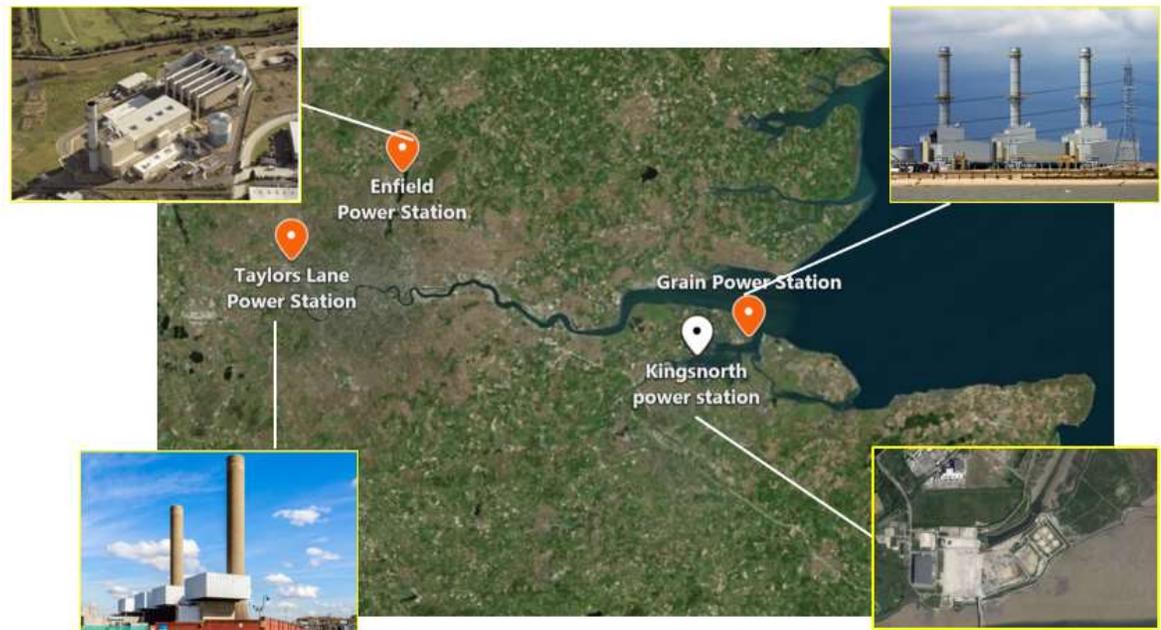
The background of the slide is a dark blue color with a grid pattern. Overlaid on the grid are several faint, light blue line graphs and data series, suggesting a technical or financial context. The graphs show various trends, including peaks and troughs, and some have numerical labels on their axes.

uni per

Enfield C06 Insp + HE Upgrade Outage
“Adapting existing GT assets to meet the changing market needs and prepare for a net-zero future”

Lee Thompson (Outage Manager)
14th October 2021

Uniper Enfield, Grain, Kingsnorth and Taylors Lane - Where are we?



Enfield Power Station is a modern Combined Cycle Gas Turbine Power Plant located at the borders of Essex, Hertfordshire & Middlesex, just inside the M25 London Orbital Motorway and on the edge of the Lee Valley Regional Park.

Introduction to Enfield Power Station

This modern Alstom GT26B powered plant is the third power station to occupy the Brimsdown site which has a long history of power generation dating back to 1904.



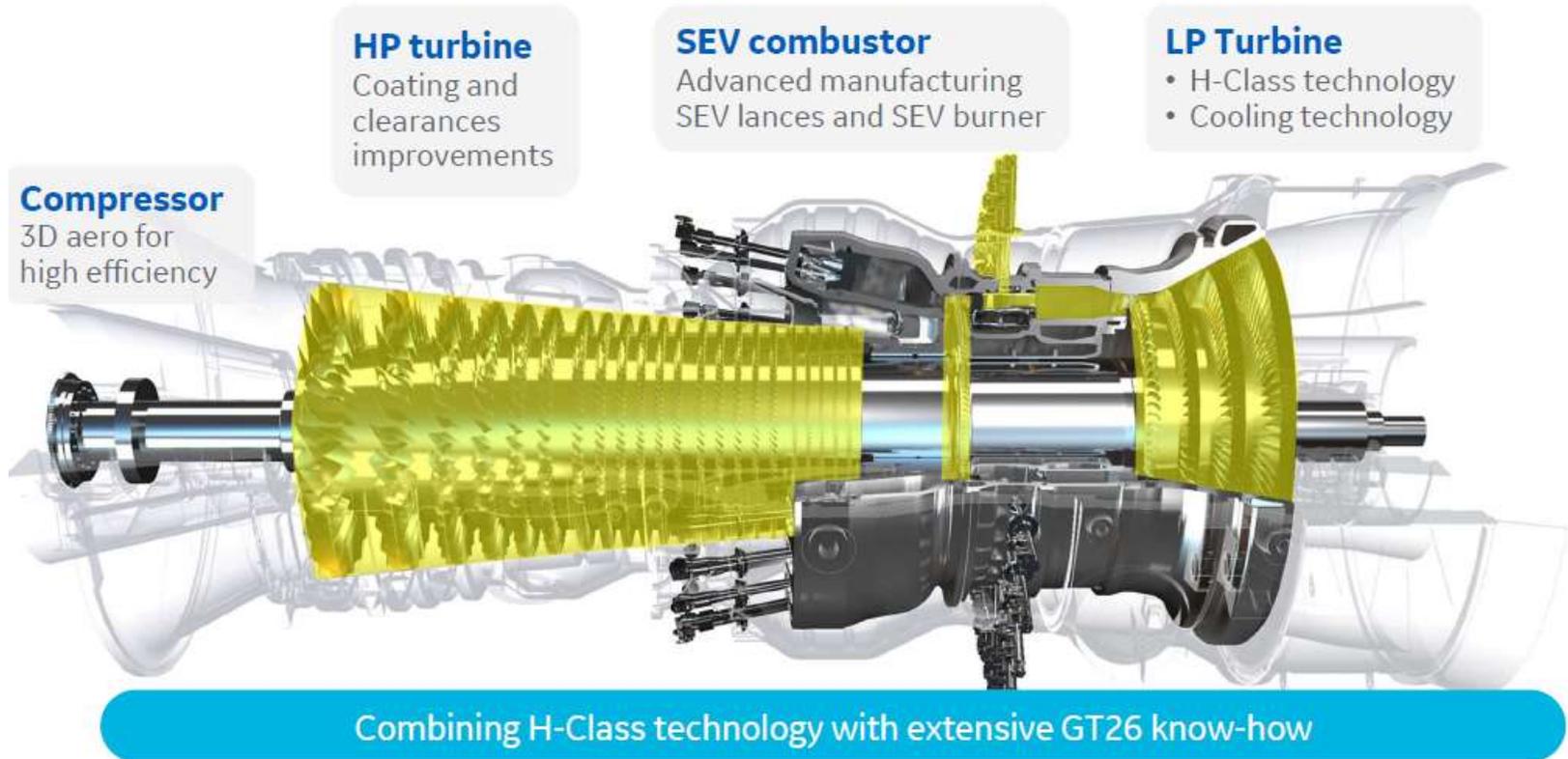
- Built by EECL and Commissioned in 1999, sold to E.ON in 2005, and then Uniper from 2016
- 1 x Single Shaft Combined Cycle Unit (Gas & Steam Turbine)
- ALSTOM GT26 Gas Turbine (B2.2 upgrade 2007)
- Maximum electricity output: 408MW
- CCGT Thermal efficiency: 55%
- Fuel - Natural Gas
- Air Cooled Condenser

Setting the Scene pre HE – the Challenge!

- ‘Vintage’ GT26 Technology – Enfield was one of the first GT26 gas turbines in 1998
- Low to mid-merit Asset in terms of Capacity, Flexibility and Efficiency (2-shifting operation)
- After nearly 20 years of operation, Uniper’s Enfield power plant needed a solution that could increase life-cycle value and utilization of the power generating equipment, while moving towards decarbonizing the gas power plant by reducing CO2 emissions per MW.
- As trusted partners for over 35 years in the gas technology industry, Enfield Uniper was the perfect fit to receive GE’s GT26 HE upgrade.



The GT26 High Efficiency Upgrade



- HE provides both Capacity and Efficiency improvements

“ The GT26 HE upgrade will enable reliable operations at Uniper’s Enfield power plant to generate more energy per unit fuel with lower carbon emissions. It will also improve the plant’s performance by increasing its flexibility, efficiency and output and extend the inspection intervals of the unit “

High Efficiency (HE) Upgrade - Expected levels of Improvement in Plant Performance

Plant maximum export limit (MEL) ↑↑

- Total generated load expected to rise by 10%+, primarily in GT.

Plant operating range



- MEL increases by more than stable operating limit (SEL), thus increasing range of loads.
- Lower load limit also affected by separate modification.

Plant thermal efficiency



- Increased firing temperature and improved compressor aerodynamics suggest combined cycle efficiency to rise above 58% (cf. 60% estimate for new/clean plant & optimised HRSG).

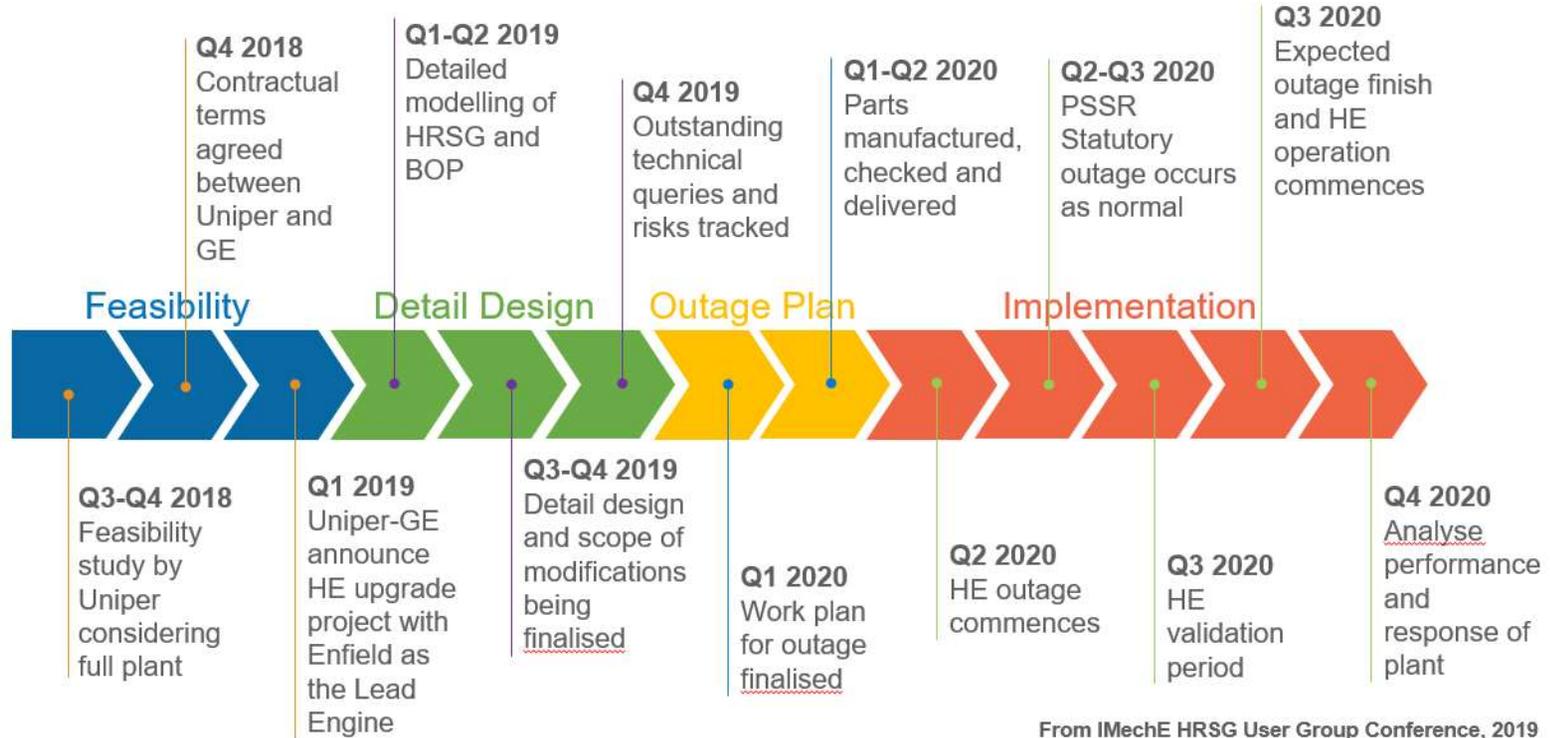
Plant Life ↑!

- Plant has an excellent opportunity for life extension as part of modifications, but will require detailed analysis of component-by-component remnant life and degradation rates.

HE Upgrade – Project Timeline & Key Dates

Project Management Framework

- 1). Initiation phase (12 months duration)
 - 36 to 24 months prior to outage commencement
- 2). Scoping phase (15 months duration)
 - 24 to 9 months prior to outage commencement
- 3). Preparation phase (9 months duration)
 - 9 to 1 months prior to outage commencement
- 4). Implementation phase
 - 1 month prior to outage commencement & outage duration
- 5). Close Out phase (3 months duration)
 - 0 to 3 months post outage completion



- Planned Outage Duration - 161 days (26th April to 4th October 2020)
- Contractor numbers - expect to CDM induct > 800 people

Consents Required as part of the Upgrade

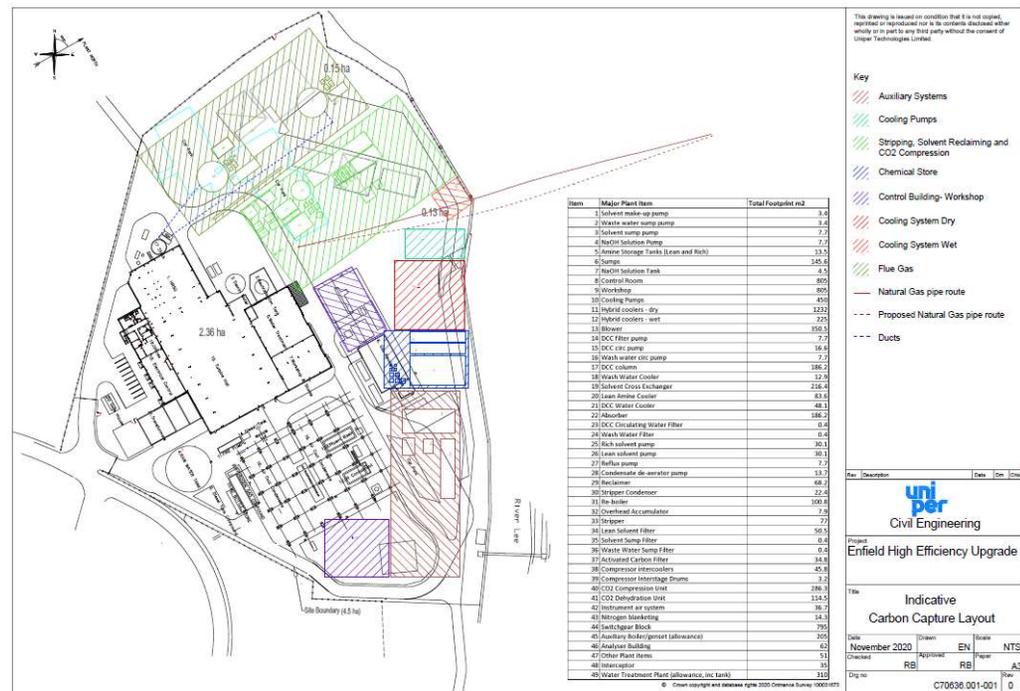
Due to the increase in capacity the Project required the following Consents / Permits to be varied:

- **Section 36 Planning Consent:** (issued by UK Government Under the Elect. Act 1989)
 - Variation application made to BEIS consenting Team, with supporting information.
 - BEIS consider merits of variation in consultation with statutory consultees.
 - Information will be made available to the public by Uniper as part of the variation process.
 - BEIS issue a varied consent.
- **Environmental Permit:** (issued by the Environment Agency, under the Environmental Permitting Regulations 2016)
 - Permit application for a minor permit change to be made to EA.
 - EA determine permit variation, consultation part of the permit variation process.

Carbon Capture Ready

UK Requirements The Carbon Capture Readiness (Electricity Generating Stations) Regulation 6(b):

Where it is proposed to vary a Section 36 consent which already authorises an output of 300MW or more to increase the output, the Secretary of State must not grant the Section 36C consent unless it has determined whether the CCR conditions are met in relation to the modified plant.



Achieved Plant Technical Performance

- Efficiency and Power Output improvements have been achieved:
 - **Capacity** > + 25 MW
 - **Full Load Efficiency** > + 2%
 - **Flexibility** – Emissions compliance at 130 MW (- 100MW)
 - **Time to Load** > 21 MW / min
- Uniper independently verified pre-outage and post-outage plant performance at Enfield
 - It is among the most extensive and rigorous site tests in the GT26 gas turbine history of more than 20 years
 - Over 2000 sensors provided data to GE’s engineering team to confirm safe and reliable operations.

Publicly advertised HE Upgrade performance by GE:

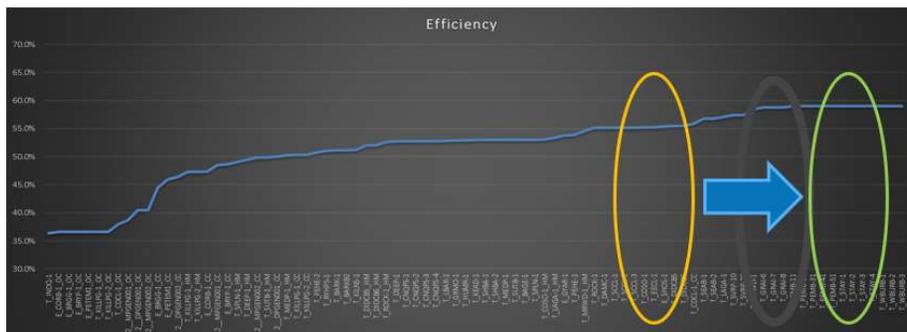
“Installed with HE upgrade, the GT26 unit at Uniper’s Enfield power plant is the world’s first to achieve H-class performance levels approaching 60% combined-cycle efficiency”



From GE Website

Post “High Efficiency“ upgrade Operating Regime:

- Top end of % band for UK GT power plants
- Extended Base Load Operation
- Only 20 starts since RTS end May 2021
- High Merit Order
- Reliability - 99.8% since RTS



Summary Overview

- HE – installing a world’s first prototype
- Significant plant improvement and risk management projects
- A peak of 500 working personnel
- In outage mode for 12 months (execution phase) + *12 months planning and preparation*
- Delivery with full COVID19 controls in place
- Staff from across EGTL supporting Enfield HE Outage throughout 2020/21
- Significant Enfield HE scope being delivered at Grain
- Functional organisations supporting



Thank you for listening

Any Questions?

