



# Welcome to Powertech Labs Inc.



Powertech

[powertechlabs.com](http://powertechlabs.com)





## Powertech Labs Summary



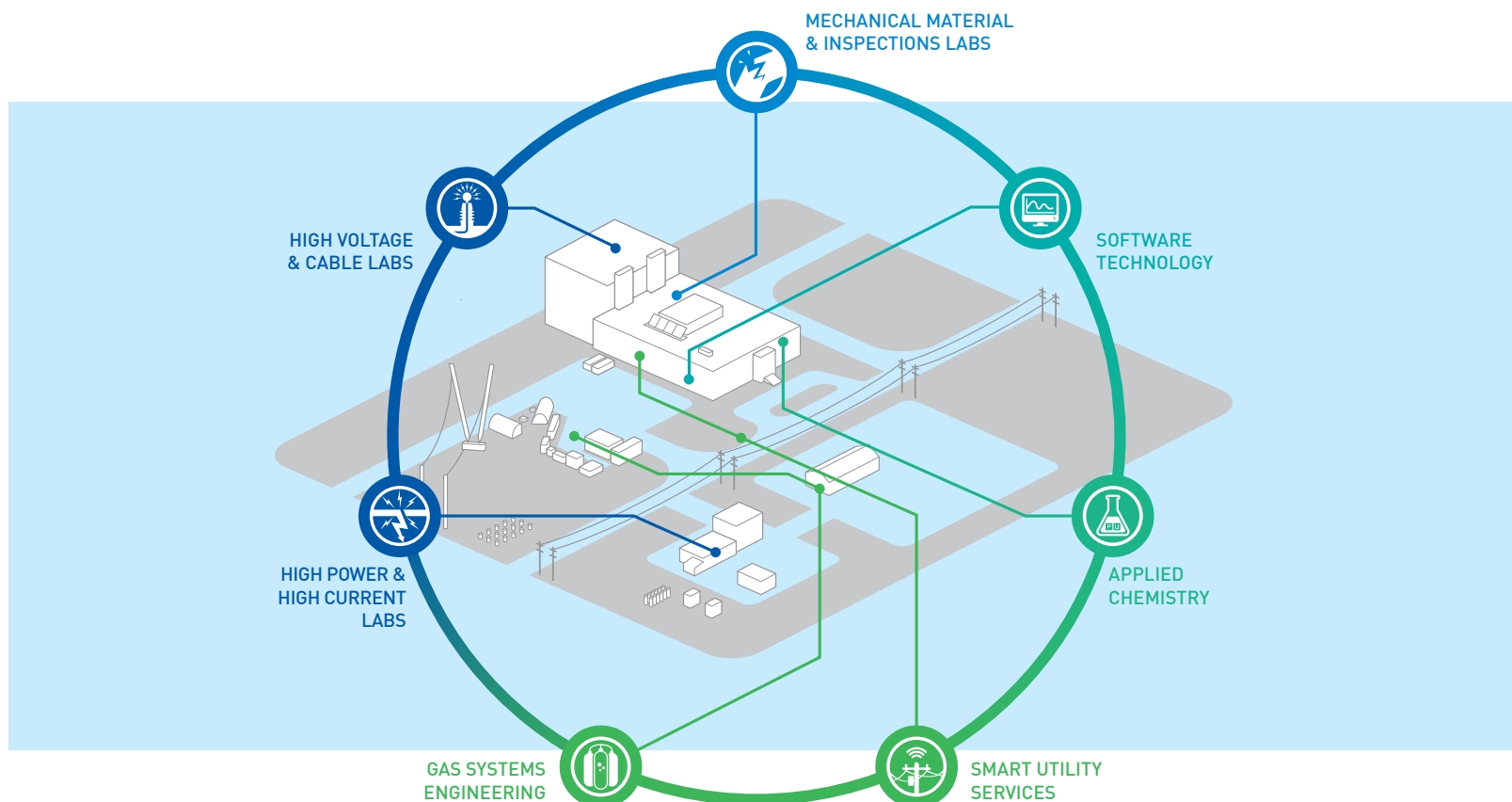
# Powertech Labs Inc.

## Who We Are

Powertech is a wholly owned, unregulated, subsidiary of BC Hydro and provides research & development, consulting, equipment testing and evaluation, condition assessment, asset management, power system analysis and software development to support the power utility industry, equipment manufactures and other industries such as automotive. For over 30 years, our engineers, technologists and scientists have provided clients with a qualified, diversified and value added, one-stop solution to electrical, mechanical, materials, civil, chemistry, non-destructive testing, and inspection services.

As an integrated multidisciplinary testing, research and development facility, we have 19 different laboratories situated on 11 acres in Surrey, British Columbia. We

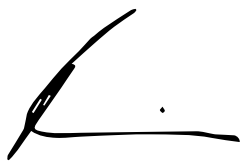
pride ourselves on being one of the largest testing, research and development facilities in North America, supporting power utilities, electric manufacturers, and automotive original equipment manufacturers (OEM) with specialized testing, qualification and non-standard testing to North American and international standards. Around 30% of our business comes from BC Hydro. Our remaining customer base includes Canada, US and all six continents. Through our engagement with a broad range of customers, we are able to bring back into BC Hydro the best-in-class when it comes to technology and practice. Likewise, by being associated with a world-class utility, Powertech staff have a deep, first-hand understanding of utility practices, needs and challenges and we bring this to bear when tackling projects.



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Powertech's  
Corporate  
Policies



Raymond Lings  
President and CEO  
Powertech Labs Inc.



Quality

Our Quality Policy is to continually improve all products and services to satisfy customer needs and to do so efficiently while meeting or exceeding the requirements of good laboratory practice, sound engineering principles, applicable standards, statutes and regulations.

As employees, we are collectively responsible for implementing our policies and procedures. Powertech's quality management system has been registered to ISO 9001 since 1997. The registration covers all aspects of Powertech's products and services. In addition, a number of tests are accredited under the ISO 17025 program and we participate in various proficiency testing programs to benchmark our testing performance.



ISO 17025  
QMI-SAI Global



ISO 14001  
QMI-SAI Global



ISO 9001  
QMI-SAI Global



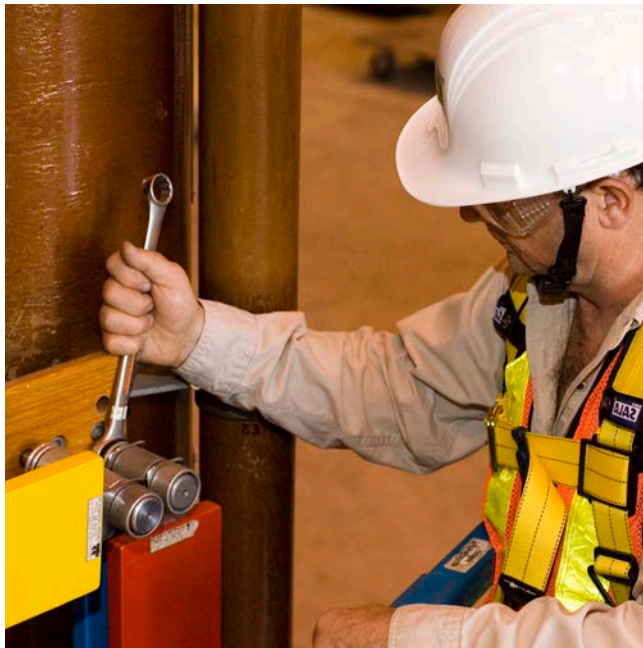




## Environment

Powertech will organize and manage its operations and activities in a manner that prevents pollution and demonstrates care and respect for the environment; and will do so efficiently while meeting or exceeding all applicable environmental laws and regulations. We will work towards continually improving our environmental performance.

Each employee is responsible for implementing this policy as it pertains to his or her job. This policy is a guiding document and there is no substitute for sound judgment. Employees are encouraged, and supported, to constructively challenge actions that may cause adverse impacts on the environment. Powertech's Environmental Management System has been registered to ISO 14001 since 2002. The registration covers the Environmental Management System for the activities of research, design, testing and consulting services.



## Safety

Powertech Labs Inc. will conduct its operation in a responsible manner that minimizes the risk of injury or disease to employees, contractors and the public.

Powertech will not only meet the mandatory requirements of the Workers' Compensation Board (WorkSafe BC) and BC Hydro but will aim to achieve superior standards of safety and health specific to Powertech Labs Inc.

The core of our safety effort is only achieved through our commitment to provide a safe work environment for all employees and customers. As such, all employees are accountable for the mindful support of safety and health. No job is so important or service so urgent that we cannot take the time to perform our work safely.

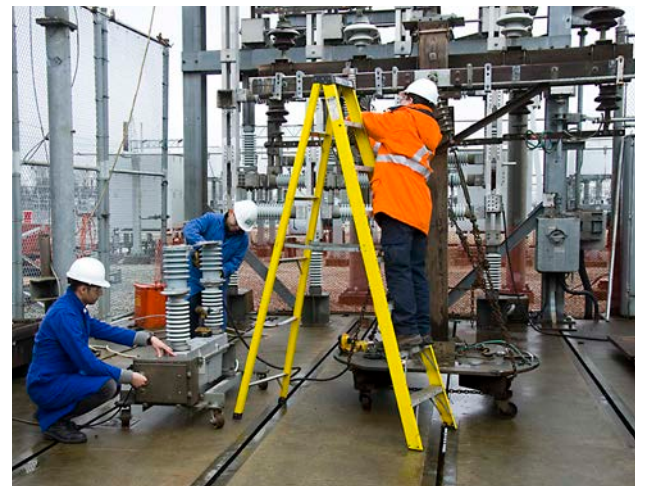


## High Power Laboratory

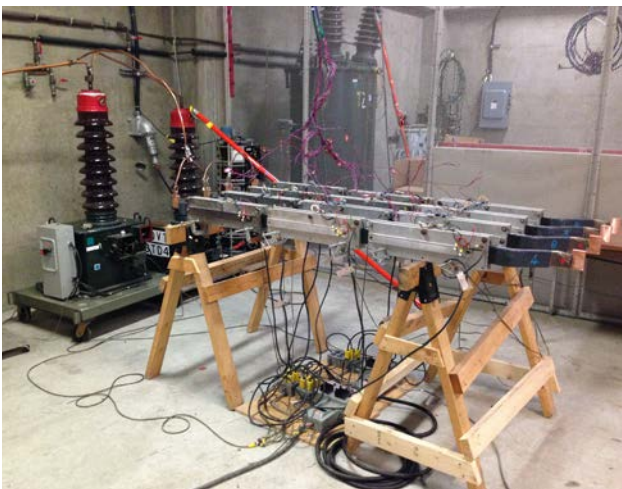
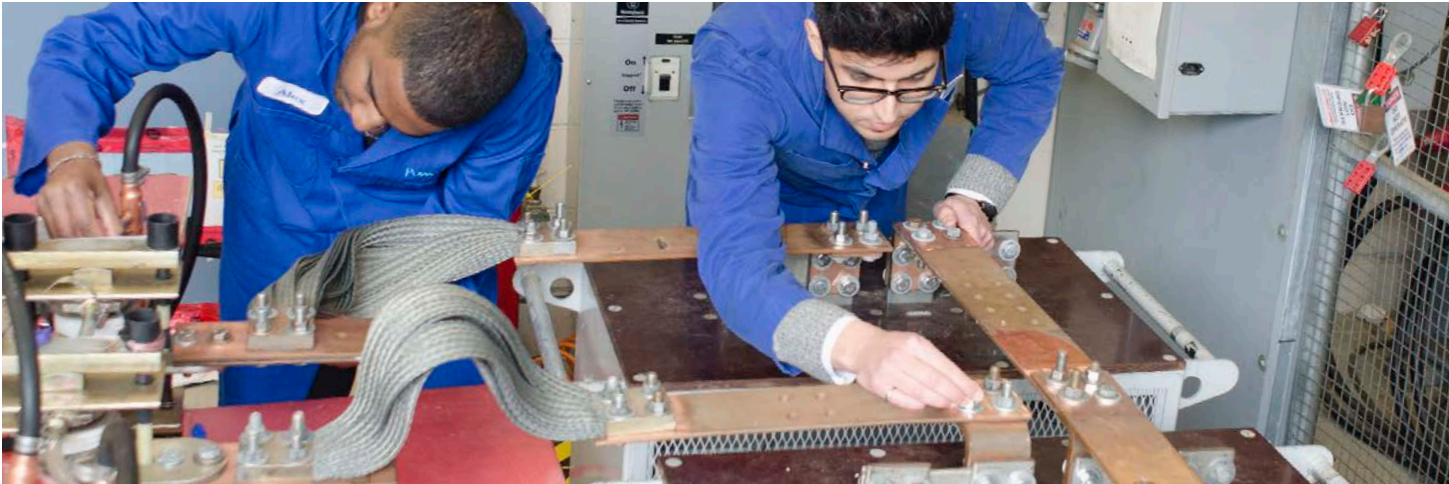


### High Power Laboratory

The High Power Laboratory is the largest, independent grid-connected short-circuit testing facility in North America. The laboratory offers high quality certification, evaluation and verification tests of medium and high voltage products to support manufacturers, power utilities, and other users of electrical equipment from around the world. The laboratory has ISO 17025 accreditation and is signatory to the STLNA agreement. The laboratory is capable of performing three-phase tests up to 38.8 kVrms ph-ph and 80 kArms and single-phase tests up to 44.8 kVrms ph-g and 110 kArms. Tests are conducted to recognized standards such as ANSI, IEEE, IEC, CSA and UL. If required, tests can also be tailored to the customer's requirements. The equipment tested includes switchgear, transformers, fuses, disconnects, safety grounds, separable connectors, switches, circuit-breakers, reclosers and other transmission and distribution class equipment.







## High Current Laboratory

The High Current Laboratory provides testing at high current levels and low voltages to evaluate the thermal performance of electrical equipment. Types of equipment tested include conductors, cables, connectors and splices, switchgear, fuses, transformers, metering equipment, and bushings. The laboratory's capabilities include low-voltage single-phase continuous current up to 10 kArms, 60 Hz or DC, and three-phase current up to 2500 Arms at low voltages or up to 400 Arms at 600 Vrms. Variable frequency high current tests can also be performed at similar levels. The laboratory specializes in failure analysis and evaluation of high current components, including connectors, fuses, and circuit breakers, as well as in voltage endurance, thermal-cycle, and diagnostic testing on generator and motor stator bars and coils.





## High Voltage Laboratory

The High Voltage Laboratory is the largest on the West Coast, providing high voltage tests at voltages up to 1,600 kVrms AC, 3 MV impulse, 1 MV DC. Our business services include testing, failure analysis and consultation on all types of high voltage equipment including transformers, insulators, switchgear, bushings, cables, generators, GIS, and transmission line hardware. The laboratory facilities include a high voltage lab and a medium voltage lab, which are equipped with state-of-the-art equipment for measurements such as partial discharge, tan delta, and electrical properties of materials. A full range of laboratory tests on electrical equipment including thermal and short circuit testing, qualification testing and certification in accordance with all relevant industry standards are available. The HV laboratory provides contract research, custom testing solutions, forensic investigations, condition assessment etc. on all type of High Voltage equipment both in the field.

### The facilities include:

- 1600 kV, 5 A, AC resonant test equipment for testing in the laboratory or in the field (can be configured for 800 kV, 10 A or 400 kV, 20 A)
- 3.2 MV, 225 kJ impulse generator
- DC test set rated 1000 kV, 10 mA for testing in the laboratory or in the field
- Equipment to test under a variety of electrical and environmental conditions, including:
  - Clean and salt fog pollution testing chamber,
  - Tracking and erosion testing - fog chambers, tracking wheels, inclined plane testing
  - Thermal/humidity/UV testing

Testing is conducted to recognized standards such as ANSI, IEEE, IEC, CSA and UL and if required, tests can be tailored to the client's requirements.



### Cable Engineering Services

Cables and accessories fail. The failure modes include aging, substandard materials, improper installations, misuse, and damage. The failures result in power interruption, loss of revenue, damage to electrical utility and public property, and present a safety hazard. Our team offers a complete set of services for low voltage, distribution, transmission, and submarine cables and accessories which include:

- **Condition Assessment** tests on in-service cables and accessories. These tests are carried out to prevent unscheduled outages and determine the condition, and future performance. We offer the following testing services:

#### On-line Tests (with the cables energized)

These tests include Visual inspections, Partial discharge using tests using conventional and non conventional partial discharge measurement techniques and acoustic detection, Infrared imaging, Metallurgical tests on PILC cables

#### - Off-line Tests ( with the cables de-energized and isolated )

These tests include 60 Tan $\delta$  and AC withstand tests, VLF Tan $\delta$  and VLF withstand Tests.

Powertech has the state of the art partial discharge TECHIMP Partial discharge measurement system, a 90 kV variable frequency Resonant Test set capable of energizing long lengths of cables ( 3 $\mu$ F load), and 1600 kV Resonant Test set.

#### • Laboratory Tests on Cables and accessories removed from service

These tests are carried out at our multidisciplinary research and testing facility to determine the degree of degradation and validate field tests. These tests include AC breakdown/ withstand tests, Hot and cold Impulse/switching surge tests, partial discharge measurements, Tan Delta measurements, Water tree analysis, and a variety of material and chemical tests including thermal analysis, and chemical analysis.

#### • Qualification Analysis

These tests are carried out in accordance with all relevant industry standards to improve quality and reliability on new installations. Our Medium and High Voltage laboratories are equipped with resonant tests sets, test transformers, impulse generators, de-ionized HV water terminals for AC breakdown and Impulse Tests, and 400 kVA current transformers for conducting thermal cycling and hot impulse tests, and dielectric tests at elevated temperature.

#### • Forensic Analysis

A full range of forensic analysis investigations to determine the cause of failure of a cable or accessory. Our team has successfully conducted a number of high profile failure analysis investigations for legal proceedings. The majority of these investigation requests come from equipment manufacturers, industrial plants, insurance agencies and lawyers, who are involved in legal proceedings related to product failures, fires, fluids or explosions; cables and accessories failures; effects of gasoline (Hydrocarbons); vandalism or industrial accidents.



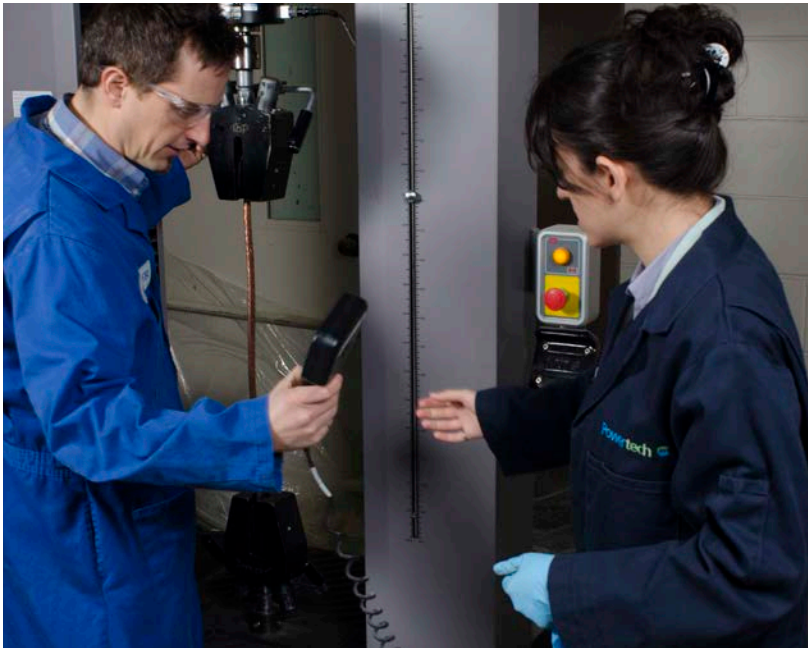


## Mechanical Technology & Testing

The Mechanical Technology & Testing Department conducts standard and non-standard tests to evaluate the performance of a material or component. To simulate in-service conditions or adhere to internationally published standards, our team of skilled technologists and engineers conduct vibration and shock, environment (thermal cycle with humidity control), tension and compression, fatigue, fracture and impact toughness, and self-lubricating bearing testing. The department conducts a variety of value added projects for electric utility, transportation industries, fabrication shops, and certification agencies.

## Applied Materials

Failure of mechanical components or systems can be costly, inconvenient, and sometimes dangerous. The Applied Materials Department offers engineering solutions for metallurgical or material related problems to extend equipment life and ensure safe and reliable operation. Our service offerings include failure analysis (forensic investigation), stress-strain measurement and analysis, fitness for service studies, material selection consulting, evaluation of material properties, welding engineering and qualification, protective coatings testing and inspection, cathodic protection design, installation, and quality assurance, and corrosion testing and consultation.



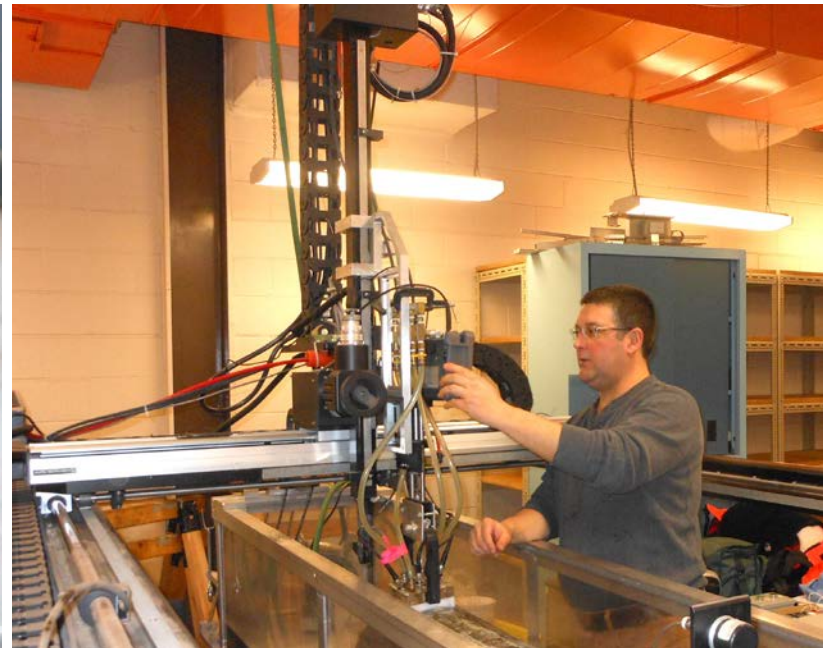





## Assessment Management Inspections

The Asset Management Inspections Department provides diversified testing, consulting and R&D services in non-destructive Testing (NDT), welding inspection, soil thermal and resistivity measurement, asset integrity and reliability. In addition to routine NDT inspection on aerial lifting devices such as bucket trucks and cranes and line-men safety equipment we also conduct specialized inspections on turbine runners, piping system, pen-stocks, gates, pressure vessels, fuel tanks, among other equipment. The group also specializes in offering asset management solutions to utilities for managing their aging T&D assets such as wood poles, towers, crossarms,

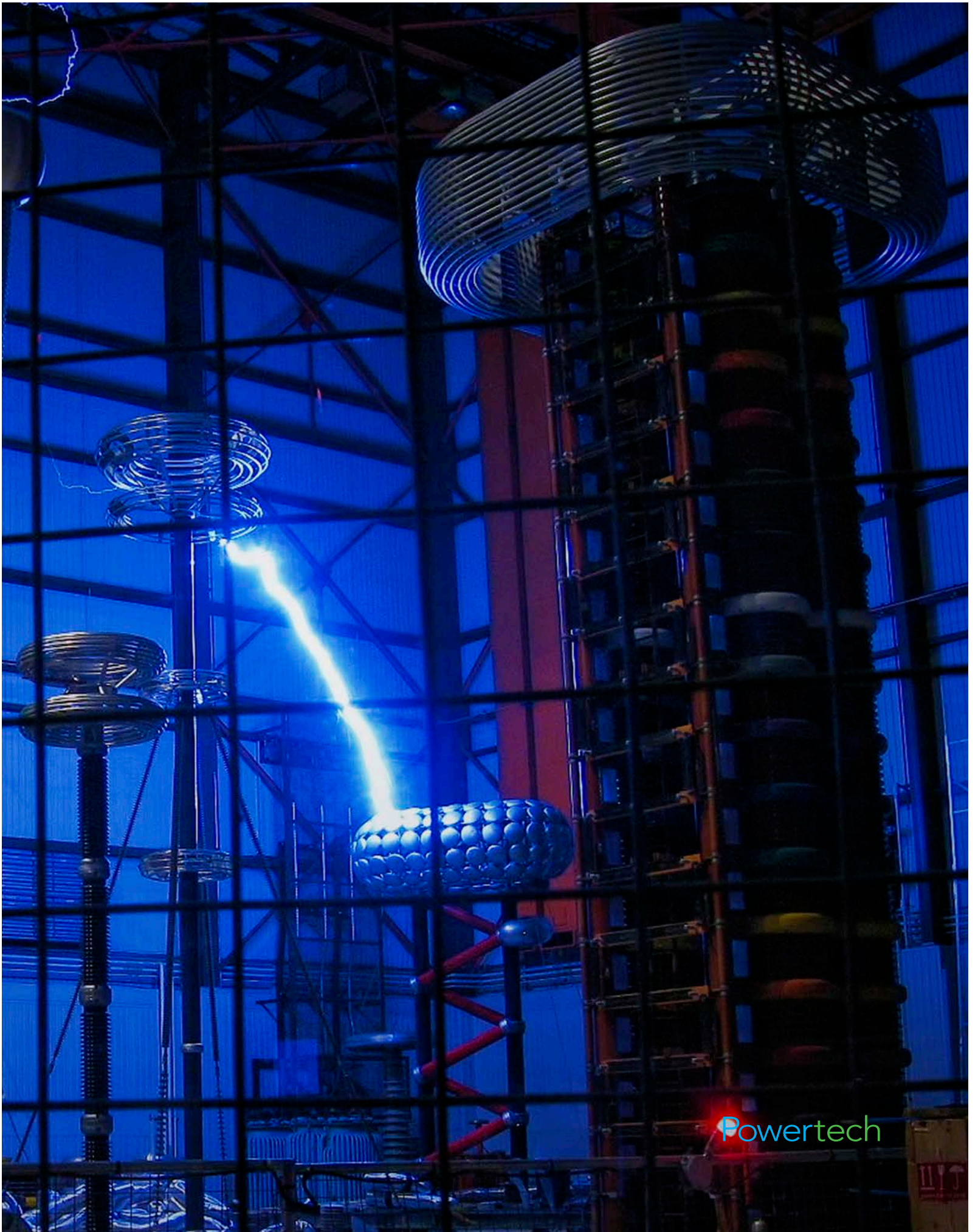
insulators, connectors and anchor systems. The offers include determination of asset remaining strength and life span, development of maintenance and risk-mitigation strategy, evaluation of inspection methods and techniques for condition assessment. Supported by experts from other departments of Powertech the asset management work is usually conducted through in-situ NDT inspection and condition assessment, laboratorial testing (structural, mechanical materials and electrical), finite element analysis, serviceability analysis and risk and reliability evaluation.





Powertech is a trusted  
provider of knowledge  
and innovative solutions  
supporting a clean  
energy future.





Powertech





Software Technologies Services



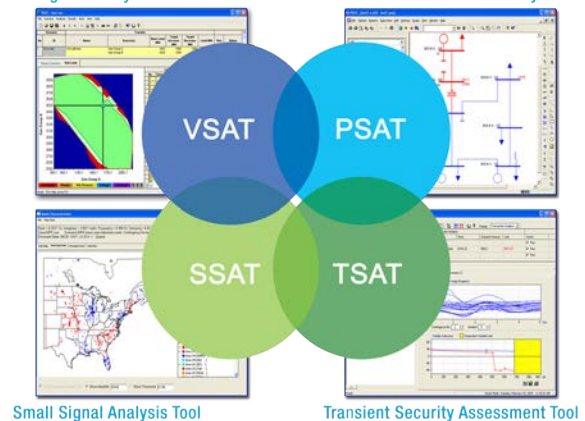
## Software Technologies Services

The Software Technologies unit at Powertech has more than 20 years of experience in power system analysis and software development. The software engineers and programmers are responsible for the development and licensing of the power system analysis software suite DSATools™ and other tools. To support our clients, the DSATools™ software package incorporates leading-edge technologies for the modeling, design, and analysis of power systems. It has been especially useful for on-line dynamic security assessment (DSA) where real-time power system conditions are analyzed continuously to identify potential violations of operation criteria. Powertech has a large client base for DSATools™ and other software including a few dozens of on-line DSA installations around the world.

### DSATools™

Voltage Security Assessment Tool

Powerflow & Short circuit Analysis Tool



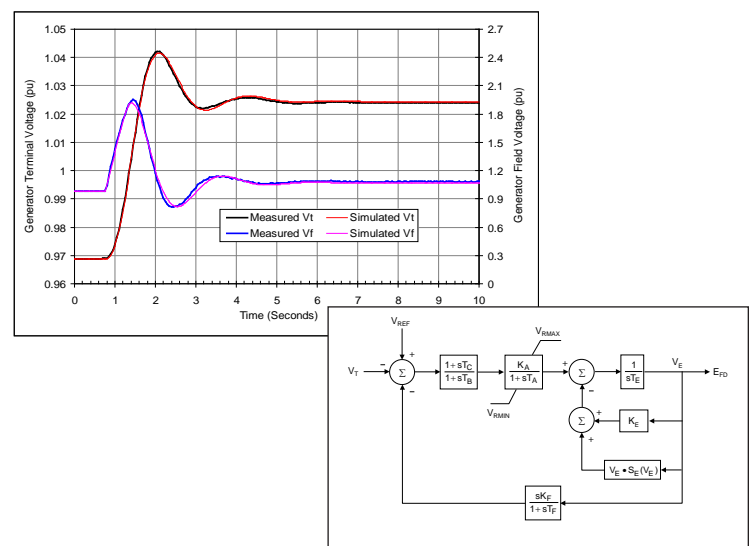
Small Signal Analysis Tool

Transient Security Assessment Tool



## Power System Studies

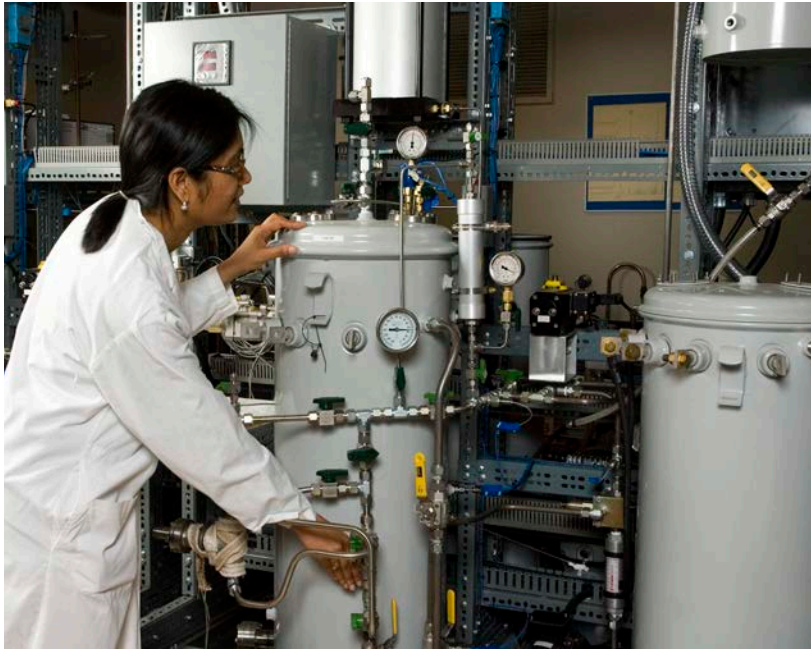
The Power System Studies Group provides a wide range of power system consulting study and field testing services, including comprehensive stability assessment for transient, small-signal voltage and frequency stability, evaluation of transfer capability and security limits, post-mortem analysis of system disturbances, development and assessment of system design alternatives, generation and load interconnection studies and electromagnetic transients studies. The Group also specializes in generator and load parameter measurement and model development for various types of machines, ranging from a few megawatts diesel generator sets to large nuclear-generation units. Powertech has tested and model validated more than 300 generating units worldwide. The group also offers a full range of technical training on various subjects of power system analysis.







## Applied Chemistry Services

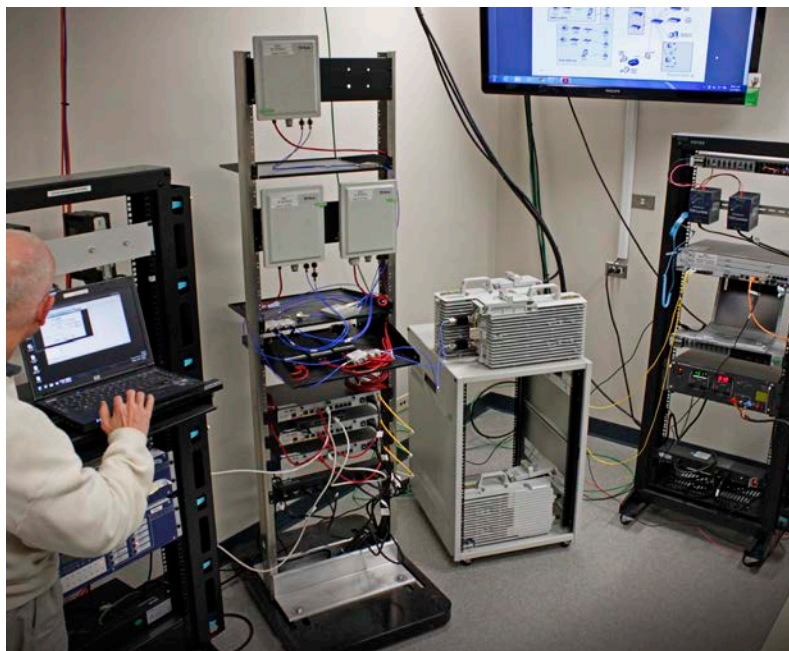


### Applied Chemistry Services

The Applied Chemistry department has more than forty years experience in providing testing, analysis, investigations and applied research in the chemistry of insulating fluids and solids used in electrical equipment. Modern analytical instruments for complete chemical assessment for the purpose of diagnostics, condition assessment and material evaluation are complemented by expert analytical capabilities for full predictive and proactive maintenance. The research and development section is considered world-class and focuses on life extension, on-line monitoring and on-line oil purification of electrical equipment. We also have extensive experience in all aspects relating to PCB

contamination including analysis (ISO 17025 accreditation), on-line removal and destruction with oil reclamation. Other services include environmental testing, fuels, lubes and coolants analysis and extensive capabilities in polymer and material testing including thermal analysis, rheology, spectrometric, chromatographic, mechanical testing and failure analysis.





## Smart Utility Services: The Smart Utility Lab

The Smart Utility lab is an innovation centre that develops and validates grid automation solutions prior to deployment to the field. The lab undertakes advanced technology demonstration projects and performs interoperability testing to utility clients and vendor OEMs. These demonstration projects play a critical part of a risk reduction strategy as utilities seek to modernize their systems. The lab environment includes a bench top testing for modeling and simulation and a test yard that emulates the infrastructure of the utility network. The yard serves as a test bed where devices can be evaluated under real grid operating conditions in one location without posing the risk of disruption to the grid

at large. The Smart Utility Lab has the capability to create current and future utility environments including telecom and network infrastructure, management and operating systems, relays and physical devices for interoperability, integrated and non-integrated system performance testing. It represents a model of a modern distribution management system with state of the art grid control and monitoring capabilities including variable and interchangeable loads, sources, protection, and communications.



## Smart Utility Services

### Smart Utility Services: Electric Vehicle Services

The Electric Vehicles group is involved in the development of charging infrastructure solutions for battery electric vehicles. Powertech offers a range of EV services including, project management, charge station site selection, evaluation and planning, requirements definition site design, hardware selection and procurement, construction management, system integration and data management. A significant focus is to develop and demonstrate communications pathways for grid-aware charge infrastructure for utility management of charge events. Powertech's EV Technology Park facility in conjunction with the Smart Utility Lab provides a test bed to develop and validate smart charging solutions for utilities, automakers and charging equipment manufacturers.



### Smart Utility Services: Energy Services

The Energy Services group focuses on the development of renewable energy solutions. Powertech assesses the reliability of the integration of renewables to the electric power system, and acts as a systems integrator for distributed generation and microgrid environments. The group offers a range of services from consulting on remote community electrification solutions, system design through to fabrication and testing of DG systems, which include energy storage solutions and complex micro grid control algorithms.







## Gas Systems Engineering Services

The Gas Systems Engineering group is a global leader in design verification, performance, and certification testing of high pressure gas components and systems, primarily for the hydrogen and compressed natural gas (CNG) industries. We offer standardized, customized, and destructive testing services to component manufacturers, Tier 1 & 2 integrators and suppliers, automotive OEMs, regulatory authorities, and aerospace companies around the world. Our component testing labs include test capabilities for pressure vessels, regulators, relief devices, valves, nozzle/receptacles, and fittings/tubing as well as complete or partial fuel systems. Our hydrogen fueling and systems testing labs include test capabilities for the simulation of hydrogen fueling protocols, end-of-life and durability testing, performance testing, drive cycle simulations, and other specialized fuel system tests.



## Hydrogen Stations Services

The Hydrogen Stations group has taken their extensive knowledge of hydrogen components and developed reliable hydrogen fueling station designs. As a leader in the design, construction and operation of compressed hydrogen fueling stations, we are credited with the world's first 700 bar hydrogen fast fill fueling station in November 2002. We offer turnkey hydrogen fueling station packages including retail style dispensers. In addition to the North America market, we market our hydrogen stations in Germany and Japan through strategic partnerships.



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