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HIGH VOLTAGE SPECIALISTS
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CASE STUDY 16206

Crystal Rig IV Wind Farm

11 Wind Turbines with a connection capacity of 49.1MW capable of powering 50,000 Homes

GRID CONNECTION | 33kV Grid Route | TOTAL CAPACITY 49.1 MW | 11 TURBINES

RJ McLEOD

Fred. Olsen Renewables

Introduction

Powersystems were appointed as the Electrical Balance of Plant (EBoP) contractor for Crystal Rig IV, responsible for the design, installation, testing, commissioning and energisation of all electrical infrastructure supporting this 49.1 MW wind farm extension.

Crystal Rig IV expands one of the UK's largest onshore wind farms, following consent from the Scottish Government. The site comprises 11 wind turbines, exporting clean energy at 132 kV - enough to supply more than 50,000 homes.

Construction began in mid 2024 as an extension to the existing Crystal Rig II facility, integrating seamlessly with the established Scottish Power Transmission (SPT) network.

Project Facts and Figures

- 132 kV substation: 1
- Grid transformers: 1 (90 MVA)
- Auxiliary transformers: 1
- Wind Turbine Generators: 11
- Turbine ratings: 4.5 MW and 4.3 MW
- Installed capacity: 49.1 MW
- Connection voltage: 132 kV
- Site altitude: Approx. 250 ft
- 33 kV cabling installed: 20 km
- NERS accredited ICP
- Energy for: ~50,000 households

33 kV 132 kV

Powering the Transition to a Sustainable Future

Crystal Rig IV - Wind Farm delivering a connected capacity of 49.1MW

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400kV 132kV 11kV 33kV 275kV 66kV

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Powersystems Partnerships

Crystal Rig IV is located in Innerwick, East Lothian, adjacent to the existing Crystal Rig II Wind Farm and the nearby SPT Crystal Rig Substation.

Delivered in partnership with civil engineering specialists R.J. McLeod, the project continues a long-standing relationship between Powersystems and Fred Olsen Renewables.

The wind farm connects directly to the SPT 132 kV transmission network, requiring close coordination with the Transmission Network Operator to ensure compliance, protection integration and safe energisation.

With decades of experience working with all UK TNOs, Powersystems brought essential HV expertise to support the successful delivery of this technically complex extension.

Wind Generation Development

The UK continues to expand its renewable energy capacity as part of a broader transition to a more sustainable, low carbon energy landscape. Wind generation remains the most significant contributor to Scotland's electricity supply.

Crystal Rig IV consists of:

- 9 × 4.5 MW turbines
- 2 × 4.3 MW turbines

Turbines generate at 33 kV, arranged across three arrays, before being stepped up to 132 kV via a 90 MVA 33/132 kV grid transformer. Power is then exported directly into the SPT transmission network.

This extension enhances the output of the existing Crystal Rig wind cluster, improving regional energy resilience and maximising the use of an established renewable zone.

Scope of Works and Major Design Considerations

Powersystems designed, supplied, installed and commissioned all major electrical infrastructure, including:

- 132 kV Substation Works
- 90 MVA 33/132 kV Grid Transformer
- 145 kV Hybrid (Hypact) Circuit Breaker with VT
- 132 kV busbars and steel support structures
- 132 kV disconnectors and earthing switches
- 33/0.415 kV auxiliary earthing transformer

33 kV and Balance of Plant Systems

- 5 panel Schneider WS 33 kV switchboard
- 20 km of 33 kV cabling
- Substation and WTG earthing systems
- LV, control, communication and signal cabling
- LV distribution systems
- Compound lighting and associated controls
- SCADA system interfacing with client networks and turbine supplier
- 132/33 kV protection scheme design and deployment

Design Studies

- Protection coordination
- Load flow analysis
- Fault level calculations
- Harmonic studies
- Cable loss analysis
- Transformer bund calculations
- Multiple regulatory and safety compliance checks

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Project Timings

Civil engineering works commenced in early 2023, with Powersystems mobilising in mid 2024.

Despite a short construction period and challenging environmental conditions, the project achieved key milestones, including:

- First energisation of the main substation and initial WTG array: 1 September 2025
- Full site energisation scheduled for November 2025

Proactive planning, strict health and safety management, and strong communication were essential in delivering the project on programme.

What the Client Wanted

Fred Olsen Renewables are committed to developing renewable energy in a way that:

- Supports a decarbonised society
- Protects the environment
- Maintains the highest HSEQ standards
- Delivers long-term value to local communities

Their strategy aligns with Scotland's sustainable energy ambitions, with Crystal Rig IV contributing directly to cleaner, more resilient electricity supply.

How Powersystems Helped

As the HV Balance of Plant contractor, Powersystems delivered high-quality design, installation and commissioning across all electrical systems.

Our support included:

- Ensuring technical accuracy across all engineering outputs
- Providing cost-effective, resilient HV solutions
- Upholding our "Safety First" principle throughout
- Rapidly resolving engineering challenges through experienced HV specialists
- Coordinating diligently with SPT to meet energisation dates
- Prioritising works to enable early generation and avoid costly delays

Our responsibilities included:

- Full electrical design and studies
- Technical support to Fred Olsen Renewables
- HV/LV installation and commissioning
- Protection and control panel installation
- Point on wave commissioning
- SCADA integration
- Cable installation, design and containment

vSAP provision for energisation

Design Works

Design remained a vital stage in ensuring the project met all safety, regulatory and performance standards.
This included:

- 132 kV substation compound and building design
- 132/33 kV protection scheme development
- Battery charger and LV system design
- Substation civil GA drawings
- HV and LV network modelling
- Cable sizing and loss calculations
- SCADA architecture design
- Review of client technical documents
- Full control and signal wiring design

Installation Works - Powersystems installed:

- Substation and compound earthing
- WTG earthing systems
- All 132 kV substation equipment
- 20 km of 33 kV cabling
- LV and control cables
- Five-panel Schneider WS switchboard
- All protection and control panels
- 110 V DC battery chargers
- Compound lighting and custom control panel
- All 33 kV jointing and terminations

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Commissioning Works - Commissioning included:

- Hot and cold commissioning of 33 kV switchboard
- Hot and cold commissioning of transformers
- VLF testing of HV cabling
- Testing of 132 kV and 33 kV protection schemes
- Interface testing with SPT
- LV installation certification
- Insulation and functional testing of all circuits

Energisation Works - Powersystems provided:

- 132/33 kV SAP for substation energisation
- 33 kV SAP for pre energisation checks and turbine array energisation
- Safety documentation issuance and supervision

The Results

The Crystal Rig IV Balance of Plant works will be completed in November 2025, with all turbine arrays energised and handed over on time and within budget.

This project marks another significant collaboration between Powersystems and Fred Olsen Renewables, helping advance the UK's renewable energy landscape.

Environmental Benefits

- 49.1 MW of clean energy for approx. 50,000 homes
- Supports Scotland's sustainability and climate goals
- Reinforces long term renewable energy capacity in East Lothian

Economic and Social Value

Over its 25 year operational life, Crystal Rig IV will:

- Deliver a dedicated community benefit fund
- Support 560 jobs across Scotland, including 180 jobs in the South West
- Provide long-term investment into the Scottish economy

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