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Life Extension and Maintenance Strategy Optimisation of Gas Power Plants

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Abstract

Across mature power markets, gas-fired assets are entering mid- to late-life. Declining capacity factors, driven by rapid renewable integration, are intensifying budget pressures and making cost-effective maintenance planning critical. Simultaneously, the shift toward renewables is forcing plants into increasingly cyclic operation, accelerating component degradation and introducing new reliability challenges. Grid capacity constraints, connection delays, and rising Original Equipment Manufacturer (OEM) costs and lead times exacerbate challenges for new-build projects. Meanwhile, global energy systems are pursuing ambitious decarbonisation targets, aiming for near-zero emissions within the next two decades. Achieving these objectives requires significant investment in low-carbon technologies, often with long payback periods and under uncertain regulatory and market conditions.

Life Extension and Maintenance Strategy Optimisation (LEMSO) provides a pragmatic, engineering-led response to these challenges. The methodology integrates whole-plant condition assessment, risk modelling, and cost forecasting, with systematic evaluation of strategic options aligned to business objectives. LEMSO enables operators to extend asset life, optimise maintenance strategies, or combine both approaches to meet business goals. It delivers visibility of long-term risks and costs, prioritises maintenance and life-extension investments, and ensures operation within acceptable risk thresholds. Additionally, it creates pathways for new business opportunities such as performance upgrades, carbon capture integration, peak-load support, high-demand applications such as data centres, along with maintaining grid reliability throughout the energy transition.

LEMSO has been successfully implemented at the Pembroke (2.2 GW) and Staythorpe (1.85 GW) Power Stations, the UK's largest Combined Cycle Gas Turbine (CCGT) sites, delivering extended asset strategies through 2050. These studies identified high-risk equipment and potential failure modes, unlocked opportunities to defer or reduce future maintenance expenditure, and provided life-extension costings to support business case development. The approach also optimised major spares strategies across the portfolio and strengthened RWE's late-life asset expertise to independently verify OEM recommendations. Building on these results, LEMSO is now being deployed across additional gas power plants.