POWERSYSTEMS™
HIGH VOLTAGE SPECIALISTS
An Employee Owned Business

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

CASE STUDY 15825

Ginsters

11 kV CHP Transformer Substation

PROJECT VALUE THOUSANDS 89 | 5 MONTHS | CHP ENERGY | 2.7 MegaW

Base Power

nijhuis INDUSTRIES

Clarke Energy® A KOHLER COMPANY
Engineer - Install - Maintain

Ginsters CHP Callington

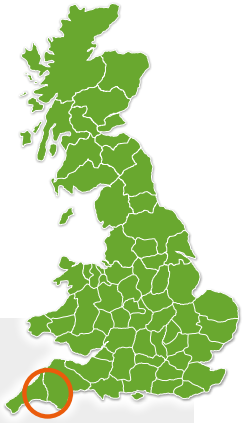
Powersystems high voltage (HV) power engineering were responsible for the design, installation, testing and commissioning of the electrical infrastructure associated with the construction of the 2.7 MW Combined Heat and Power (CHP) Generator Connection at The Cornwall Bakery.

The plant was designed to allow The Cornwall Bakery (Ginsters) to generate their own electricity, hot water and steam as required to supplement the systems already in place. The principle of the development and its impact on environmental, social and economic factors was carefully assessed and given the go-ahead.

The Cornwall Bakery (Ginsters) CHP plant is a 2.7 MW generation platform that will begin to supply power to the bakery in December 2019. The site consists of one 2.7 MW generator powered by a Jenbacher Engine supplied by Clarke Energy which is capable of supplying continuous electricity to the bakery in parallel to the grid. As a trusted NERS accredited company with over 40 years' experience, Powersystems were appointed to assume the responsibility for the installation of electrical infrastructure.

Project facts and figures

- **Number of generators: 1**
- **Generator capacity: 2.7 MW**
- **Total Installed capacity: 2.7 MW**
- **Number of transformers: 1**
- **Transformer rating: 800 kVA**
- **Connection Voltage: 11 kV**
- **Altitudes of site: 590 ft**
- **Length of onsite 11 kV cabling: 0.12 km**
- **Length of onsite 400 V cabling: 0.01 km**
- **Length of onsite control & signal cabling: 0.20 km**
- **Powersystems are a Lloyds registered (NERS) approved independent connection provider (ICP)**



About The Cornwall Bakery

The Cornwall Bakery is a Savoury Pastry Centre of Excellence with class-leading bakery capabilities.

It brings together two long-standing and award-winning bakeries in Callington, Tamar Foods and Lynher Bakery, which are now operating as one centre of excellence under The Cornwall Bakery name.

They are a zero to waste land-fill site, with all of their food waste going to anaerobic digestion. They also recycle all of their waste cardboard and always use fully sustainable palm oil.

They are a large-scale manufacturer of fresh chilled foods, focusing on four main areas: hot eating savoury pastry pies, savoury slices, pasties and rolls, and the one which we all know and love and proud of its Cornish roots, Ginsters is the UK's number 1 savoury pastry brand.

As we celebrate Cornish Pasty Week from the 25th - 29th May, Ginsters has unveiled a gourmet pasty range exclusively available in Selfridges.

Available in a choice of three deluxe flavours, the new range is exclusively available from Selfridges' flagship store on London's Oxford Street. The pasties are served chilled from the deli counter in the renowned Foodhall.

11 kV

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Powersystems partnerships

The site is located in Callington, Plymouth and was constructed in partnership with Njhuis Construction and Clarke Energy on behalf of the client, BasePower.

The site connects onto Western Power Distribution's (WPD) 1 kV electricity network and Powersystems have connected more than 20 MW of CHP generator projects to the grid over the years, this being the largest for BasePower as a client. Our engineers have the much-needed experience of working with every Distribution Network Operator (DNO) across the UK on this type of project, helping customers connect this type of project up and down the country.

CHP development

As UK energy production is changing fast and becoming more expensive, manufacturers who consume large amounts of energy need to find new ways to reduce cost and remain competitive.

Ginsters' CHP will provide The Cornwall Bakery with on-site energy generation. This not only helps the manufacturer reduce cost, it also addresses the Government's strategy for a low carbon economy.

CHP technology works by utilising a fuel source to generate electricity, this project utilised natural gas which is a typically used fuel source. The electricity produced by the CHP will be utilised by the bakery to match the current load consumption, where any excess electricity produced may then be sold back to the grid provided it is within the limits of the export agreement.

The CHP engine will also harness the waste heat produced by the process of generating electricity, this heat will distribute hot water and steam through heating pipework to provide heating and hot water to the bakery buildings.

By being able to generate electricity and heat through one fuel source simultaneously, the CHP becomes much more efficient than traditional power generation due to the reduction in wasted energy and has been known to improve energy efficiency by up to 45%.

Scope of works and major design considerations

The major items of electrical Infrastructure that Powersystems designed, supplied, installed, and commissioned were for the design, supply, installation, testing and commissioning of the 11 kV grid connection consisting of:

- 1 x GBE 80 kVA, 11/0.415 kV ONAN Dyn-11 transformer and associated bund
- Installation of a Schneider RN2c-T1 close coupled Non-Extensible Ring Main Unit (RMU)
- 11 kV Cabling from the Intake substation to the RMU
- 11 kV connection from the RMU to Clarke Energy' G99 circuit breaker (ABB CB)
- Installation of a Power Measurement panel for site import/export signals to the BMS to enable control of the generator output
- 0.415 kV supply connections to Clarke Energy' LV Panel from the 800 kVA transformer
- Cabling for the protection of the associated circuit breakers
- Cabling and marshalling of DNO voltage constraint signals for export limitation
- Transformer earth system installation and testing
- Within the CHP site, the installation of 11 kV power, low voltage, control, signal and communications cabling works
- Carry out full protection study for all new equipment

Design works

Design work is a vitally import part of any Powersystems project, at this stage we ensure the project will meet the clients regulatory, economic and most importantly safety requirements. The design works included in this project are listed below;

- 800 kVA 11/0.415 kV Transformer Bund/Plinth design including general arrangements of the transformer area
- Transformer HV and LV earthing design - this included the general arrangements and conductor calculations for cable sizing adequate enough to carry the relevant fault currents in the event of an earth fault
- HV & LV cable calculations and cable sizing appropriate to the project loads
- HV & LV cable route design, including full site layout high-lighting the fully ducted route from the offsite intake substation to the CHP area. This also included a trench section design which were issued to the civils for construction
- Fault calculations & Protection study for all new equipment, all the new equipment required protection co-ordination to achieve correct and effective grading and this was achieved through the protection study. This included producing protection Single Line Diagrams (SLD) and the study of the protection relay curves using Amtech Protect Software and CAD
- Power measurement panel design, this involved designing a panel that utilised an i5MT Transducer and incorporating the existing CT/VT references to measure the import/export power being utilised by the bakery
- Control & signal cable - this included the design of all small power and equipment control wiring

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Ginsters Project timings

Construction of The Cornwall Bakery CHP generator initially began in 2017, with works being carried on the existing Merlin Gerin Switchgear at the bakery's intake substation. Unfortunately, the project was halted following the successful alterations by Powersystems, mainly for commercial reasons. The project resumed with mobilisation on site in early September 2019 which involved preparing the ground for construction activity. Plant deliveries such as Transformer, RMU and Generator commenced in September/October 2019, with key dates such as Energisation and G99 Testing on 26th November and 5th December 2019 respectively.

What the client wanted

As UK energy production is changing fast and becoming more expensive, manufacturers who consume large amounts of energy need to find new ways to reduce cost and remain competitive.

BasePower offer a solution to manufacturers via their award-winning business model, that would see manufacturers develop and operate on-site energy generation schemes. This not only helps the manufacturer reduce cost, it also addresses the Governments strategy for a low carbon economy. Powersystems being an Independent Connection Provider (ICP) would be charged with becoming a conduit for the grid connection to allow these types of schemes become reality.

How Powersystems have helped

Powersystems were appointed as the CHP project HV contractor, involved with the design, installation and commissioning of the electrical infrastructure for the CHP project. Powersystems aim was to provide a high-quality service throughout this project, Powersystems achieved this by setting out objectives such as ensuring technical correctness, ensuring the client was getting exactly what they asked for whilst adding cost-effectiveness and finally by adhering to the number one Powersystems moto of "Safety First".

During the project there were a number of obstacles to overcome and Powersystems engineers were at hand to provide full support to the client through our excellent engineering knowledge and experience, which enabled the client to smoothly and successfully complete the project.

Powersystems worked closely with the project partners in order for the client to meet their deadlines that included arranged G99 testing and energisation date of 26th November 2019. To achieve this, Powersystems engineers worked with the customer to prioritise the work tasks which resulted in the customer being able to generate power at the set target date to avoid costly penalties.

The list of responsibilities tasked to Powersystems can be summarised by the below;

- Electrical design
- Interface with WPD for status & constraint signals
- Switchgear installation and commissioning
- Transformer installation and commissioning
- Cables & containment design, supply & installation
- HV testing
- Senior Authorised Person (SAP) provision

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Installation Works

Following the design stage, the installation work listed below was undertaken and completed;

- Civils works - the cable route including ducting along with the transformer plinth were completed
- 11 kV cable installation – 185 mm² Triplex cable at roughly 120 m was installed in to a fully ducted route from the Intake substation located north of the bakery and arrived at the close coupled RMU/TX plinth located in the CHP area. The 185 mm² triplex cable then continued from the TX/RMU area into the newly constructed GRP HV room where the ABB switchgear was housed
- Transformer - Installation of the 800 kVA 11/0.415 kV Dyn-11 transformer and close coupled RMU onto the newly installed plinth located in the CHP area
- LV cable installation – Small power, control and signal cables were installed parallel to the 11 kV cable route this allowed us to act as a conduit for the voltage constraint signals from the DNO and other signals such as client back up shunt trip to the CHP feeder CB and accurate import/export status signals
- Earthing - this included the HV earthing that integrated into pre-installed earth matt which was 25 x 3mm copper tape that encompassed the CHP area. The transformer tank was earthed at two POC using 70mm² BS6491 LSZH, along with any other extraneous metal parts such as cable glands, gland plates and the TX fencing. Powersystems also supplied a 120 mm² LV earth to clients LV panel
- Power measurement panel installation - this panel was installed at the Intake substation and involved terminating small power, control and signal cables. The transducer in the panel used the current and voltage references provided by the measuring CT/VT installed in the incomer CB to calculate the import/export consumption of the bakery and visually showed this on the remote display and to the client VIA the BMS
- HV Terminations – there were several HV terminations completed during the project all 11 kV indoor straight terminations to the following equipment; CHP feeder CB, RMU SW1, RMU SW2 and the ABB G99 CB

Energisation Works

- Provision of an 11 kV SAP to liaise with WPD to take control of the CHP feeder CB from WPD
- Provision of an 11 kV SAP to attend site to provide supervision and to undertake pre-energisation checks and issue safety documents to Powersystems operatives
- Provision of an 11 kV SAP to carryout HV cable testing and initial energisation of the CHP feeder CB. Also, to control the testing of the shunt trip between the CHP control panel and the CHP feeder CB
- Provision of an 11 kV SAP to Liaise with WPD to relinquish control of the CHP feeder CB back to WPD

The results:

The Cornwall Bakery CHP connection work was completed in line with the client programme against constricted timescales and within budget. The first generation to the bakery was achieved on 6th December 2019. This project is just one of a number of BasePower CHP projects and hopefully signals a long-term working partnership with Powersystems UK.

Environmental benefits

- Due to the fact that less fuel is burned to produce a given energy output and the bakery is avoiding the use of power from the grid (mitigating transmission and distribution losses), the CHP therefore reduces emissions of greenhouse gases and other air pollutants such as carbon dioxide, nitrogen oxide and sulphur dioxide

Economic benefits

- The CHP will save the bakery considerable amounts of money on their energy bills due to its high efficiency
- Protection of revenue through onsite generation and improved reliability, the CHP can allow the bakery to continue to operate in the event of an interruption of the grid supplied electricity
- Less exposure to electricity rate increases, due to the fact less electricity is being purchased from the grid, the bakery will have less exposure to any rate increases

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