Isa for future mining expansion.

Being part of most of these projects has required various jobs including research and report writing which has helped the building of skills in these areas for future tasks similar in nature to these.



**STUDENT:** Benjamin Moore (JCU)

**COMPANY:** Ergon Energy

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For the duration of my vacation work with Ergon Energy, I worked in the Transmission Line Design department located within the Garbutt, Dalrymple Road depot. My time spent with Ergon has given me important industry experience in the field of power engineering by exposing me to real projects that are being undertaken and working as part of a team on a project.

Since starting employment with Ergon, I have been required to learn how to use the program called Space Gass in order to simulate a new design for a 220kV transmission line structure. I have also used other applications such as Microsoft Excel spreadsheets in order to assist with some of the calculations used in the simulation.

I have worked with Civil engineers during my time working for Ergon, where I have learnt about the properties concrete, wind loading and other factors that are taken into consideration when designing a high voltage transmission power line structure. The placement has given me greater exposure to the power industry and the workforce.



**STUDENT:** Timothy Nakhla (UQ)

**COMPANY:** Powerlink Queensland

This report is a summary of my vacation experience over the 2009 summer break at the transmission utility, Powerlink Queensland. I was placed in the Principal Consultant team in the Engineering Business Unit. This team contains technical experts from different sections of the industry; ranging from primary plant to secondary systems experts.

My time was spent assisting Pascal Schaub in the field of substation system development and David Francis in a synchrophasor investigation. The two projects that I worked on were the development of an IEC61850 training manual and the implementation of synchrophasor measurements on a SEL-421 relay. In the Synchrophasor project, I learnt about different relay settings, the complexities of GPS clocks and network servers. I assisted with a test bench, with relays, clocks and routers. I learnt about the use of the IEC61850 industry standard, its data models and the importance of multi vendor interoperability. I wrote a complete starter guide to IEC61850 with real life demos and exercises. I used several software packages working with IEC61850 and different relay programs.

I thoroughly enjoyed my time at Powerlink Queensland and I am now more motivated to continue my studies in the power industry.

**STUDENT:** Harry Willis (UQ)  
**COMPANY:** ENERGEX Ltd



This report documents the summer vacation placement that I undertook with ENERGEX Ltd as part of the Australian Power Institute Power Engineering Bursary.

During the time I spent with ENERGEX I was placed in the Distribution Planning Department, and undertook a variety of tasks that were mainly concerned with maintaining the Power Load Flow modelling system of the 11 kV distribution network.

The Distribution Planning Department within ENERGEX uses industry leading methods of modelling, forecasting and analysing their 11kV Distribution Network. The entire network is modelled in a CAD-like environment, called DINIS, which is specifically designed for Electricity Distribution Networks. The data is stored in a large Oracle Database, and includes such information as conductor types for individual line segments and positions of assets like voltage regulators, isolators, transformers and zone substations. All of this information is presented through the front-end application (DINIS) as a geographically accurate map of the network (as opposed to a typical one-line-diagram). This information is used to perform Automatic Load Flow analyses of the network weekly. The Department also use sophisticated methods of forecasting the load growth on their assets, which involves collecting and handling large amounts of load and climate data.

My placement with ENERGEX was valuable because I gained knowledge that will be useful in my career as an Engineer. I gained an insight into the workings of an Electricity Distribution utility, and increased my understanding of how work is performed in a large Engineering company.

I would recommend a summer vacation placement with ENERGEX to other Power Engineering students. ENERGEX is a great company to work for, and offers many different opportunities for career development for Power Engineers.

**STUDENT:** David Winsor (UQ)

**COMPANY:** United Group Limited

During my 2009/2010 university summer vacation I commenced my second work placement with United Group Limited. I was assigned as a vocational student electrical engineer and was based in the Brisbane office and spent one week out on site at the Southpine substation. I was placed in a substation design and construction team whose main clients were Powerlink and Ergon.

The two jobs that I worked on were both Powerlink 275 kV to 110 kV substation upgrades and reconstructions at Belmont and Southpine in Brisbane. In the office I was a part of the secondary systems design team and positioned with a protection engineer. The main project that I worked on was the design of the protection systems for two capacitor banks at the Belmont substation, which introduced me to protection engineering and substation design. This job gave me an understanding of how a substation works and the components within a substation, common design protocols and protection engineering. During my time at the Southpine substation site I helped with earthing support structures, pulling cables and various other tasks.

My time spent in the office and on site allowed me to get a better understanding of engineering as a whole as I got to see the design process, construction and commissioning. Throughout my placement I have gained several valuable skills that have furthered my academic and professional engineering skills.



**STUDENT:** Robert Bartlett (UQ)

**COMPANY:** Powerlink Queensland

This report outlines the experience gained in the power industry, as an API bursary holder during the summer vacation period following my first year of engineering studies at the University of Queensland. During this twelve week period, I was fortunate to work for Powerlink Queensland (PQ) in their Substation Field Support Team within the Network Field Services (NFS) business unit where I gain a range of experience in the maintenance and refurbishment of electricity transmission plant and equipment. My primary task was assisting with the refurbishment of a 275/110kV 250MVA power transformer at South Pine Substation.

My role in NFS required me to frequently be present at Powerlink's substations in Southern Queensland, typically two to three times per week, where I became familiar with high voltage plant and equipment and Powerlink's associated maintenance and plant refurbishment processes. My site duties required me to work with other PQ employees to take measurements, discuss technical issues and assist with sourcing the materials required for the refurbishment project. Other on-site learning included interacting with external suppliers and contractors to obtain quotations and to arrange deliveries of equipment and resolving a range of logistical, commercial and technical issues.

Assisting with the management of the refurbishment of the 250MVA power transformer provided me with invaluable experience in project management, procurement of miscellaneous items and services and technical understanding of large power transformers. This was a "hands-on" role where I was provided with a wide range of learning opportunities which I found challenging, stimulating and satisfying. Working under the supervision of a very experienced power engineer, Ray Holzheimer (who was the Project Manager for this refurbishment project), I learnt many practical aspects of electrical and mechanical engineering and now have a good appreciation of the important and broad role of a power engineer in the electricity industry. I also learnt about the procedures and processes used in a large and complex engineering business like Powerlink. For instance, I was required to purchase a range of equipment and services for the refurbishment project which required learning and applying the Powerlink process for raising purchase orders for the numerous items needed to be sourced or fabricated including the competitive quoting process, payment and delivery and in some cases negotiating win-win outcomes. The methods of payment varied significantly between companies as did their approach to delivery and defects rectification.

I was also given the opportunity to work for a brief period in the overhead transmission lines section of NFS where I gained an appreciation of the maintenance of overhead lines including the use of live-line techniques. I was immediately impressed by the very high priority placed on safety - both electrical safety and working from heights. I participated in a field trip to the Chinchilla region where I learnt firsthand the importance of correct earthing to mitigate the effects of induction. The case in question being a fence that ran parallel to the energised transmission line for about a kilometre. There was a low level of electromagnetic induction found. I assisted with improvements to the earthing system to help reduce this.

Another of my assignments that I found particularly beneficial concerned a new Alfa Laval oil filtration unit PQ had recently purchased. I was heavily involved with arranging commissioning, maintenance, being trained in how to use the unit, writing a work instruction and then training some PQ employees on the unit.

Working with PQ has provided me with a diverse and intense learning experience of the practical aspects of electricity transmission plant and maintenance as well as an appreciation of the roles of power engineers in a large engineering business. I have gained priceless experience working in the field and interacting with many experienced and knowledgeable engineers and technical experts.



**STUDENT:** Benjamin Bokma (JCU)

**COMPANY:** Ergon Energy

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Between November 2009 and February 2010 I completed ten weeks of vacation work at Ergon Energy in the Network Data Department in Townsville, which is responsible for maintaining the data for all Ergon assets. During this period considerable time and effort was spent and contribution made to various data quality initiatives including automatic data loading and synchronising databases. The main emphasis has been on improving the general data quality for Ergon Energy assets, the purpose of which is to constantly improve efficiencies and minimise 'downtime'. During this time, my aim has been to get an overview of the power industry and how engineers work within this industry.

The data for Ergon Energy distribution assets is stored in several databases for use in various applications. This data is essential for the safe and efficient operation of the electricity distribution network and is used by many departments in the organisation. Currently, many of the databases are manually aligned, which has caused many discrepancies to arise. During this vacation work the aim has been to reduce the number of discrepancies within the databases in preparation for the implementation of an automated alignment process.

Another project that I was involved with was developing an automated input method of data for a new zone substation. This project was an effort to increase efficiency with manual input being very time consuming and uneconomical. It also allowed me to see how people can collaborate to improve processes and develop solutions to problems.

Working in the Network Data Department has given me the opportunity to learn about many of the components of distribution networks as well as gaining an understanding of the power industry as a whole. It has also shown me how Engineers operate within a large organisation and how projects are managed when several departments are involved.

**STUDENT:** Bianca Crow (UQ)

**COMPANY:** Tenix



The purpose of this report is to summarize the skills and experience gained during the vacation placement period as an API Bursary holder for other companies and students to peruse and perhaps learn from too.

I was fortunate enough to complete my placement with my first preference, Tenix Alliance, a successful business concerned with infrastructure design and engineering, fabrication, operation, maintenance and property and asset management of water, gas, power, industrial and transport sectors across Australia, New Zealand and the South Pacific.

Tenix Alliance have taken a slightly different approach than most sponsoring companies, in that they are investing in the student from an early stage, teaching them the core basics of construction in the first year and slowly, yet meticulously training the student to become a very knowledgeable and effective Power Engineer over the length of the degree. This process is highly beneficial, as, from my experience already, I have observed numerous communication errors and structural issues occur in the physical construction of the engineer's designs.

The role engaged in was that of a Trade's Assistant, working alongside electricians and other Trade's Assistants on the construction of the new Gateway Bridge. My duties included understanding and transposing drawings as well as being involved in designing circuits to include switchboards and lighting, taking into consideration the spacing between lights and the loading the cable is capable of for certain distances. Along with this, I gained experience in dealing with suppliers and took part in a lot of physical work including the installation of junction boxes in the shared pathway, standing of light poles, installation of the bridge lighting boxes along the entire Eastern stretch, pulling cable through conduit and much more.

Majority of the issues raised in these tasks concerned; receiving wrong or late parts, lack of quality of work from other sub-contractors (for example the rag bolts to fix the base of the light poles to the barrier of the bridge were not positioned exactly how designed, requiring engineers to come out to site to elongate the holes in the base plate. This resulted in the loss of time and money) and lack of drawings from engineers. All these issues were able to be resolved in numerous meetings primarily held between engineers, electricians and project managers. Experiencing these issues first hand has given me a much greater appreciation of the effectiveness of communication between engineers and tradesmen, the requirement to be on-site and the importance of considering constructional processes when designing.

Other valuable lessons I learnt by taking part in these tasks include; the use of power and hand tools, the methods implemented to lay cable over large distances, working conditions permissible on site, understanding what processes need to be implemented to stop seizing and rust as well as an appreciation for team-work in a construction environment, time constraints and a general knowledge of fastenings and supports and implementing them in individual ways for different situations to form supportive structures. Most importantly however, I now have a greater ability to view a situation, apply my technical knowledge in a practical sense to understand it and resolve it if need be.

As a result of my highly educational and enjoyable placement experience, I am looking forward to continuing working for Tenix Alliance in the Future.



**STUDENT:** Erin Daley (JCU)

**COMPANY:** John Holland Power

**POWER**

From 23<sup>rd</sup> November 2009 until the 29<sup>th</sup> January 2010 I commenced my work with John Holland Power (JHP). I was assigned to work with the Stringing crew as Student Engineer based in the Woodstock office, outside of Townsville.

I learnt about all aspects of stringing transmission lines including the site preparation, run-out, tensioning, spacer installation, earthing procedures, risk management procedures, environmental aspects of works and quality assurance.

My main role was to assist the Project Engineer, Francis Novis, in reviewing and updating Activity Method Statements (AMS), especially immediately after incidents on site. We also followed and documented the daily progress. I worked closely with the Project Supervisors and assisted in distributing weekly reports and co-coordinating sub-contractors that were required. I organized permit applications dealing with Main Roads and Queensland Rail. I was heavily involved in the development of a new earthing training package and also had the opportunity to help implement it before I left the project.

I learnt so much about Project Management while with JHP and developed a strong passion for transmission line construction. It is an exciting, unique field and the skills and knowledge I gained from my placement is very relevant to my sought after job once I finish my studies. I worked with a close-knit team of all-rounders from riggers, Engineers to safety officers and *the Enviro's*. I have learnt from them all; and managed to build a strong picture of the engineering world from all of these aspects.

I have developed good technical knowledge; built on my electric circuits' knowledge; gained experience, friendships, memories and professional work exposure.

Thank you! To the JHP team out at Woodstock for having me and for taking me under many wings to see transmission line construction at many different angles and also to the Australian Power Institute who saw my potential and gave me the fortunate opportunity.

**STUDENT:** Edmund Fox (QUT)

**COMPANY:** AREVA T&D



Over the 2009/2010 Christmas break, I was fortunate enough to be employed by Areva T&D – Rocklea. This particular branch of the international company specialises in the transmission and distribution of energy in the power grid. Areva T&D is separated into 3 distinct businesses: TFR, which specialises in the manufacturing and selling of transformers. MRA, which specialises in the manufacturing and selling of switchgear, and ASB, which is responsible for the after sales servicing of both transformers and switchgear around Australia. I was stationed in the services sector and was given several projects along the way which helped improve my understanding of both the power industry as well as an understanding of the managerial functions of a large engineering firm.

The primary project assigned to me at the commencement of work at Areva was to design and manufacture a working prototype of a GHA VT Lowering Device. This task required me to communicate with several engineers and technical advisors as I regularly put forth proposals and submissions.

The second project that I worked on was the design and compilation of an excel database that informed users when equipment used in the servicing transformers and switchgear required maintenance. This particular task allowed me to become accustomed with Microsoft Excel which will be invaluable in my further studies and future jobs as it is used in many engineering firms throughout Australia.

I also spent several days working with a senior technician on the floor and assisted him in working on switchgear. This practical experience helped me gain invaluable understanding of the operational functions of the plant as well as increase my technical knowledge in that area. As well as this, I spent time in the company's oil lab which plays an integral part in the manufacturing and servicing of transformers. Steps taken to ensure the oil is purified, as well as the analysis of oil from old transformers highlighted how broad the engineering facet reaches.

Overall, my time at Areva T&D greatly assisted in forming a better understanding of the engineering field, in particularly the power industry. In addition to this, it has given me a better understanding of what tasks and responsibilities are required to be carried out by engineers in the working arena.



**STUDENT:** Alexandra Gregory (UQ)

**COMPANY:** Ergon Energy

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With over 4,500 employees and a service area that covers 97% of Queensland, Ergon Energy offers an invaluable induction into the professional career of a Power Engineer. Fortunate enough to be positioned in the hub of the Cairns office of Ergon, I completed eleven weeks of insightful employment for the Principle Control Systems Engineer of Network Protection and Control.

Over the course of this report, employment structure and background information will be portrayed in an effort to convey the objectives and achievements of my time with Ergon Energy. Placed in sub ordinance with Load Management, my task was to review the current Local Programs across Maryborough, Bundaberg, Isis, Kilkivan and Kingaroy in order to generate a consistent program across the entire Wide Bay Region. Tasks included

- Obtaining current statistics from the Customer Database on household load usages across particular Tariffs
- Detailed analysis of work and timing schedules to unveil irregularities on the Load Profile
- Design, installation and testing of a new Local Program (work schedule) for use across the entire Wide Bay region
- Calculated the estimated savings for Ergon through refurbishments

Although a complex and unfamiliar process to begin with, by January I finished yet another workday with a completed analysis report in one hand, including restructured timetables, and plane tickets to the various Wide Bay injection sites in the other. The trip was a great success and allowed me to travel in rural Queensland; familiarizing myself with each individual substation.

Despite my enthusiasm for the job and the progress that was made both professionally and intellectually, my time in Cairns also posed numerous unforeseen challenges. Fortunately, Ergon Energy supplied a supple balance between constructive theory and hands-on experience that allowed me to absorb diverse departments that are within a power distribution company.

Ergon not only provided exceptional opportunities for me in my allocated field, but also exposed me to an unlimited source of wisdom, experience and knowledge; current engineering staff. It was this nested community that provided the genuine support and encouragement to soar into my early experience as a power engineer. Over the past three months, I only hope my contributions have met the standards of API as a bursary holder, Ergon Energy as an employee, University of Queensland as a student and myself as an electrical engineer of the future.



**STUDENT:** Carl Harch (CQU)

**COMPANY:** CS Energy

For my first placement as an API Bursary recipient, I got the opportunity to work at CS Energy Callide Power Station for four months over the 2009/10 summer.

During my time at Callide Power Station I worked on a number of small projects that incorporated a large range of different plant areas and tasks. I felt this was a very good way to learn as much as possible particularly since I had very little experience in the power generation industry. I was able to work with a number of different Mechanical Engineers and Technical Officer as well as a number of other people of various positions from different teams.

Some of the different areas in the power station that I got to work with include the mills, the Hydrojet system on the boiler, the cooling tower, the feed pumps, the fabric filters, the station air compressors and the blowdown water plant. Some of the tasks that I completed in these areas included modification of the pulveriser grinding roller, completing the installation of KKS labels of the Hydrojet system, researching and getting quotes for critical spares and performance testing and analysis. I was also lucky enough to be working at the station during a unit overhaul, as this was a really good experience that allowed me to see much more in terms of the internals of a lot of the equipment and the work that goes into getting it all up to standard and ready to run again.

I am extremely grateful for my opportunity to engage in this vacation work at CS Energy Callide Power Station, it was very rewarding and worthwhile and I feel I will be able to now transfer much of the things I learnt and picked up from the professional engineers in the power generation industry back to my course at university.

**STUDENT:** Tash McGrath (QUT)

**COMPANY:** ENERGEX Ltd



For three months I was lucky enough to be employed as a Student Engineer with ENERGEX Ltd within the Network Development Planning Department working in the field of Power Engineering. This is thanks to the API Bursary Program, which arranged the work experience.

This report aims to present the outcomes of that vacation employment along with an outline of the experience and knowledge that has been acquired during this time. The report will also present a summary and discussion relating to the time spent employed at ENERGEX Ltd.

During my time spent employed at ENERGEX, it became apparent that planning engineers faced a number of challenges that were continually required to be overcome. A main challenge faced was finding appropriate compromises so that progress could be made proficiently to solve problems identified while still being cost effective. In overcoming this, a number of tools are used, including a Net Present Value Calculator which compares the costs of doing works across a time frame and calculates the best option as to which is the least expensive option overall. This is a better method than simply evaluating which is the least expensive initial cost as it plans for future works and finds the most cost effective option with all future works considered.

My time employed at ENERGEX gave me a great introduction to the Australian Power Industry. Leaving me with knowledge of the fundamentals of the distribution sector, I feel I have been able to gain an advantage which is otherwise unobtainable as a university student. I have also gained confidence in being able to make informed, educated judgments and have seen the relevance of university to the real world.



**STUDENT:** Edward Pepperell (UQ)

**COMPANY:** ENERGETEX Ltd

In 2009, I completed my first year of the Bachelor of Engineering (BE) program at the University of Queensland, majoring in mechatronics. In this time, I was fortunate to be awarded an API bursary in power engineering, which will provide me with vacation work experience throughout my degree.

This report details my first of such experiences, working at ENERGETEX Limited for ten weeks. My placement began on Monday, the 7th of December, 2009, and concluded on Friday, the 12th of February, 2010.

In this time, I worked in the Systems Engineering Department, where I was supervised by Mr Colin Lee, who is the Network Systems Development manager. This area of ENERGETEX develops and maintains standards, detailed specifications, tender evaluations and network design solutions.

My first task was to research and gain an understanding of the methods used to determine the relative risk scores of roadside utility poles. This involved understanding the weighted risk factors contributing to the overall risk score. I then developed a spreadsheet which will automatically calculate these factors based on input parameters. The result was a versatile tool which can be used for determining if proposed installations are safe, or reassessing existing infrastructure to check if mitigation is required.

The majority of my vacation work involved working on supplements to an upcoming handbook. I studied limit state design principles and how to mathematically apply them to various components. This allowed me to utilise equations and develop spreadsheet tools for mechanical design of insulators and bending moments on pole crossarms.

My time working at ENERGETEX was enjoyable and educational. Overall, my understanding of the power industry and the methods involved in design considerations has been greatly increased, both through my conversations with professional engineers and the activities I completed throughout my placement.



**STUDENT:** Jordan Williams (JCU)

**COMPANY:** Ergon Energy

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During my placement at Ergon Energy, I worked in the Protection and Control Assets group as an electrical engineer. I was able to gain invaluable insight into the techniques used to protect the electricity network of one of Queensland's largest energy distributors.

Whilst on my placement, I was given the task of creating templates of Ergon Energy's protection devices. This information would then be incorporated into a new version of the Ergon Energy's protection database system, where it would then be used to check for errors in settings issued for protection devices. Consequently, I learnt about the technology used in the numerous protection devices and systems employed by Ergon Energy.

To completed this task, I developed ways of extracting and formatting the required information from numerous manufactures' software packages. However, to reduce the size of the task, I improved my ability to create macros in Excel, which simplified the sometimes long and repetitive task of formatting the data.

By working at Ergon Energy, I have learnt how to better manage tasks, perform in an office environment and increased my knowledge of numerous electrical devices. Undoubtedly, the skills and knowledge I have gained from my time with Ergon Energy will benefit my studies and my professional career.