ME-GI Engine Fuelled by LNG

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All data provided on the following slides is for information purposes only, explicitly non-binding and subject to changes without further notice.
12K80MC-GI-S – Chiba Power Plant
The 10 Years GI Experience

1994 - 2003

GI = High Pressure Gas Injection
General Data for
Liquid Gas Delivery Condition:

**Pressure:**
Nominal 550 bar
Max. value 600 bar
Pulsation limit 3 bar
Set point tolerance 5%

**Temperature:**
Approx. 25°C -> 55°C / tolerance 10 °C
From Diesel to Dual Fuel Gas Burning Combustion Process

**Two-stroke**
- Diesel process maintained
- Unchanged power density
- Unchanged load response
- No knocking or misfiring risk
- Insensible to gas quality
- No methane slip
- High pressure gas injection

**Four-stroke**
- Otto process by gas-air premix
- Power reduction or increased cylinder bore
- Risk for knocking and misfiring
- Load ramp needed
- Methane slip 2%-4%
- Low pressure gas injection

ME-GI is two-stroke
The ME-GI uses the Diesel Cycle.

**Diesel Cycle**
- Unchanged power density
- Unchanged load response
- Avoids knocking
- No methane slip
- High pressure gas

**Otto Cycle**
- Power reduction or increased cylinder bore
- Load ramp needed
- Pre-mixed combustion process
- Methane slip 2%-4%
- Low pressure gas
- Gas Leakage Control
- Gas Injection Control
- Gas Combustion Control
ME-GI
The Engine Parts

7S70ME-GI

Gas Condition:
300 bar & 45 degC

Fuel (& Pilot) Injector
Gas Injector
Gas Control Block
Double Wall Piping
ME-GI
Gas Combustion Control
PTFE sealing rings – chrome plated sealing surfaces

- Stainless steel spring
- PTFE sealing ring
- Chrome plating
Gas distribution in ventilated, monitored duct
No escape of gas to engine room
Gas distribution in ventilated, monitored duct
No escape of gas to engine room
ME-GI Characteristics

- No gas slip
- No escape of gas to crankcase
- No escape of gas to engine room
- No unintentional gas injection
- No knocking
- No gas quality sensitivity
Heat Release at 75% Load

Heat Release & Overall Performance: SFOC equal or better
Emissions

\( \text{NO}_x: \ 24\% \text{ lower} \)

\( \text{CO}_2: \ 23\% \text{ lower} \)
Gas running @ 15% engine load
ME-GI Gas Fuel Mode Concept

Fuel oil only mode
• Operation profile as conventional engine

Gas fuel operation mode
• No methane slip
• No knocking problems
• Insensitive to gas fuel
• Unchanged load response
- Power Unchanged
- Consumption Unchanged (or Lower)
- 5% Pilot Oil (or Lower)
- Change-over at 15% Load (or Lower)
- 23% CO2 Reduction
- IMO NOx Tier II
- IMO NOx Tier III (w/EGR Scheduled)
- IMO SOx
IMO NOx Tier III
Exhaust Gas Recirculation (EGR)
IMO NOx Tier III
Exhaust Gas Recirculation (EGR)

EGR Service Test Retrofit on 7S50MC-C
Proof of Concept
ME-GI and IMO NOx Tier III
Exhaust Gas Recirculation (EGR)

ME-GI + EGR

= Tier III in *Gas Mode* + Tier III in *Fuel Mode*

= Full Fuel Flexibility
Conclusion ME-GI and ME-LGI

- Over all efficiency: Better
- Operational cost: Better with gas price of today
- Reliability: Unchanged
- Emission: Filling Tier II /alt. Tier III with EGR/SCR
- Emission: 95% reduction on SOx
- Load response: Unchanged during gas operation
- Pilot oil amount: 5% at 100% Load, reduced to 2% at 10 % load
- Gas operation: Gas operation during full load
- Auto Tuning: Available
- Gas Supply system: 6 different solutions available
- Future fuels: LNG, LPG, DME, Methanol, Ethanol
The ME-GI Add-on Platform
Applicable for all ME Engine Types
Thank You for Your Attention!

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