



Technical Feasibility of Power System Stabiliser (PSS) Compliance in Engine Power Plants

Grid Connection European Stakeholder Committee meeting (GC ESC)

Wednesday, 4 March 2026



Europe's leading engine power plant manufacturers:

ABB Oy, Caterpillar Energy Solutions, EC Power A/S, Everllence, INNIO, Rolls-Royce Power Systems, Wärtsilä – collectively delivered over 25 GW of decentralised, flexible generation capacity.



Reliable – Flexible - Efficient – Sustainable

Ultraflexible power & heat when needed and as long as needed – running on many fuels from natural gas, biogas, biomethane, HVO, to hydrogen & derivatives



European Technology

Engine power generation has a strong European footprint in manufacturing & innovation – the European industry provides globally competitive energy technology solutions

The Challenge - PSS Verification Gap

Power System Stabiliser (PSS) Verification: A Technology-Neutral Challenge

The Facts:

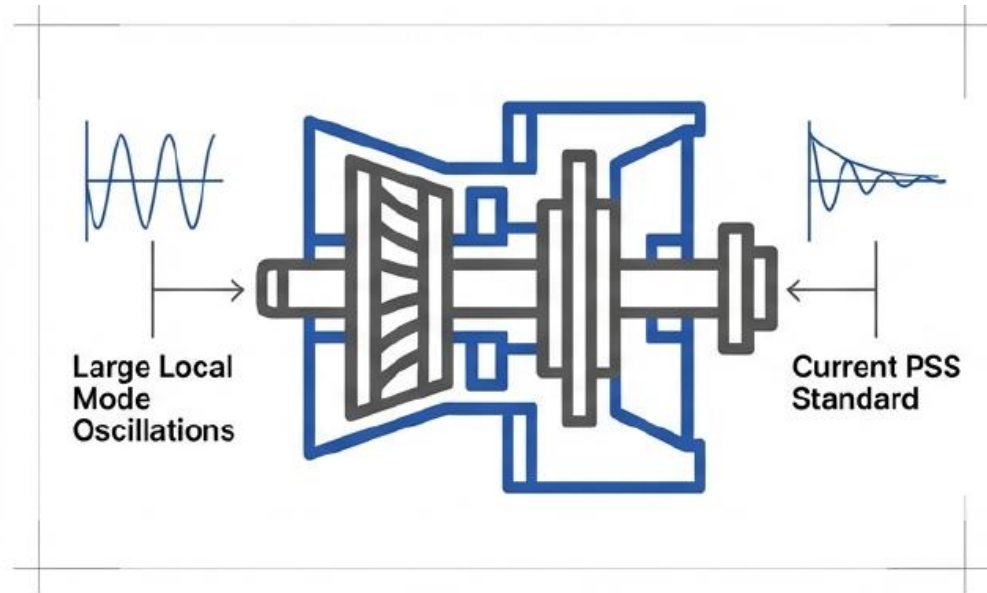
- Gas reciprocating engines **CAN provide PSS functionality** → **The issue is verification, not capability**
- Current testing methods designed for gas turbines are technically inappropriate for reciprocating engines:
 - Technical Reality: Engines exhibit higher local eigenfrequencies (1.5–5 Hz) compared to gas turbines (1–2 Hz)
 - The Conflict: This requires the PSS to cover twice the frequency spectrum of a standard turbine, leading to unavoidable phase shift deviations across the range
 - Gas Turbines operate with static exciters, while Gas Engines operate with rotating exciters; this influences the exciter reaction time and therefore impacts the engine's PSS effectivity
- This affects ALL gas engine manufacturers (industry-wide issue)

The Methodology Failure

- Legacy testing standards are calibrated for gas turbines.
- Gas engines have distinct eigenfrequencies (1.5-5 Hz vs. 1-2 Hz).
- Applying protocols tailored to Gas Turbines on Gas Engine units may lead to an inaccurate assessment.

Technical Limitations of PSS Functionality in Gas Engines

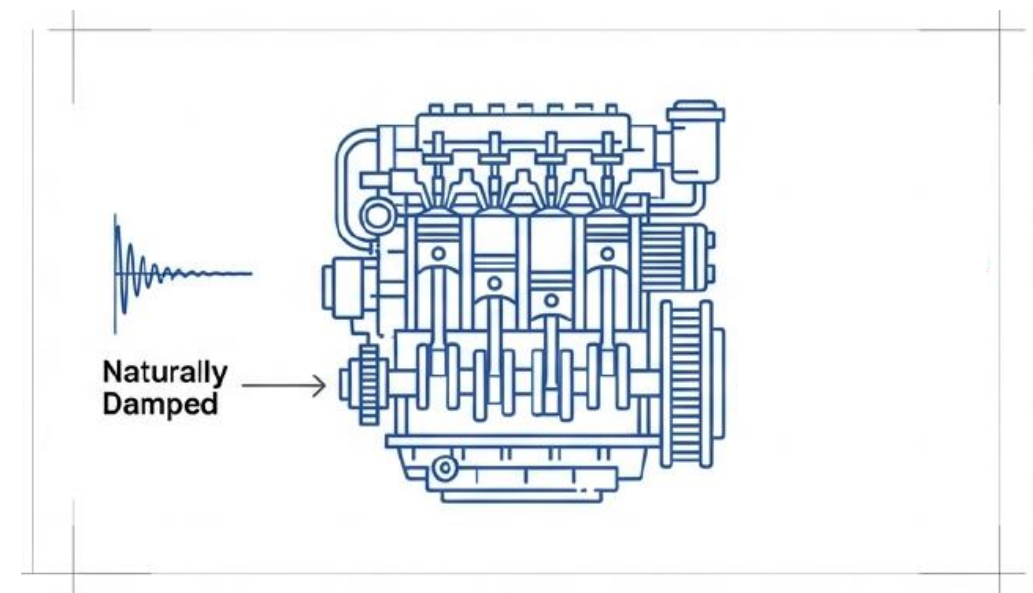
Gas Turbine



The Inertia Discrepancy

Current requirements are tuned for Gas Turbines where PSS is critical for stability. In contrast, gas engines are naturally well damped in the required area due to the higher natural frequency oscillations which dampen faster.

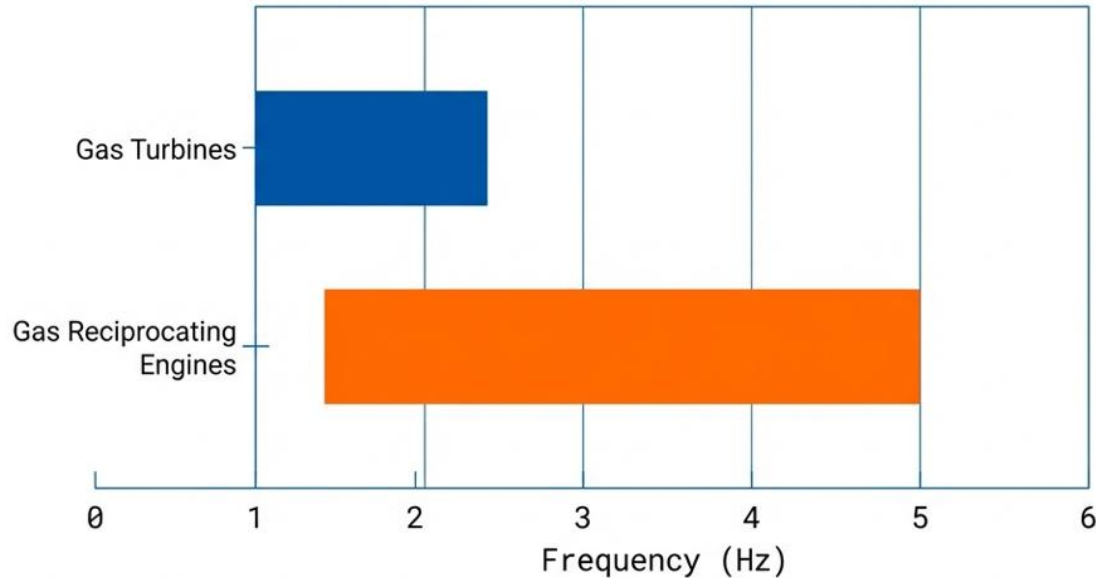
Reciprocating Engine



The Compliance Gap

Individual PGUs (<25 MW) have minor contributions to oscillation. Strict voltage step-response tests fail to capture performance due to low amplitude power changes.

Fundamental Frequency Range Challenges



Higher system eigenfrequencies (1.5 - 5 Hz) due to lower mechanical inertia require a broader damping range (0.3 - 5 Hz).

This extended range complicates PSS tuning compared to traditional turbines.

Extended Tuning Spectrum

PSS must dampen oscillations from 0.3 Hz to 5 Hz

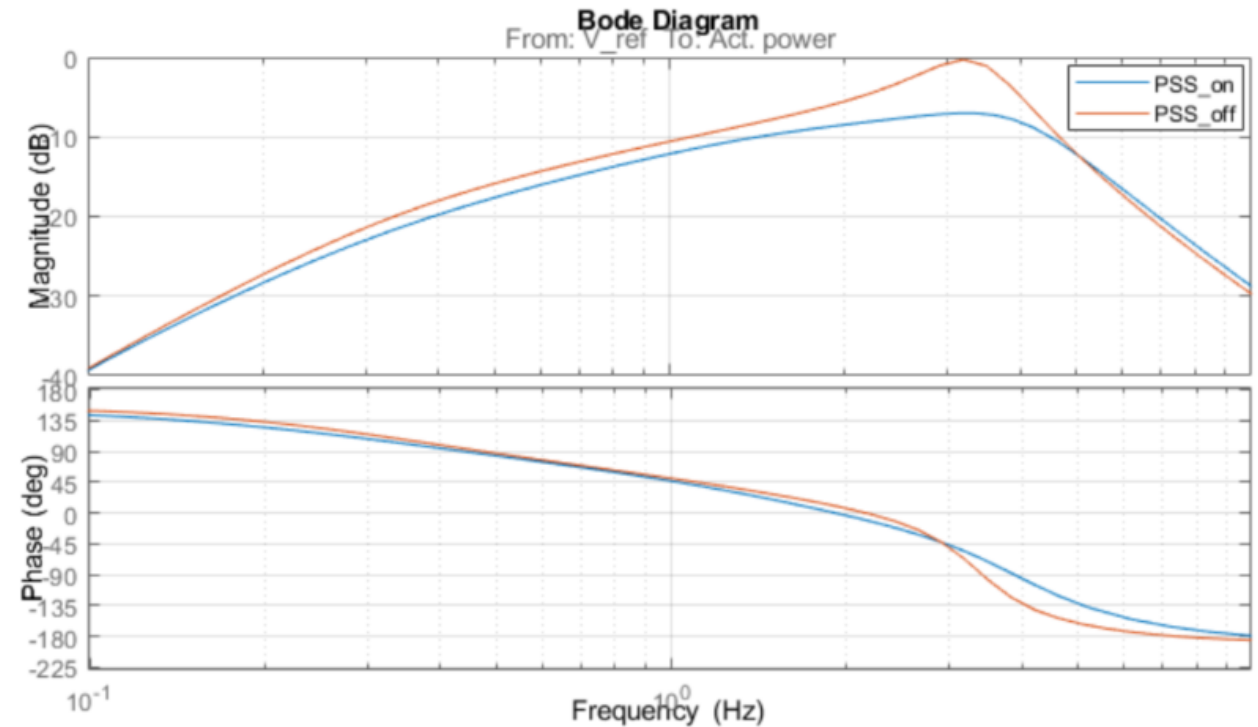
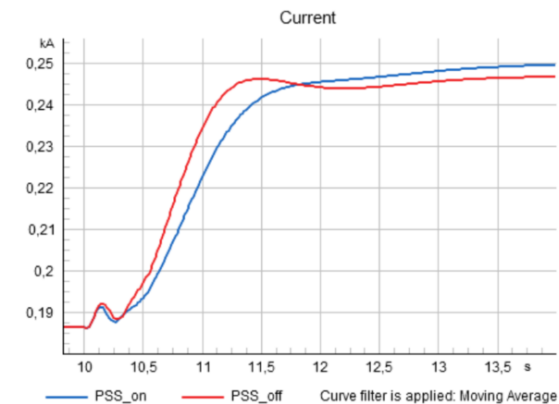
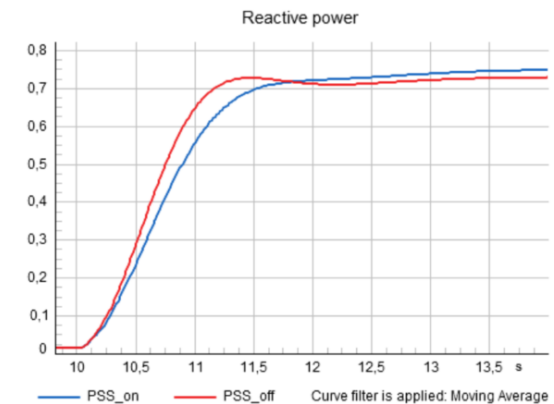
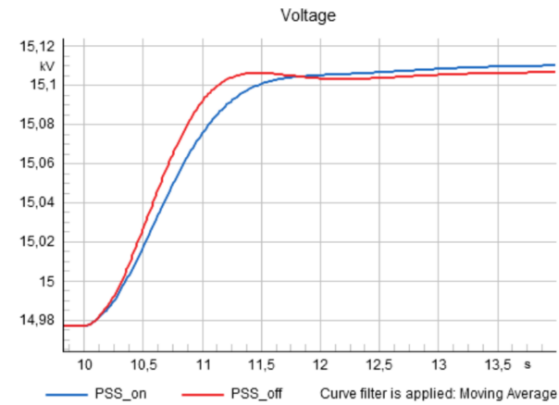
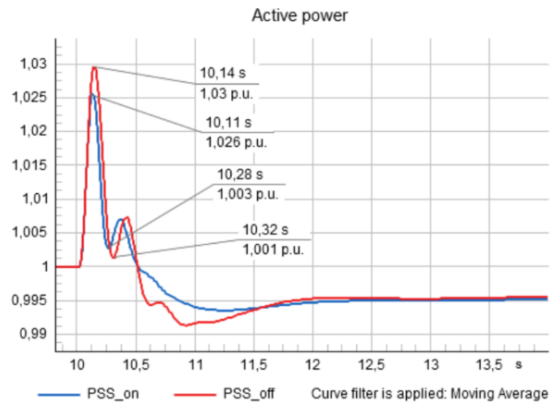
The Trade-Off

Maintaining optimal phase compensation across double-width spectrum is technically extreme

Implication for Gas Engines

Broader range = reduced damping effectiveness at specific frequencies

Evidence of Compliance – Simulation Based



Lower damping seen at frequencies below 1 Hz

The Solution: Technology Neutral NC RfG 2.0

Move from One Size Fits All to Equivalent Assurance



Amendments to Article
19 and Article 53 of NC
RfG 2.0

Proposals for Modification of NC RfG 2.0 – Main Points

Proposal: Amendment to Article 19 (Definition of Requirements)



Adjust Requirements Based on Technology

Article 19 (2)(b)(iii)

The relevant TSO shall take into account the **technical characteristics of the prime mover technology** when establishing capacity thresholds and verification requirements.

Proposal: Amendment to Article 53 (Compliance Simulation)



System
Simulations

OR



Factory Acceptance
Tests

OR



Equipment
Certificates

Article 53(2)(New Paragraph D)

Where on-site commissioning tests are demonstrated to be technically infeasible...compliance may be demonstrated through **alternative means**.

- High-Fidelity Simulations
- Factory Acceptance Testing (FAT)
- Equipment Certificates

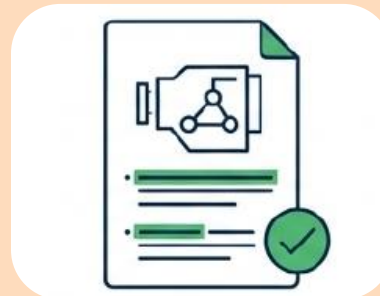
Technology Neutral NC RfG 2.0: Why This Matters Now

The Urgency



Decarbonisation requires a diverse mix of flexible, decentralized power. Modify existing verification methods that stall the connection of high-efficiency engines.

The Request



Adopt the proposed amendments to Article 19 & 53 in the NC RfG. Acknowledge that gas engine technology inertia (H 0.5-3 s) and high eigenfrequencies (1.5-5 Hz) require adapted verification.

The Result



Standardise simulation and FAT as a valid compliance pathway to ensure safe, efficient grid operation.