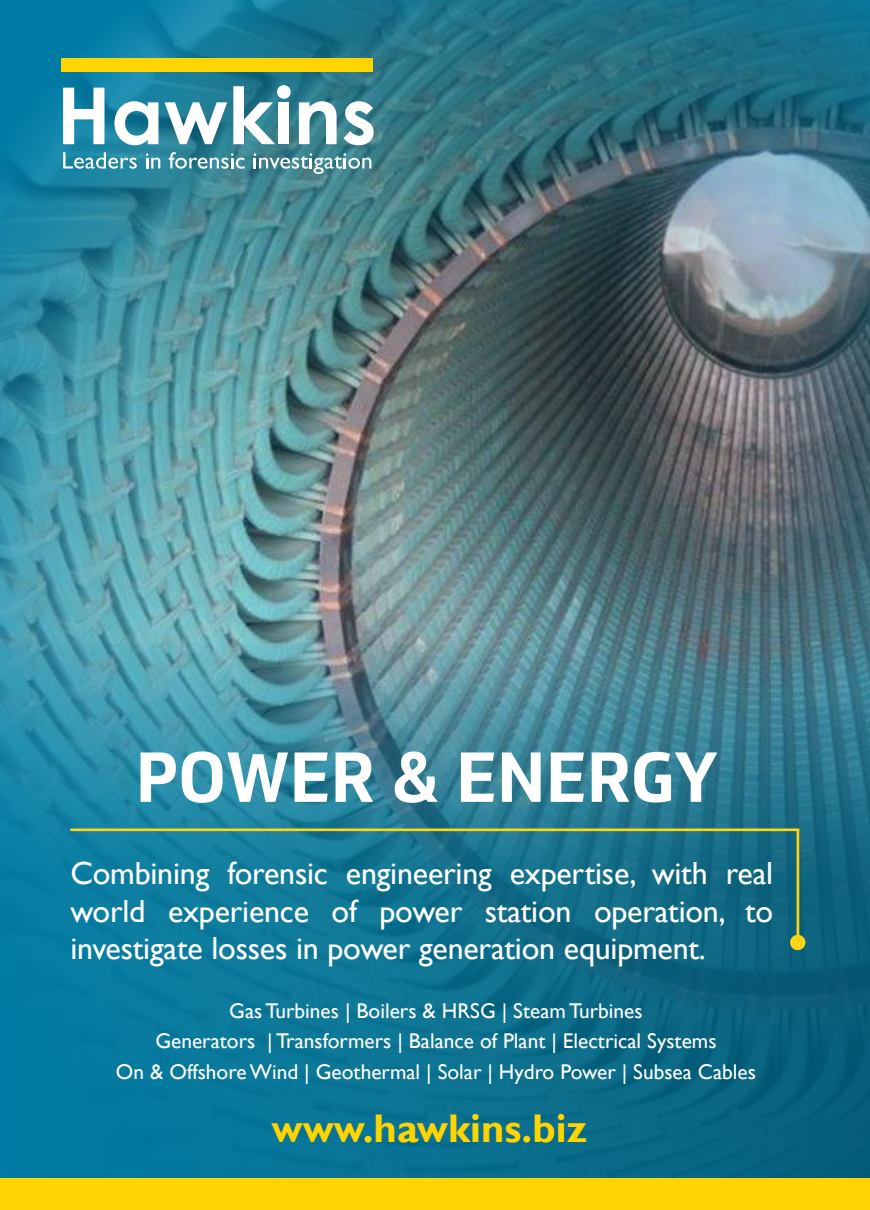

Hawkins
Leaders in forensic investigation
POWER & ENERGY
Combining forensic engineering expertise, with real world experience of power station operation, to investigate losses in power generation equipment.
Gas Turbines | Boilers & HRSG | Steam Turbines
Generators | Transformers | Balance of Plant | Electrical Systems
On & Offshore Wind | Geothermal | Solar | Hydro Power | Subsea Cables
www.hawkins.biz



Established in 1980, Hawkins specialises in forensic investigation and root cause analysis for the insurance, legal and risk management professions, on behalf of both claimants and defendants, representing insurers, owners, operators and manufacturers.

Our clear, concise and timely reports will provide the understanding you need to make the correct decisions on your risks.

With a recognised and growing global presence, we have over 150 experts providing worldwide coverage from offices in Europe, MEA, APAC, and key locations across the UK.

Our experts can investigate, advise, and assist at any stage of an incident, including pre-loss prevention and risk assessment, root cause analysis, post-failure remediation advice and expert witness services.

Our extensive group of credible power experts specialise in each of the major components found on conventional and renewable power plants. Between them, they have hundreds of years' experience in design, manufacture, operation and maintenance, working for some of the world's largest manufacturers and operators of power plants.

We understand that any power generation outage is costly for all stakeholders involved, whether they are owners, operators or insurers. From the very beginning, decisions need to be made quickly and based on sound and clear advice.

Regardless of where in the world the incident took place, we can attend quickly after instruction, often the next day. A typical investigation might include taking witness statements, inspecting site equipment, considering any relevant documents, reviewing operational data, and examining exhibits in a laboratory, while updating clients with prompt reporting.

Hawkins understands the significance and complexity of operation and effective life management of critical power generation assets. We can help operators to optimise production performance while ensuring safety and compliance. Our services extend across life management, condition assessment and life extension of assets, and in the case of a forced outage, failure and root cause analysis.

"Clients come back to Hawkins because of our honesty and integrity. Our subject matter experts have sound technical knowledge and expertise, married with a real commercial awareness of what our clients need. Hawkins provides a rapid response, giving timely, accurate advice and communication of the evidence in a way our clients can act upon."

Dr Andrew Prickett, Managing Director, Hawkins





What we do

FAILURE PREVENTION

Guidance on design, installation, and regulations to ensure safety, compliance, and risk reduction.

ROOT CAUSE ANALYSIS

Scientific investigation into all aspects of an incident to determine what happened, why and in what sequence.

EXPERT WITNESS SERVICES

Independent and impartial technical advice, including quantum & delay services to assist Counsel during all aspects of litigation.

POST-FAILURE ADVICE

Consultancy advice to reduce, mitigate and prevent risks associated with similar events happening in the future.

MAJOR & COMPLEX LOSS

Global resources and multidisciplinary teams, armed with the knowledge, equipment and facilities to manage and investigate major and complex incidents.

HAWKINS GROUP

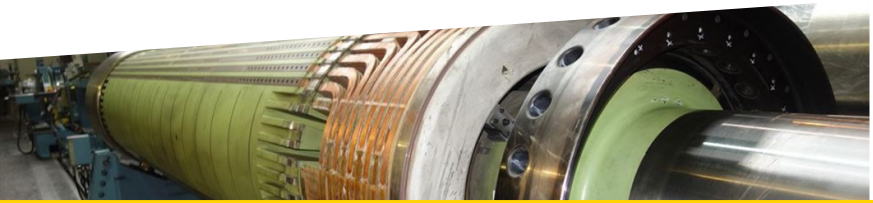
We provide world-leading cost consultancy, dispute resolution, and quantum & delay expert witness services through our specialist subsidiary A Lamb Associates (ALA).

ALA EXPERIENCE

ALA provides specialist quantity surveying and planning services. Established in 1996, they are leading specialists in cross-country pipelines worldwide, and have extensive experience across the power and energy sector.

Our team of Expert Quantity Surveyors and Forensic Planners have a wide range of experience, including:

- Energy from Waste Plants
- Offshore Wind Farms
- Cross-Country Pipelines
- Recycling Plants
- Wastewater Treatment Works
- Nuclear Plants
- Hydrogen pipelines



ALA EXPERIENCE

Our team of Expert in-house Quantity Surveyors provide a range of services including:

PRICING PROPOSED WORKS

Our experts provide support pricing proposed works. This includes pricing proposed remediation options so that an informed decision can be made on the most cost-effective solution.

ASSESSING CLAIMS

We investigate and assess the reasonableness of claims received. Our experienced team will review all costs to determine if costs have been reasonably and properly incurred. We assess whether a reasonable procurement process has been followed, whether rates represent market value and whether work pricing reflects the scope. We are able to make adjustments for betterment, inflation or other relevant matters.

IMPACTING DELAY

The duration of a project can have a significant impact on the amounts claimed. Our experienced team of Forensic Planners can assess the cause of any delays to progress, determining whether all costs claimed are properly due.

THERMAL ASSETS

GAS TURBINES

Gas turbines vary in size from micro (20-350KW) to large industrial units (590MW). With the reduction and eventual elimination of coal fired power stations, gas turbines play a crucial role in the transition to renewable power generation. Gas turbines such as aero derivatives and smaller industrial units, offer flexible operation and faster ramp time to full power when compared to larger industrial units. This gives smaller units an added advantage when supporting renewable generation, but rapid starts and relatively short periods of operation will have a detrimental effect on the life of many components, which can impact reliability and maintenance intervals.

Whilst the majority of gas turbines in use today burn fossil fuels, all major manufacturers have a firm eye to the future,developing the capability of burning 'low' or 'no' carbon fuels. Currently, the focus is on utilising 'green' hydrogen, with many hydrogen co-firing units already in operation. Despite the significant technical challenges that remain, it is hoped that100% hydrogen-fired gas turbines will be a reality in the not too distant future, but as with all new technology, there will almost certainly be reliability challenges and failures along the way. Nevertheless, gas turbines will continue to provide outstanding service in the power generation sector for many decades to come.

BOILERS AND HEAT RECOVERY STEAM GENERATORS

Boilers can range from small to several thousand tonnes for large thermal sub and super critical boilers. Issues due to water chemistry control and presence of erosion/corrosion can lead to failures. The assessment of the boiler tubes is critical during the annual inspection to give the operator an idea of their position on the life curve, as tube replacement is time consuming and expensive.The move from coal to energy from waste (EfW) and renewable fuel sources, such as wood and straw, has led to issues in relation to fireside corrosion due to the aggressive nature of the combustion flue gases.

STEAM TURBINES

Steam turbines are found in geothermal, EfW, nuclear, coal and gas plants. The largest of which currently being installed are in the region of 1.6 GW.

The addition of the steam turbine to the gas turbine, to form a combined cycle power plant, increases the efficiency. The rotor forgings large thermal mass does not work well with rapid start up, as the thermal stress generated can lead to fatigue cracks. This is especially true on old rotors which have moved from base load to flexible operation.





GENERATORS

Generators convert the mechanical power output of the plant into electrical power, for transmission onto grid systems. This means that they are as much mechanical machines as they are electrical, suffering from issues including both fatigue and degradation of the high voltage insulation. As generators get larger, other problems are introduced, like the risk of explosion from the hydrogen cooling system or the chemical and operational complications brought by cooling the generator windings with water. Failure of generator components may take well over a year to replace in the event of catastrophic damage to the key components.

TRANSFORMERS

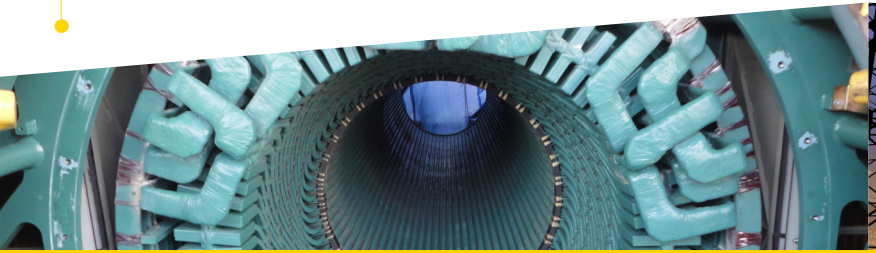
Transformers are found throughout electrical systems. From small transformers found in the home, to those used in the worlds transmission systems. Generator step-up transformers often produce the largest potential for business interruption at a power plant, as it is a single point of failure with no redundancy. A failure may cause catastrophic damage to the power plant as its cooling oil burns, and a replacement may take over a year to procure, construct, ship and install.

BALANCE OF PLANT

The balance of plant refers to all the supporting components and auxiliary systems of a power plant needed to deliver the energy. These may include transformers, inverters, switching and control equipment, protection equipment, power conditioners and supporting structures. These components are no less important than the generating units themselves. For example, poor chemical control of the water systems or failure to lubricate oil pumps can lead to catastrophic failure of the boilers and turbines. There is usually redundancy built into balance of plant systems, which can mitigate risk, but not remove it completely.

ELECTRICAL SYSTEMS

Electrical systems in power networks are complex. They connect power plants, renewable generation and interconnectors to the transmissions and distribution systems, then into the low voltage networks which supply our homes. Within these systems are an array of high value, critical equipment such as transformers, power lines, circuit breakers and substations. The efficacy of electrical systems and their protection systems is built on the competence and quality with which they are installed.





RENEWABLE ENERGY SYSTEMS

ONSHORE AND OFFSHORE WIND

The increase in wind generation technology has been significant and rapid. The improved availability of advanced materials (e.g. glass and carbon-fibre composites) and manufacturing techniques has enabled the production of ever-larger and more efficient wind turbines. Although this has led to great strides in output, the reliability has lagged behind. The continuing demand for larger turbines, with very rigid, but lightweight blades has led to difficulties associated with blade manufacture, gearboxes, slew rings, generators, installation and tower construction. These problems have led to numerous structural failures, fires and mechanical breakdowns. As demand grows and wind farms become larger, their electrical systems become more complex and can cause very large losses (e.g. offshore wind farm electrical cables).

GEOTHERMAL

Flash power plant units are based on nuclear rotors. The geothermal rotors work in aggressive steam conditions with carry over of silica and other rare earth elements. Mineral deposition and moisture damage can affect the turbine efficiency, leading to generation losses. In low temperature steam, the use of binary plants/heat exchange are employed. In binary plant, the area exposed to the aggressive steam is the heat exchange tubing and as such, cleaning and inspection is critical as scaling can occur.

SOLAR

In the past decade the price of solar photovoltaic power has plummeted, making it a very attractive investment, leading to many projects being built in the UK and around the world. Common failures experienced are related to failure of inverter panels and other electrical failures. With the developments of offshore solar voltaics there is the added risk of damage to mooring lines and export cables.

Solar thermal has a far smaller installed capacity around the world, but we have supported clients with problems relating to the heat exchangers and problems associated with the frequent stop/start operation of the steam turbine and generators.

HYDRO POWER

Hydro power is a dependable power generation method with plants typically having very long intervals between major inspections. Hydro plants are classed as conventional (head of water), pumped storage and, run of the river. The units can be small to very large and rotate at a variety of speeds based on the head and flow of the scheme. Issues can arise in the wicketgates (impact damage), penstock, and turbine (impulse or reaction). Impulse units are located where there is a large head of water, and reaction units used for low to medium heads.



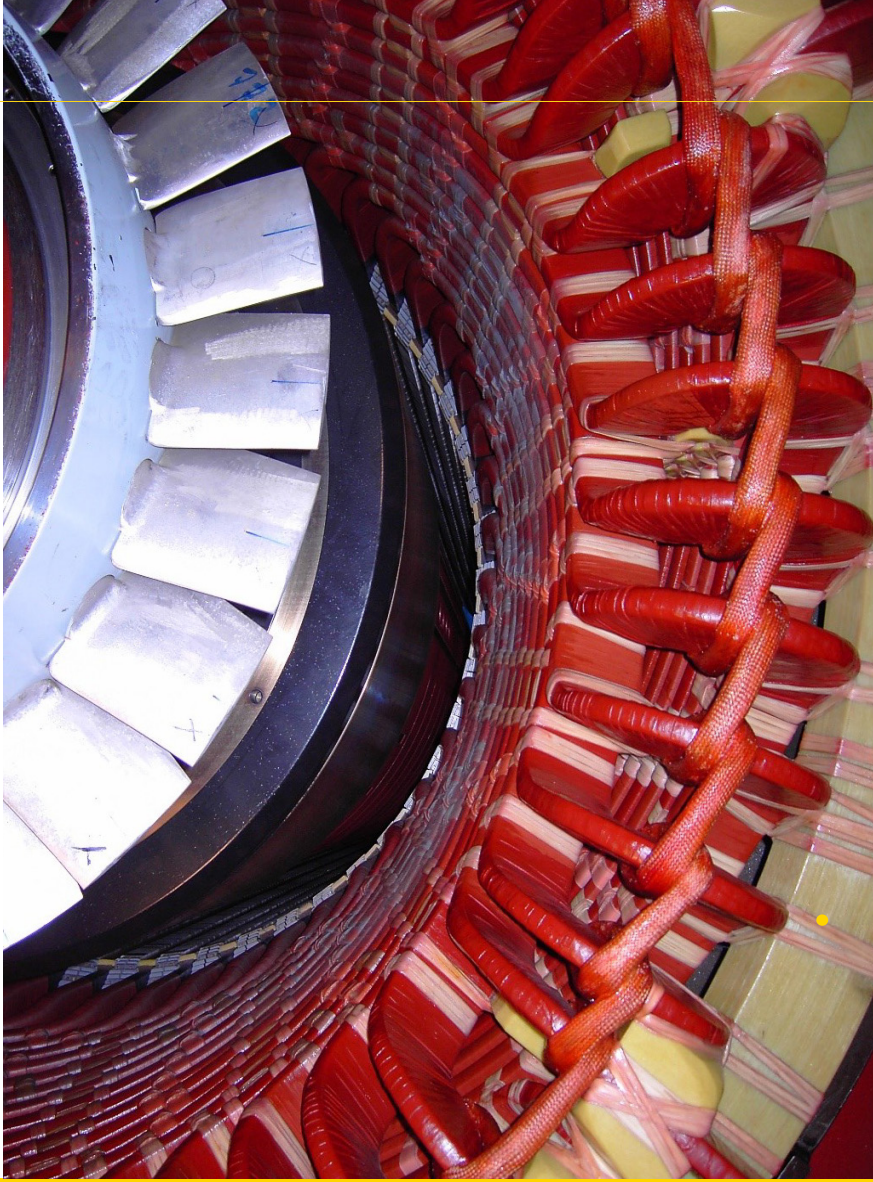


SUBSEA POWER CABLES

All offshore renewable power generation is dependent on subsea power cables, including offshore wind, wave, tidal and solar power. Subsea power cables include interconnectors, for large-scale high voltage power transmission between national grids, Export Cables, for high voltage export from power generation system substations, and Inter-Array Cables, used in offshore wind farms (fixed-bottom and floating), for medium voltage connections between turbines and substations. Medium voltage cables are also used for smaller export requirements e.g. from wave energy devices.

Subsea power cables are multi-layered polymer/metal structures consisting of cylindrical layers and helically wound strips or wires. AC cable cores consist of three multi-layered cables wound together helically. Subsea power cables are very long, flexible and torsionally unstable, and require great care when handling and installing to maintain control and to avoid exceeding their mechanical limits. Some of the cable layers are delicate and are at risk of damage during transportation, installation and operation. The cables operate in harsh, dynamic environments, and cable systems need careful design and monitoring to mitigate the threats from wear and fatigue at exposed locations, usually near the cable ends.

Lifetime monitoring of cable condition, loads and displacements, and of the condition of any ancillaries, greatly reduces the risk of unexpected damage or failure.



Hawkins' Expertise

With a recognised and growing global presence, we have over 150 experts providing worldwide coverage from offices in Europe, MEA, APAC, and key locations across the UK. Our expertise covers a vast number of specialist areas including:

ACOUSTICS & AUDIOLOGY

Our experts assess and advise on acoustic design in the planning stages, and provide mitigation strategies post-construction in the event of a noise dispute.

ARCHITECTURE

We investigate building defects to determine whether design or workmanship is the root cause. With experience in many sectors and across all RIBA stages from inception to occupation, we can provide advice tailored to your project.

THE BUILT ENVIRONMENT

Our civil, structural, geotechnical and fire engineers provide expert investigation of defects and failures in the built environment, including water ingress, structural collapses, storm damage and personal injuries, especially on construction sites.

CHEMISTRY & CHEMICAL ENGINEERING

Hawkins' team of highly qualified and experienced chemists and chemical engineers provide expert opinion on problems associated with chemical processes in a wide variety of industries, including: post incident investigation, goods handling, environmental concerns, hazardous substances and personal injury.

CONTAMINATION

Our team of highly qualified and experienced chemists can investigate a wide range of contamination and spillage incidents.

DIGITAL FORENSICS

Hawkins experts collect, authenticate and preserve original evidence. We discover the source of a digital event or attack, how it occurred, and what information may have been lost or compromised.

ELECTRICAL

We investigate incidents including failures and injury involving most types of electrical equipment, from micro-electronics and domestic electrical appliances through to high voltage generation and distribution.

ESCAPE OF WATER, GAS, OIL AND OTHER FLUIDS

We can provide system failure analyses for incidents involving all fluids and gases in industrial and domestic settings with on-site and laboratory investigations.

FIRE & EXPLOSIONS

As a leader in forensic fire investigation, Hawkins has the necessary knowledge and experience to investigate the full scale of losses globally, and advise on recovery, liability and risk management.

FIRE ENGINEERING

Hawkins has the necessary competencies to advise on fire engineering matters including compliance with fire safety legislation and guidance,investigation of fire spread and building fire safety design,construction and management.

FRAUD

We compare physical evidence with witness accounts to establish if the evidence is commensurate with a suggested sequence of events or actions. This applies to both small and major losses.

HYDROLOGY

Our expert hydrologists and engineers have years of experience identifying the cause(s) of complex flooding incidents.

MARINE INCIDENTS

We assist on a wide range of incidents including agricultural cargoes, liquefaction, fires, explosions and chemical contamination.

MATERIALS

From medical implants to satellites, our experts are on hand to establish the cause of failure of manufactured items.

MECHANICAL

Losses often involve the failure of multi-component mechanical systems. We have the knowledge and experience to identify the cause, no matter how complex.

PERSONAL INJURY

We provide independent and expert assistance with all types of personal injury, including specialised and complex areas like slips, trips and falls, and noise-induced hearing loss.

PLANT PATHOLOGY

At Hawkins, plant pathology encompasses agricultural, horticultural, forestry, marine and contamination claims. Our experts are experienced in investigating the causes of plant diseases, crop failures and spoilage of fresh produce and agricultural cargoes.

POWER & ENERGY

We investigate all aspects of failures in traditional thermal power, oil and gas, and renewable energy sources. As well as incidents such as electric shock, gas leaks, power failure, over-voltage, equipment failure and poor design and maintenance.

PROCESSES

Our engineers help identify the cause of a problem and advise on liability and future prevention.

PRODUCT LIABILITY

We are experts in the field of product liability and often deal directly with UK Trading Standards offices or similar statutory bodies.

QUANTITY SURVEYING

We provide cost consultancy, dispute resolution, and quantum & delay expert witness services through our two specialist subsidiaries. Services include insurance reinstatement valuations, pricing proposed works assessing the quantum of claims, and the impact of delays.

RAILWAYS

We have investigated incidents including derailments, unintended runaways and accidents at level crossings.

ROAD TRAFFIC COLLISIONS

Our investigators identify all contributory factors and analyse issues such as vehicle speed, visibility, human factors, CCTV, road positioning, weather, vehicular faults and damage assessments.

VEHICLE, PLANT & MACHINERY

We investigate fires and failures involving all types of vehicles and plant. We routinely review designs and maintenance practices to provide recommendations to our clients.





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