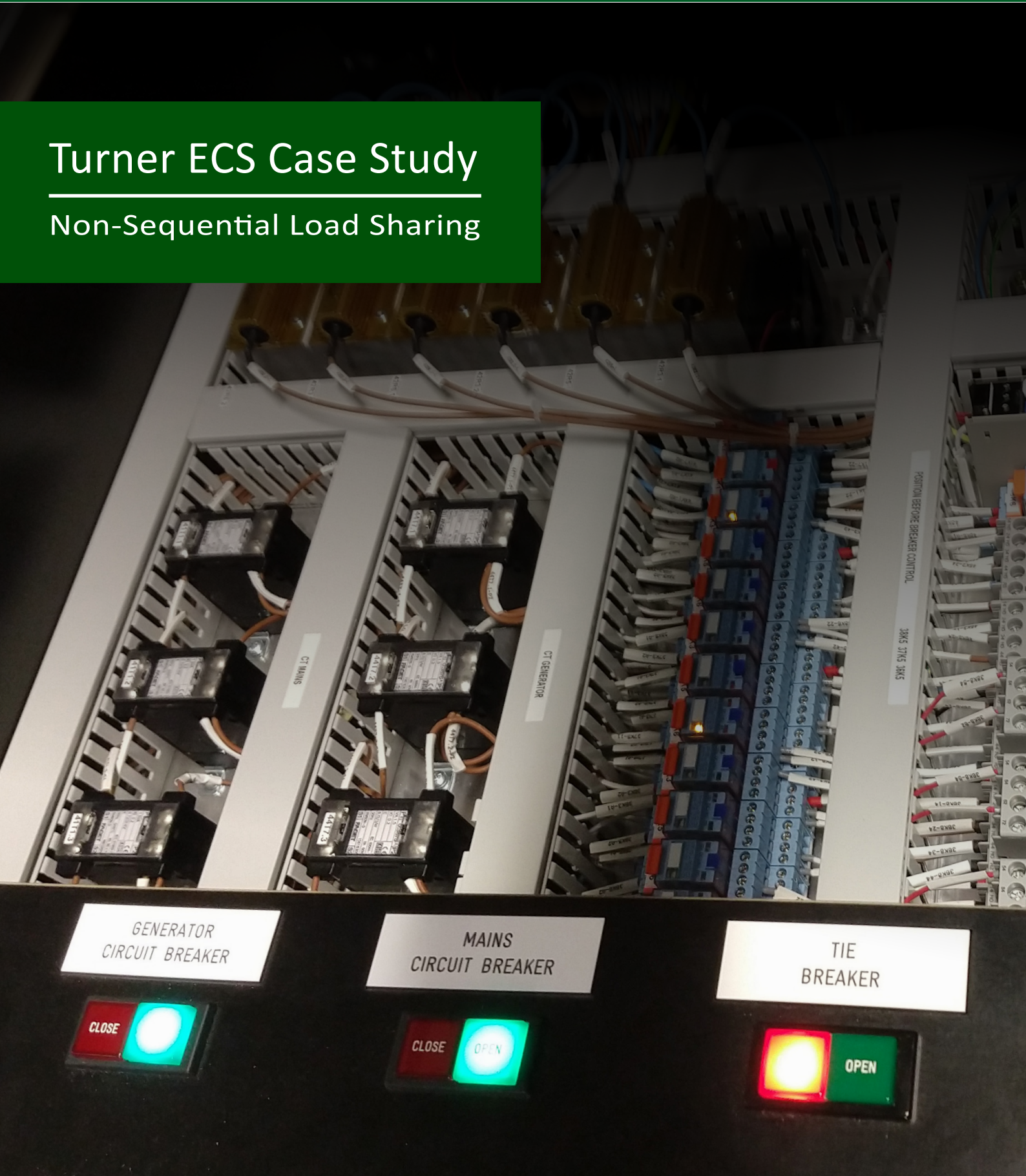


April 2019

## Turner ECS Case Study

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### Non-Sequential Load Sharing





### Introduction

Turner ECS, together with NeoDyne, has performed a reliability upgrade to the standby generator compound at a large biotech plant in Dublin, Ireland. The compound consists of four diesel generators and one CHP (combined heat and power) generator feeding a complex bus bar system where bus and grid voltage references need to be switched to allow for non-sequential load sharing.

### Latest Woodward Hardware

Due to obsolescence and reliability issues the current system, consisting of the obsolete DSLC and MSLC controllers, LON network and relay logic, was replaced by a new system, consisting of DSLC-2 and MSLC-2 controllers, Ethernet networks and a PLC for communicating the segment numbers to the controllers. For supportability and ease of replacement it was decided to use only standard Woodward products.

### Synchronization and Load Sharing

For synchronizing and load sharing the generators, the Digital Synchronizer and Load Controller (DSL-2) and the Master Synchronizer and Load Control (MSLC-2) were used to simplify the integration and control of the complex power system, having multiple generators, utility feeds, and inter-tie breakers.

### Generator and Feeder Protection

From Woodward's HighPROTEC line MCDGV4 generator differential protection, MRA4 CHP incomer protection and MRU4 mains incomer protection was used on the 21 kV bus.

LATEST WOODWARD  
HARDWARE

SYNCHRONIZATION &  
LOAD SHARING

GENERATOR & FEEDER  
PROTECTION

IN-HOUSE TESTING

INSTALLATION &  
COMMISSIONING

### PROJECT DETAILS

#### GENERATOR CIRCUIT BREAKER CONTROL

- 4 Diesel Generators
- 1 CHP Generator
- 2 Load Sharing Networks

#### TIE & GRID CIRCUIT BREAKER CONTROL

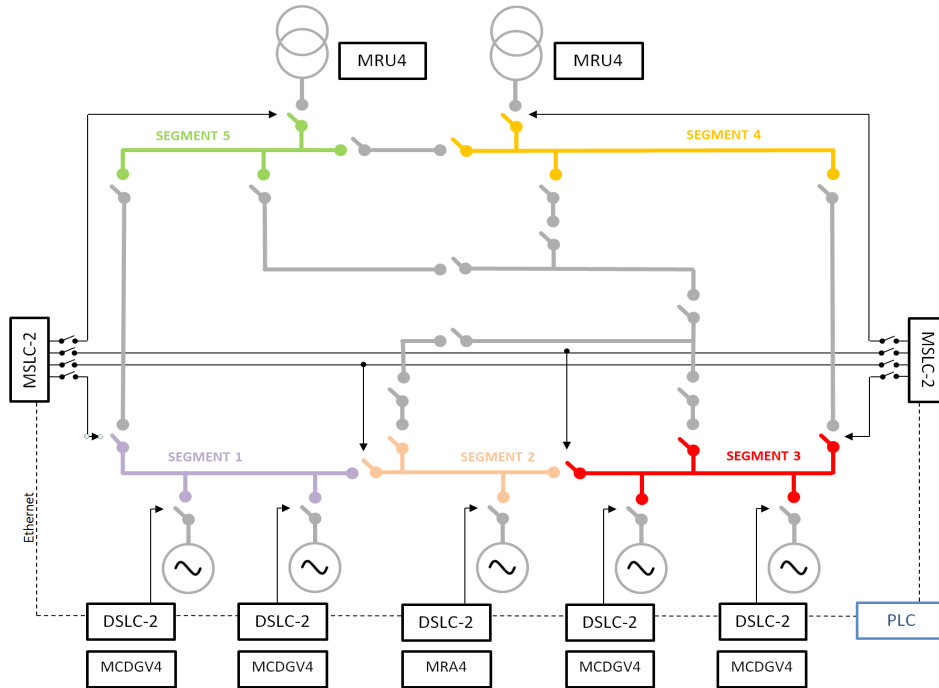
- 5 Bus Segments
- 2 Grid Breakers
- 4 Tie Breakers
- Multiple hand breakers

### FACT SHEET

Diesel OEM:	Caterpillar
CHP OEM:	Turbomach
Site Name:	Grange Castle
Plant:	Biotech
End-User:	Pfizer
Integrator:	NeoDyne

## Turner ECS Case Study | Standby Generator Compound | Non-Sequential Load Sharing

### Single Line Diagram

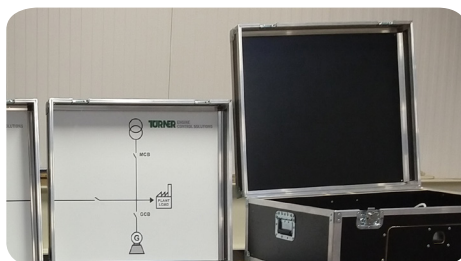
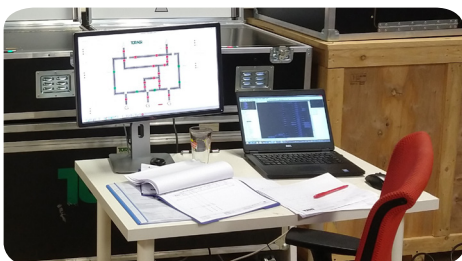


### In-house Testing

To ensure effortless implementation on site the system was first factory tested at Turner ECS' premises using Turner ECS' own generator test stand and a custom made Toolkit HMI application for visualization. The Turner ECS test stand comprises of two miniature generators, allowing for both speed and voltage regulation, a load bank, a tie breaker and a grid breaker. The DSLC-2 and MSLC-2 controllers as well as the PLC were wired to the test stand to verify multiple scenarios.

### Commissioning

At site various tests were performed to prove the integrity of the new system and to tune the synchronization and load sharing. These tests included running individual gensets in baseload against the grid and against a load bank, simulated mains failure, all generators in island mode and tripping on high load. Throughout all the tests the new system performed as expected and was thus successfully handed over to operations.



### HARDWARE USED

#### WOODWARD MSLC-2 / DSLC-2

- Load Sharing
- Synchronization
- Redundant Ethernet



#### WOODWARD HIGHPROTEC

- Generator protection
- Feeder protection



### HARDWARE REPLACED

- DSLC (generation 1)
- MSLC (generation 1)
- LON network
- Relay logic

## Turner Range of Services

**LSTK Projects, Retrofits & Upgrades**  
Turner ECS delivers reliable retrofit solutions for a wide range of prime movers and other applications. This includes lump sum turnkey projects on turbines and compressors.

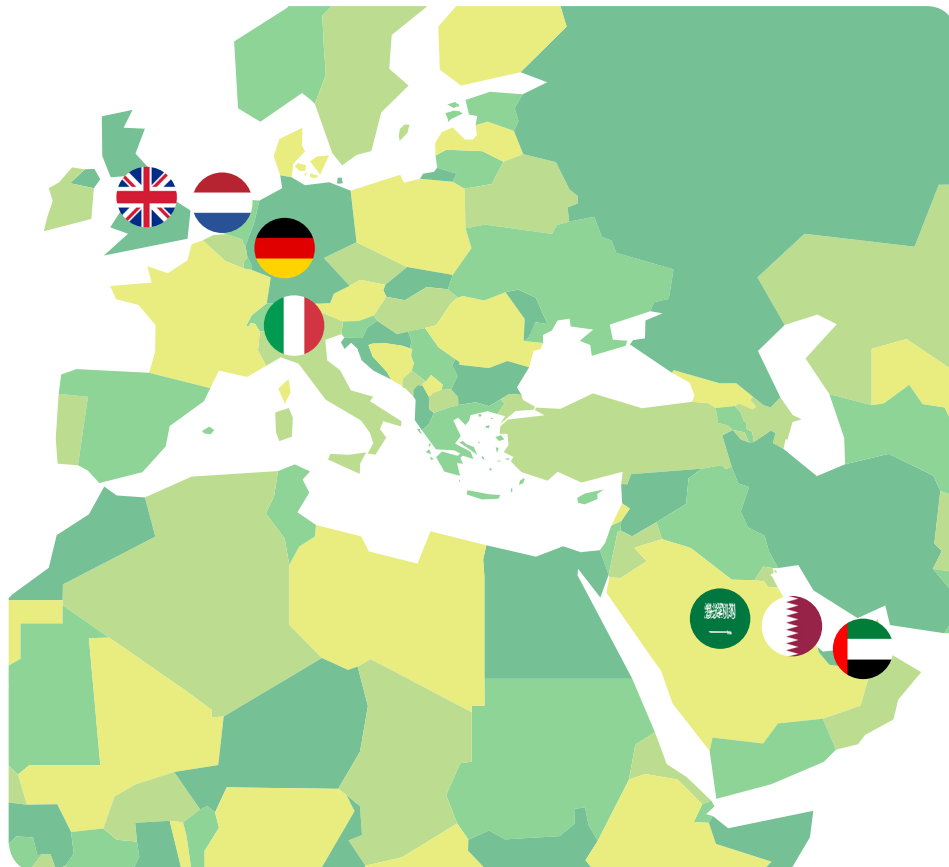
**Genuine Parts & Service Exchange**  
Turner ECS has the largest stock of parts, service exchange governors and electronics in Europe and can provide a fast turnaround service.

**Product Training**  
Turner ECS can provide official Woodward product training covering both theoretical and practical training on a wide range of Woodward products.

**Electronic Repair & Mechanical Governor Overhaul Service**  
Turner ECS provides a comprehensive overhaul and repair service for electronic, mechanical and hydraulic governors.

**World Wide Field Service**  
Turner ECS field service engineers and technicians provide comprehensive solutions for commissioning and on-site repair.

**Service Contracts**  
Turner ECS provides long term service contracts to support users with Woodward governors and/or control products and electronic control systems.



### ROTATING EQUIPMENT CONTROL SOLUTIONS DELIVERED ACROSS EUROPE & THE MIDDLE EAST

Turner ECS is an official Woodward Channel Partner with offices located in:

- The Netherlands
- England
- Germany
- Italy
- Abu Dhabi
- Qatar
- Saudi Arabia

Turner ECS also operates and manages an extensive network of official agents throughout Europe & the Middle East

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