

# The Australian Experience: Works of an Electrical Supply Entity

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# Australia's Electrical Entities

- In Australia, an electrical entity means a generation entity, transmission entity or distribution entity.
- Electrical entities also include electric railway systems.

# Generation Entities

- Australia has around 200 electricity generators.
- In 2008/09 these power stations produced 266 billion kilowatt hours of electricity.
- Around 75% of Australia's power generation comes from coal, 15% from gas, 5% from hydro, 5% from other sources.

# Transmission Entities

- Australian Transmission networks transport electricity from generators to distribution networks.
- There are 8 transmission entities in Australia as well as 3 interconnectors between states.
- The transmission lines cover 50,000 kms and in 2009 they transmitted 250,000 GWh.

# Distribution Entities

- Distribution Entities supply power from transmission networks to residential and business premises.
- The distribution network consists of the poles, underground cables, substations, transformers, switching equipment and monitoring and signalling equipment.
- Australia has 16 distribution entities covering almost 860,000 kms of line.

# Regulatory Controls

- Each State in Australia is responsible for applying electrical safety laws to the generation, transmission and distribution entities within their state boundaries.
- These laws are however reasonably well harmonised between the different states.

# Queensland Regulations

- Using Queensland as the example, all electrical entities have an obligation to:
  - ensure that its works are electrically safe;
  - are operated in a way that is electrically safe; and
  - that the entity inspect, test and maintain its works.
- Works of an electrical entity means the electrical equipment and lines used to generate, transform, transmit or supply electricity.

# Queensland Regulations

- The regulatory rules are contained in the *Electrical Safety Act 2002*, the *Electrical Safety Regulations 2002* and in various Codes of Practice.
- Failure to discharge obligations under the regulatory rules carries substantial penalties of up to AUS\$1 million (HK\$7.5 million) or 3 years imprisonment.
- Where the Act or Regulations prescribe a way of discharging an electrical safety obligation, the entity must follow what is prescribed.
- In regard to a Code of Practice, the entity can either follow the procedures contained in the Code or design an alternate solution that is equally effective to, or more effective than the Code. However, any prescription in the Regulations always applies.



# Queensland Regulations

- For electrical entities, Queensland Regulations and Codes cover such areas as:
  - Earthing and protection;
  - Substations;
  - Electric lines and control cables;
  - Termination requirements for low voltage overhead service lines;
  - Maintenance of works;
  - Connections;
  - Testing;
  - Licensing requirements;
  - Clearance heights;
  - Incident notifications; and
  - Mandated safety management systems.

# Safety Management Systems

- All electrical entities, other than generation entities, are required to implement a documented Safety Management System.
- This document must detail the hazards and risks associated with the design, construction, operation and maintenance of the entity's works and how the entity is going to manage the hazards and risks to ensure that its electrical safety obligation is properly discharged.
- These Safety Management Systems must be audited annually by an independent third party auditor who must verify or otherwise that the Safety Management System complies with the regulatory requirements.

# Protection of Supply Lines

- Regulatory rules are also in place to prohibit third parties from coming into contact with supply lines or climbing power poles.
- It is an offence for a person to climb a power pole or any structure of an electrical entity without authorisation and carries a penalty of AUS\$20,000 (HK\$150,000).
- Regulatory rules apply exclusion zones, where no part of a worker, vehicle or operating plant may cross into the exclusion zone while the electrical line is live.
- The size of the exclusion zone differs considerably depending on the voltage of the power line, whether it is insulated or bare, the work being undertaken, the type of operating plant or vehicle. They can be up to 8m for 400Kv+.

# Protection of Supply Lines

- There are also regulatory rules relating to operating cranes or agricultural equipment near supply lines, for temporarily raising lines to transport high loads, and for clearing vegetation growth near power lines.
- Above all, the rules require that when any work is being done near power lines the business must consult with, and provide written notice to the entity asset owner on how they will ensure electrical safety of persons and property. Penalties of up to AUS\$20,000 (HK\$150,000) apply for not doing so.

# Case Study

- Between 30 March 2009 and 28 April 2009, there was 3 major network incidents in central Sydney that caused substantial network outages in central business districts.
- The primary cause in 2 of these 3 incidents was damage to underground cables by third parties.
- In one case damage was caused by mechanical excavation equipment and in the other by horizontal boring works.
- The NSW Regulator has responded to these incidents through tightening of rules in legislation regarding excavation near cables; increasing communication with excavation activities; restricting access to CBD substations and cables; deployment of site inspectors to observe and monitor construction activity; and an increase in the number and frequency of feeder route patrols.

# Major Incidents

- In the 8 years from 2000/01 to 2007/08 there has been 77 fatalities in Australia involving electricity supply assets.
- Of this 72 involved overhead powerlines, 3 involved substations and 2 involved underground lines.
- Electrical workers were 20% of the fatalities, non-electrical workers 51% and the general public made up 29% of the fatalities.

# Victorian Bushfires

- Australia has a history of electrical assets causing bushfires, particularly from fallen conductors, clashing of conductors, conductors contacting trees, and inefficient fuses.
- On 7 February 2009, after 3 days of temperatures in excess of 43°C the state of Victoria experienced 15 major fires that resulted in 173 deaths.
- Of these 15 fires, 5 were caused by failure of electrical assets.
- The most damaging fire on the day was Kilmore East where 119 lives were lost. This fire was caused by electrical arcing after a conductor broke.

# Victorian Bushfires

- In response to the bushfires the Victorian Government established a Royal Commission to undertake an investigation into the causes of the bushfires and to make recommendations on future actions to avoid similar occurrences.
- The Royal Commission was critical of the age profile and maintenance levels of the electrical assets and they made a number of recommendations.
- In particular, the Royal Commission recommended the progressive replacement of all SWER (single-wire earth return) lines and 22Kv distribution feeders with aerial bundled cable, underground cabling or other technology that delivers reduced risk.
- The Royal Commission made other recommendations relating to maintenance and inspection programs, training of pole inspectors, vegetation clearance, the fitting of spreaders, vibration dampers and disabling automatic circuit reclosers on SWER lines during “bushfire season”.
- The Victorian Government responded to these recommendations on 27 August 2010 with a range of initiatives including tougher maintenance regimes, more inspections, increased penalties, technology trials and the establishment of a new Powerline Safety Taskforce to oversee reforms and technology trials.



# Technology

- While there are a number of areas where technological improvements can improve safety, there are currently two technological advances being trialled in Australia.
- The *Ground Fault Neutraliser* is a resonant earthing device that reduces the amount of electrical arcing at the point where a fault occurs on the network. The device also allows for the early detection of reduced insulation levels and can significantly reduce the threat to human life and risk of fire when a ground fault occurs.
- The *IntelliRupter PulseCloser* injects multiple, non disruptive pulses into the line to check for faults before initiating a close operation.
- In addition, electrical entities are trialling overhead electrical powerline proximity warning devices, intended to warn personnel if mobile equipment moves within pre-selected minimum distances from an overhead line.

# Renewable Energy

- Australia is rich in renewable energy resources such as solar, geothermal, biomass, wind and hydro;
- Australia has a target of 20% of Australia's electricity supply is to come from renewable energy sources by 2020.
- In mid 2009, the Australian Government announced a AUS\$4.5 billion (HK\$33.75 billion) Clean Energy initiative that included:
  - AUS\$1.6 billion (HK\$12 billion) for large-scale solar power stations; and
  - AUS\$465 million (HK\$3.5 billion) for Renewables Australia to promote the development, commercialisation and deployment of renewable technologies.
- In June 2010 the Queensland Premier announced funding for the largest solar project in the southern hemisphere with the Kogan Creek Solar Boost Project that will use solar technology to heat feedwater entering the boiler, supplementing the conventional coal-fired feedwater heating process.

# Ministerial Council Review

- The Ministerial Council of Energy (MCE) has initiated a harmonisation review to:
  - develop a single National Standard for work practices within the electrical supply industry; and
  - Implement a “passport” mobility program to ensure line worker’s maintain a documented training and work experience journal that aids in movement between electrical entities.

# Summary of the Australian Experience

- Safety Regulations are in place to ensure that entity works are electrically safe and that they are inspected, tested and maintained regularly.
- Failure to discharge obligations can be met with substantial penalties.
- All entities must implement a Safety Management System that is documented and audited annually.
- In the last 8 years there has been 77 fatalities involving electrical supply assets with non-electrical workers being the highest category.
- Protection of supply assets, whether it be from third-party damage or natural disasters is an ongoing problem, with recommendations already being made to underground supply lines.

# Summary of the Australian Experience

- Technological advancements are being looked at that will deliver both in terms of safety and reliability.
- Renewable energy sources, particularly solar, are being implemented to improve our carbon footprint.
- We are looking at introducing a single National Standard for supply industry workers.