Capability Statement

Liberty Consulting Services Pty Ltd

ABN 66 122 999 884

Electrical Engineering Consulting: Earthing and Lightning Protection Design, Site Surveys, Engineering Reporting

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Business Purpose

Liberty Consulting Services (LCS) was formed in 2006 to provide a complete electrical engineering and consultancy service in the Australasian region, specialising in the design of high and low voltage electrical earthing and grounding systems, lightning protection, surge and transient protection solutions, and site audits and testing services for a diverse range of industries.

The projects worked on by LCS have included renewable energy plants utilising solar photovoltaic arrays, wind turbines and biomass cogeneration, as well as conventional thermal power generation based on coal and gas. Other industries where we have expertise include mining, oil and gas, water treatment, defence and aviation, rail and other transport systems, telecommunications and broadcasting, light industrial, and commercial facilities such as universities, hospitals and high rise buildings.

The company provides design and application advice for power and communications earthing systems in all of these types of facilities, by combining extensive experience and rigorous diagnostic tools and field testing methods to identify solutions. LCS engineers offer comprehensive risk - benefit consultancy services, and the provision of professionally written engineering reports and layout drawings.

All engineering services are completed and supervised by fully qualified professional engineers, with current CPEng and RPEQ status. Specifically, the services LCS offers include:

Design of high voltage switchyard and substation earthing systems

- Site soil resistivity testing, and computer analysis and design using the industry leading software package CDEGS by SES Technologies.
- Earthing design to achieve safe step and touch potentials in accordance with the Australian substation earthing guides - ENA EG-1 (IEEE Std 80), ENA EG-0, and AS/NZS 2067.
- High voltage substation and switchyard earth system testing using low current, off-frequency current injection testing (CIT) methods, with tuned voltmeters to measure step, touch and transfer voltages.
- Earthing and grounding design services for specialised applications, such as large scale solar PV arrays, wind turbine generation, including analysis of earth potential rise and lightning transient effects.

Lightning and surge protection design, audits and site inspections

- A specialised design service for the protection of facilities against direct and in-direct lightning strikes, in accordance with national and international standards.
- Lightning risk assessment calculations in accordance with AS/NZS 1768 and IEC 62305-2.
- Application of surge and transient protection to power and communication systems in commercial and industrial facilities.
- Provision of computer modeled lightning protection designs, and Standard compliant design specifications for tender documents.
- Specialised lightning protection earth system modelling of lightning induced earth potential rise.

Power system load profile analysis and power factor correction design

- Power system analysis, including identification of harmful harmonics and power system disturbances.
- Designs for the installation of LV and HV power factor correction equipment to improve efficiency, reliability and voltage stabilization within the power system.
- Electricity bill assessment (kW, kVA and kVAr) for cost savings under existing and future electricity tariffs, with recommendations on how to implement savings measures.
- Calculation of savings in greenhouse gas emissions, due to the reduction in kVA demand achieved by power factor correction.

Forensic engineering services, with site audits & power quality investigations

- Site surveys in the specialised fields of direct strike lightning protection, surge and transient protection, and earthing solutions for facilities and their occupants.
- Site evaluations of lightning damage effects, identification of equipotential bonding gaps in earth systems and rectification advice to eliminate dangerous earth loops.
- Investigations and solutions for stray currents and voltages, leakage current and fault loop impedance testing, AC and DC corrosion effects, and rectification of parallel earth-neutral return current paths.
- Professional engineering reports, with evaluation of site testing and inspection results, and the provision of cost-effective solutions.
- LCS engineers work together with the client and contractor to identify hazards and recommend improvements required to minimize risks presented by lightning and other harmful power disturbances.

Risk assessment and management

LCS personnel have a proven history of working with diversified industry groups to evaluate and provide recommendations on specific power quality and lightning protection solutions. Through the application of proven methods, and in conjunction with the recommendations in relevant standards, LCS can offer a comprehensive solution to all lightning and power quality problems.

With our detailed knowledge, considerable experience and understanding of all relevant codes and standards in this field, LCS will carry out risk assessments to calculate the probability of loss. Using a proven, systematic approach, LCS will make recommendations for cost-effective protection measures and techniques to bring the risk of loss below a "tolerable" level.

Key parameters considered in the risk assessment of a modern facility include:

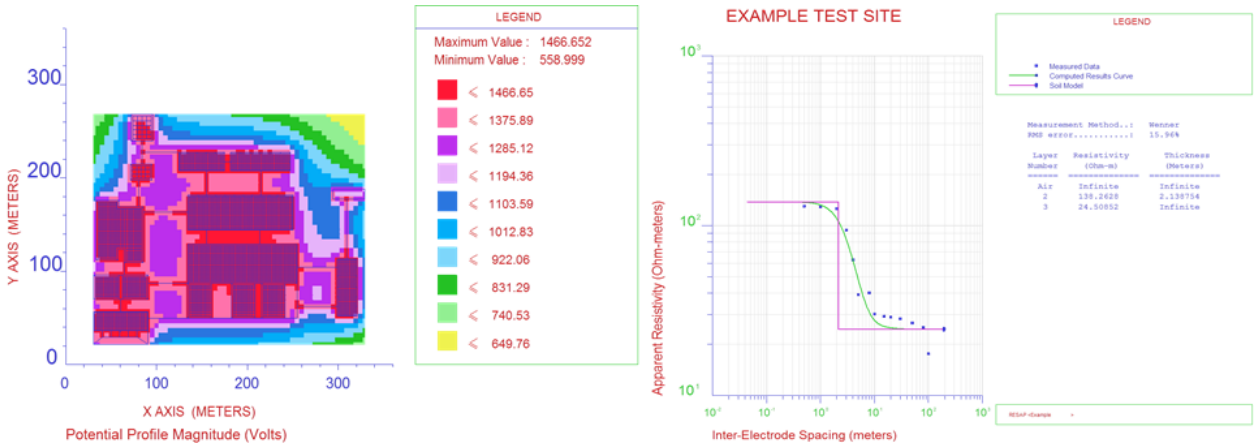
- Risk of lightning in the region;
- Site specific details such as surrounding terrain and site elevation;
- Type of structure and equipment usage; and
- Strategic importance of the operation to an organization.

Equipment and Resources

LCS uses the industry leading software package CDEGS (Current Distribution, Electromagnetic Fields, Grounding and Soil Structure Analysis) to model soil resistivity field test results and perform earth grid design calculations for high voltage substations, switchyards and power generating plants to effectively handle fault currents while limiting step, touch and transfer voltages to safe levels.

The software is based upon formulae provided in relevant international standards, including but not limited to ENA EG-1, IEEE Std 80, BS 7354, and the EA 41-24. The primary advantage of the software used by LCS is that the developed software algorithms compare well with actual field test data from installations.

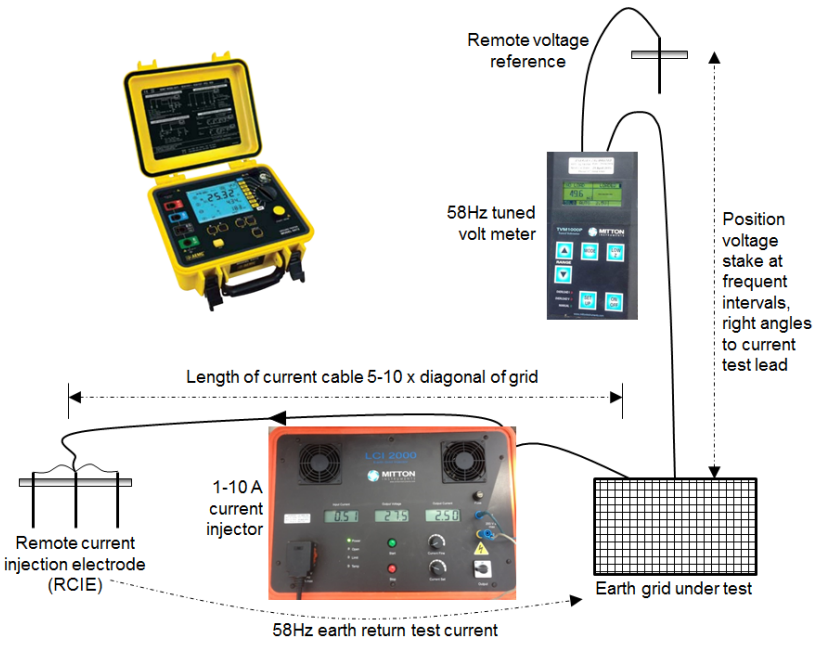
In addition LCS uses proven design methods and the latest technology equipment applications to provide lightning protection solutions to these installations.



Depending on the size of the facility being tested, fit for purpose test equipment is employed to accurately measure earth grid resistance, step, touch and transfer voltages, and electrical continuity of earthed structures in high voltage substations, switch-yards and power plants.

Testing of lightning protection earthing systems is also performed accurately using purpose designed and suitably powered test equipment.

Installations are able to be tested “live” without the need for electrical shutdowns, by using a combination of current transformers and Rogowski coils to identify test current splits and leakage.



Project Experience

LCS engineers have a proven track record of delivering power quality solutions to key customers from Melbourne to Malaysia. The diverse range of industries where we have expertise include the following:

- Power Utilities: Generation, Transmission and Distribution
- Mining: Coal and Metalliferous
- Water and Sewerage Treatment Plants
- Rail and Rapid Transport Systems
- Petrochemical, Oil and Gas
- Defence and Aviation
- Telecommunications and Broadcasting
- Hospitals and Other Health Facilities, including Aged Care
- Shopping Centres and Department Stores
- Heritage Buildings
- Warehousing Facilities
- High Rise Buildings, Resorts & Apartment Blocks
- Universities and Education Facilities
- Industrial and Manufacturing Plants

The main reasons why you should choose LCS for your project are based on our experience and capability, our cost-effective approach, our flexibility and responsiveness, and our commitment to ensure designs and test results are delivered on time.

- We are good at what we do. This is backed up by a proven track record with high customer satisfaction, and more than 10 years' experience in the electrical industry.
- You get a very personalised and responsive service, you can call us anytime.
- We strive to design the most cost-effective solutions for your project.
- We are constantly investigating new technologies to see how they can improve your project effectiveness.
- All field testing work and designs are CPEng and RPEQ supervised to ensure code compliance.

A selection of key customers and projects worked with recently include:

- Anglo American Coal, Central QLD
- APLNG – Origin Energy
- Army Barracks in QLD, NSW and NT
- BMA Coal Mines, Central QLD
- Dupont - Danisco Botany Plant, NSW
- Energex and Ergon
- Gateway Motor Services, Brisbane
- Gold Coast Aquatic Centre
- Gold Coast Rapid Transit
- Incitec Pivot (various sites in QLD and NT)
- James Cook University (Cairns and Townsville)
- Legacy Way Tunnel
- Old Museum Building, Bowen Hills
- Petronas, Malaysia
- Port of Brisbane
- Port of Townsville
- Prasarana LRT Ampang Line, Malaysia
- Queensland Health – Various Hospitals
- Queensland Rail Track Signalling Cabins
- Queensland University (St Lucia and Gatton)
- QANTAS Sydney Airport
- QGC Kenya-Chinchilla Pipeline
- RAAF Bases in QLD, NSW and NT
- Santos AWTF, Fairview
- Seaworld, Gold Coast
- SEQ Water Treatment Plants
- Southern Cross Austereo
- Wellcamp Airport – Wagners
- Wollongong Grain Terminal, Port Kembla
- Mount Isa Mines

Staff Profile

Grant Croghan is the Director and principal electrical engineer at LCS. Grant received his Bachelor in Electrical Engineering (with Honours, majoring in electrical power systems and power electronics) from James Cook University in Townsville, Australia in 1985, and received a Master of Business Administration (achieving the Brookes Scholar medal – top MBA student) from Deakin University in Geelong in 1997.

Grant began his career as an electrical engineer in the Australian military, after which he worked with one of Australia's large multinational organisations - Pacific Dunlop's Olex Cables division (now Nexans Olex). As a power systems engineer with Olex, Grant traveled extensively in Australia and Asia, working on projects involving the installation of high voltage transmission and distribution systems (including extra high voltage underground cross linked polyethylene – XLPE – insulated cables).

Grant then spent 10 years working in the electrical industry in Asia, primarily with ERICO (Electrical Railway Improvement Company, now Pentair) based in Singapore. Grant has worked in sales management and technical field application roles, and is well versed in electrical power systems, earthing, lightning and surge protection principles, and their applications for harsh environments.

Over the last decade Grant has been operating his own consulting engineering business, specialising in providing power quality solutions to the mining, water, oil and gas, building and construction industries. This role has involved conducting site surveys, and providing professional engineering reports. Grant has developed his expertise in electrical substation earthing design – in particular the application of design methods in Australian and International Standards (ENA EG-1, ENA EG-0, AS2067, IEEE80 and IEEE81), as well as the application of Australian and International Standards for lightning protection (AS1768 and IEC62305) for industrial and telecommunications applications.

More recent work has focused on power quality improvements for water treatment facilities in South East Queensland, and earthing design and testing for solar photovoltaic energy farms throughout Queensland and New South Wales.

Grant is a Member of the Institution of Engineers Australia, a Chartered Professional Engineer (CPEng), and a Registered Professional Engineer of Queensland (RPEQ). Grant has also completed a Company Directors' course, and has been a Member of the Australian Institute of Company Directors. He has presented technical papers at various Engineering conferences in Australia and Asia.

In order to keep fit Grant participates regularly in triathlons, and has completed several Ironman and other long distance triathlons in Australia and overseas. He is also a golf enthusiast, and in his early life played soccer, rugby and cricket for the Australian Army, and captained the Australian Combined Services soccer team in 1990. Keeping fit helps Grant focus on delivering high quality work product to his clients.

ENGINEERS
AUSTRALIA
Chartered Professional Engineer
MEMBER

RPEQ

Customer Service Commitment

The customer service philosophy of LCS is one of commitment geared to the long term. Key to this commitment is the focus on developing sound working relationships and ensuring a transparent approach to all work completed on behalf of the customer.

LCS provides considered and relevant advice and demonstrates customer service commitment by:

- The provision of highly qualified and experienced engineers
- Accurate project scoping to reduce the potential for scope creep
- Regular customer satisfaction reviews to ensure customer expectations are met
- Ensuring all LCS staff continuously improve their expertise through on going professional development and relevant experience
- Flexibility in adapting the approach to each assignment to cater for the dynamic project environment
- A focus on improving the customer's bottom line and their shareholder value.

Mission

LCS was founded with the mission to continually improve the safety and reliability of our clients operations. Building on the deep technical knowledge of our engineering staff, we provide exceptional value for customers by:

- Delivering excellent technical solutions with professional integrity
- Developing successful relationships through mutual trust and respect
- Striving to ensure our services provide a cost effective solution

LCS commits to design technical solutions that deliver lasting business value to our clients on time and within budget.