

**Renewable Generation Electrical  
Infrastructure and Grid Connection  
Services Provided by Power  
Systems Project and Consultancy  
Services (PCS) Ltd**

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# 1 Introduction

Power Systems Project and Consultancy Services Ltd (Power Systems PCS Ltd) is an electrical engineering consultancy formed in March 2002 by a number of experienced engineers who had previously worked within electrical utilities or major engineering consultancies in the power engineering sector.

With its electrical utility background, Power Systems PCS Ltd can add value to a project by combining a sound base of traditional engineering skills with a strong understanding of the competitive and economic pressures existing in today's environment.

We offer a full range of consultancy and project management services from scheme feasibility through to project implementation.

The range of services offered by Power Systems PCS Ltd in general and for Renewable Generation Electrical Infrastructure and Grid Connection in particular are summarised in section 2 with more detail included in Appendix A. The Power Systems PCS Ltd track record is outlined in section 3.

The Power Systems PCS Ltd contact details are given in section 4.

## 2 Range of Services Offered

The range services offered by Power Systems PCS Ltd are outlined below firstly in general terms and then in relation to renewable generation electrical infrastructure and grid connections.

### 2.1 General Services

The general services offered by Power Systems PCS Ltd are summarised below:

- Design and Consultancy
  - Feasibility Studies
  - Electrical Designs and Specifications for Electrical Power Networks from 11kV to 400kV
  - Electrical connections and infrastructure for renewable generation schemes
- Project Management
  - Project Management of Transmission and Distribution Projects
- Technical Services
  - Substation condition assessments and surveys
- Building Services
  - Design/Specifications and project management for commercial and industrial installations
  - Lightning Protection Systems
- Project Support Services
  - Project Planning
  - Project Stage by Stage Diagrams
  - Project Presentations
  - Data Management
- Earthing Design and Transient Analysis
  - Electrical interference studies with other services
  - Design/Re-design of substation earthing systems (11kV to 400kV)
  - Earthing system modelling
  - Design of Earthing / Lightning Protection /LV Supplies for aerial installations on transmission towers
  - Lightning Protection Schemes
  - Fast Transient Analysis Studies
  - Insulation Co-ordination
- Power Quality
  - Quality of Supply and fixed plant assessments and advice
  - Harmonic measurement analysis
  - Flicker measurement and analysis
  - Transient disturbance measurement and

- Protection
  - analysis
  - Protection scheme design and specification for Generation, Transmission and Distribution systems
- Power System Analysis
  - Full range of power system analysis studies ( Load Flow, Short Circuit, Harmonic, Protection Co-ordination, Dynamic Stability)
- Site Based Activities
  - Soil Resistivity Measurements
  - Earthing System Impedance Measurements (LV to 400kV)
  - ROEP Assessments and Hot Zone Plots (11 to 400kV)
  - Conductor tracing/connectivity checks
  - Risk Assessments
  - Overhead line tower footing resistance measurements
  - Protection Maintenance and Commissioning
- Training Courses
  - Earthing System Design, Analysis and Measurements
  - Earthing System Measurement Methods

In addition to the above services, through our network of associated companies, we can offer services in

- Plant Testing
- Condition Monitoring
- Mechanical and Civil Engineering
- Planning and Environmental Issues
- Renewable Energy Resource and Energy Yield Assessments

We are registered on the Utilities Vendor Database (Achilles) as supplier number 84014 as a supplier of services in

- Windfarm Construction
- Substation Design – Transmission
- Substation Design – Distribution

- Technical Consultancy
- Planning Consultancy
- Electrical Consultancy – 11kV & Below
- Electrical Consultancy – 20kV to 99kV
- Electrical Consultancy – 100kV to 199kV
- Electrical Consultancy – 200kV & Above

## **2.2 Renewable Generation Electrical Infrastructure and Grid Connections Services**

Power Systems PCS Ltd can offer a number of services in support of the infrastructure and grid connection aspects associated with renewable generation projects, as outlined below:

- Feasibility and conceptual design studies
- Earthing and Lightning Protection system design and specification
- Power System Studies including load flow, fault level, protection, harmonics, transient stability and switching/lightning strike transients.
- Power Quality and Network Disturbance analysis and monitoring.
- Electrical Infrastructure Design and Specification
- Protection System Design and Specification
- Grid Connection Design and Specification
- Review and optimisation of proposed electrical infrastructure and grid connection designs

A number of these services are addressed in more detail Appendix A.

Further details of the services available from Power Systems PCS are given on our website: <http://www.pcs-scot.co.uk/>

### **3 Track Record**

Since the establishment of Power Systems PCS Ltd in March 2002, the majority of our track record has been in the provision of project engineering services and specialist consultancy services (earthing, power system analysis, power quality measurements) to electrical utilities.

A listing of organisations that Power Systems PCS Ltd has provided services to is given below:

- SP - Generation UK - Atlantic Quay
- SP – Generation UK – Longannet
- SP – Generation UK - CRE
- Scottish Power PLC – Cathcart
- SP Power Systems
- Scottish & Southern Energy Ltd
- IGE Energy Services Ltd
- Cruickshanks Ltd
- CLP Envirogas Ltd
- Sgurr Energy
- Network Rail
- Lothian NHS Trust
- North Glasgow University Hospitals
- Perth Royal Infirmary
- Devro (Scotland) Ltd

In addition, the Power Systems PCS Ltd personnel had been involved in a wide range of electrical design, analysis and project engineering activities for a variety of organisations prior to the establishment of Power Systems PCS Ltd.

## 4 Contacts

The PCS contact details are:

Power Systems Project and Consultancy Services (PCS) Ltd  
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## **Appendix A**

### **Renewable Generation Electrical Infrastructure and Grid Connection Services Offered by Power Systems PCS Ltd**

- Feasibility and conceptual design studies
- Earthing and Lightning Protection system design and specification
- Power System Studies including load flow, fault level, protection, harmonics, transient stability and switching/lightning strike transients.
- Power Quality and Network Disturbance analysis and monitoring.
- Electrical Infrastructure Design and Specification
- Protection System Design and Specification
- Grid Connection Design and Specification
- Review and optimisation of proposed electrical infrastructure and grid connection designs

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## **A: Renewable Electrical Infrastructure and Grid Connection Services Offered by Power Systems PCS Ltd**

As outlined in 2.2, the renewable generation electrical infrastructure and grid connection services offered by Power Systems PCS Ltd include:

- Feasibility and conceptual design studies
- Earthing and Lightning Protection system design and specification
- Power System Studies including load flow, fault level, protection, harmonics, transient stability and switching/lightning strike transients.
- Power Quality and Network Disturbance analysis and monitoring.
- Electrical Infrastructure Design and Specification
- Protection System Design and Specification
- Grid Connection Design and Specification
- Review and optimisation of proposed electrical infrastructure and grid connection designs

The main features of each of the above services are outlined briefly below.

### **Feasibility and Conceptual Design Studies**

- Assessment of grid connection locations, capacity and potential reinforcements (if required)
- Assess the capital costs of connecting to the grid
- Assess the limitations and reliability of the proposed connection
- Assess connection options by identifying optimum connection points on the utility networks
- Analysis of connection costs
- Assess power flows, thermal limits, voltage constraints, fault level, stability, protection and many other limitations for generation connections

- Advise on timescales for planning, way-leaves etc

## **Earthing and Lightning Protection System Design and Specification**

- Measurement of the local soil resistivity characteristics for substation and generation locations.
- Design and specification of generation and substation earthing system to meet electrical and lightning protection system requirements and produce safe step and touch potentials.
- Calculation of substation/turbine Rise of Earth Potential (ROEP) and extent of any hot zone boundary limits.
- Measurement of impedance of installed earthing systems.

## **Power System Studies**

- Load Flow studies to assess equipment ratings and loadings, voltage profiles, losses etc.
- Fault Level Studies to, short-circuit current levels and flows to assess equipment capabilities and undertake protection co-ordination studies.
- Protection studies to determine protective device settings to achieve co-ordination.
- Transient stability studies to assess system responses to events such as fault disturbances, generation trips/start-up etc.
- Harmonic studies to assess harmonic distortion levels and penetration and effectiveness of any potential mitigation measures.

## **Power Quality and Network Disturbance Analysis and Monitoring**

- Power Quality investigations, including measurement and analysis of Harmonic Distortion; Voltage Flicker; Voltage Dips; Demand (real, reactive, pf etc); Transients

- Assessment, Design and Specification of remedial measures to improve power quality, transient performance etc.

### **Electrical Infrastructure Design and Specification**

- Outline, preliminary and detailed design of electrical infrastructure from the generation terminals to the point of connection on the distribution/transmission system.
- Specification of electrical infrastructure plant and equipment from the generation terminals to the point of connection on the distribution/transmission system.
- Tender assessment for electrical contractors
- Assistance during construction and commissioning including supervision of electrical infrastructure works; assistance with commissioning; co-ordination and management of health and safety issues.

### **Protection System Design and Specification**

- Design, specification and selection of protection schemes and equipment
- Fault flow and fault level calculations.
- Check co-ordination of existing or proposed protection, recommending changes where required.
- Check protection to ensure electrical plant is protected from damage due to short circuits and overloads, recommending changes where required.
- Setting of new protection equipment.

### **Grid Connection Design and Specification**

- Assessment of grid connection locations, capacity and potential reinforcements (if required)
- Review and optimisation of grid connection and any associated transmission/distribution system reinforcements proposed by connection utility
- Negotiation of connection agreement with utility

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- Assessment of benefits and risks of contestable /non-contestable connections
  - Management of utility activities associated with grid connection e.g. wayleaves, planning applications, reinforcement works.

### **Review and Optimisation of Proposed Electrical Infrastructure and Grid Connection Designs**

- Review of proposed electrical infrastructure and grid connection designs to ensure equipment is adequately rated e.g. cables, transformers, and switchgear.
- Review of proposed protection and control schemes to ensure that plant and personnel are adequately protected, isolation and interlocking complies with operational and health and safety requirements.