



IAGT 2015 SYMPOSIUM

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FLEXIBLE PACKAGE SOLUTIONS FOR SIEMENS SGT-800

By

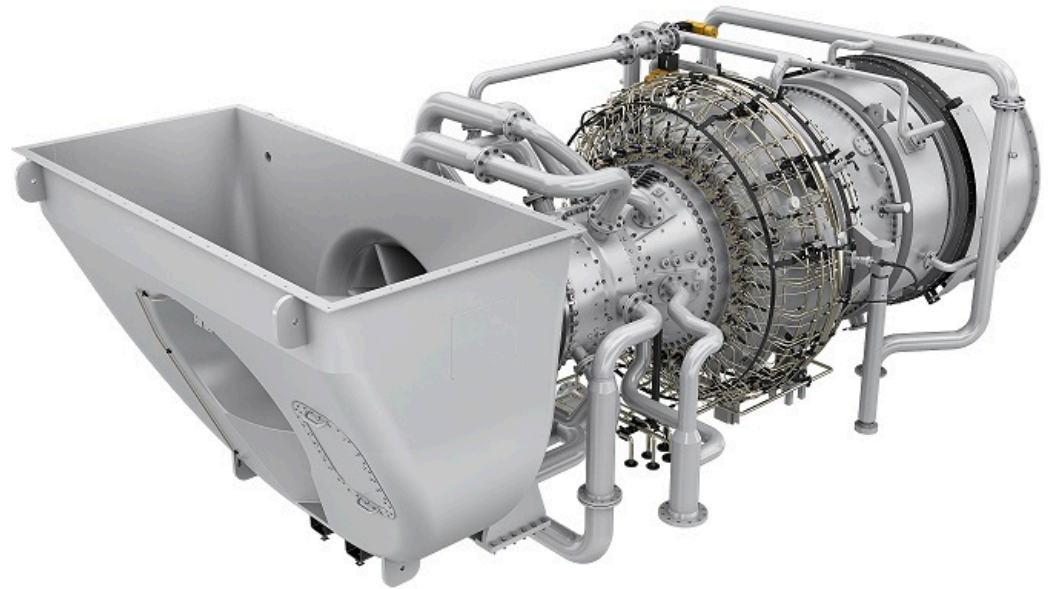
Tobias Kiuru, Mikael Öijerholm
Siemens Industrial Turbomachinery AB
Finspong, Sweden

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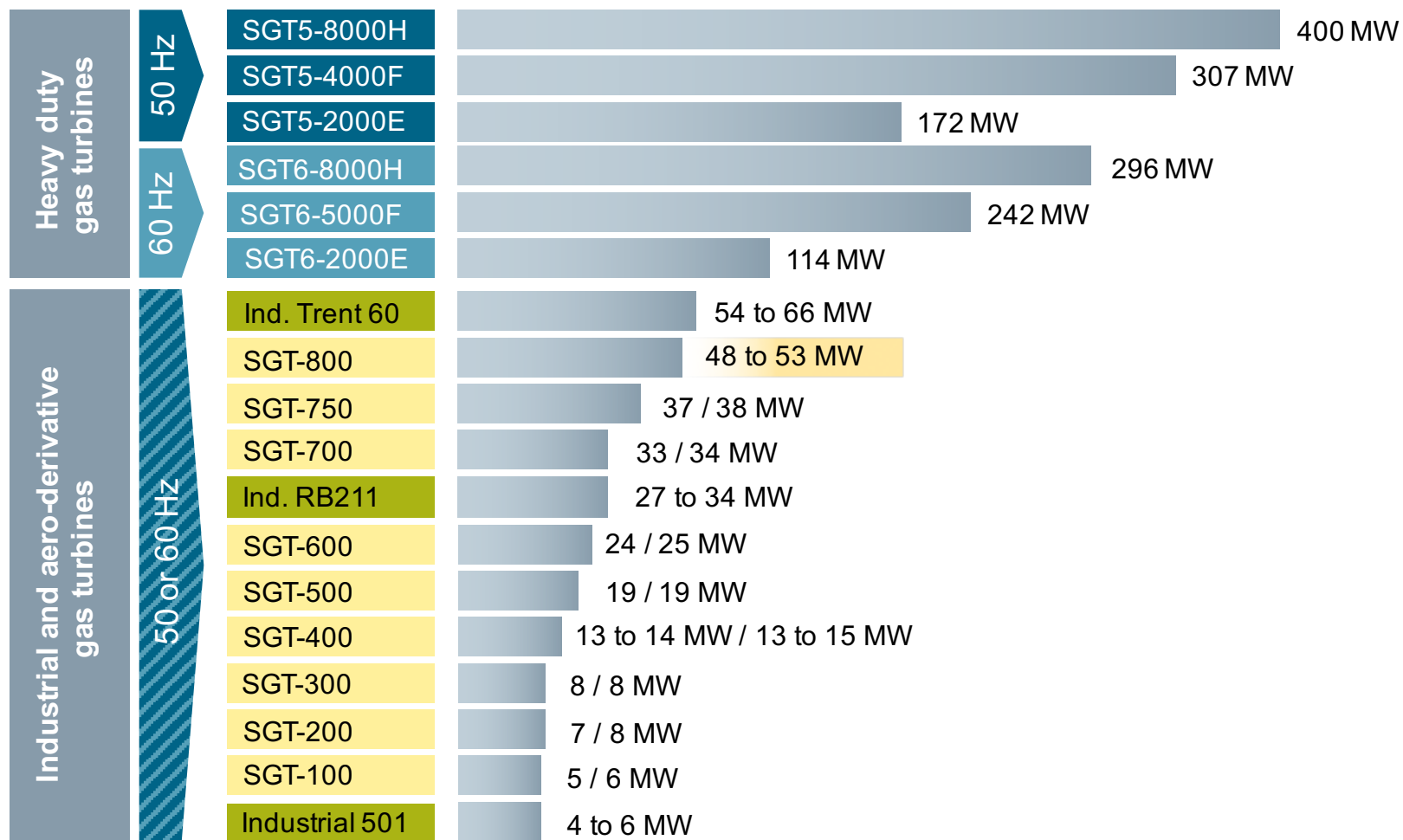
■ Agenda

- Introduction
- SGT-800 Core Engine
- Package design
 - Classic package
 - Single Lift package
- Package systems
 - Lube oil systems
 - Fuel systems
- Installation examples
 - Offshore
 - Onshore
- Summary



Market and Technical Challenges:

- Operate in remote or harsh areas
- Operate gas turbines on non-standard gas
- Provide reliable energy
- Provide low carbon energy at low cost

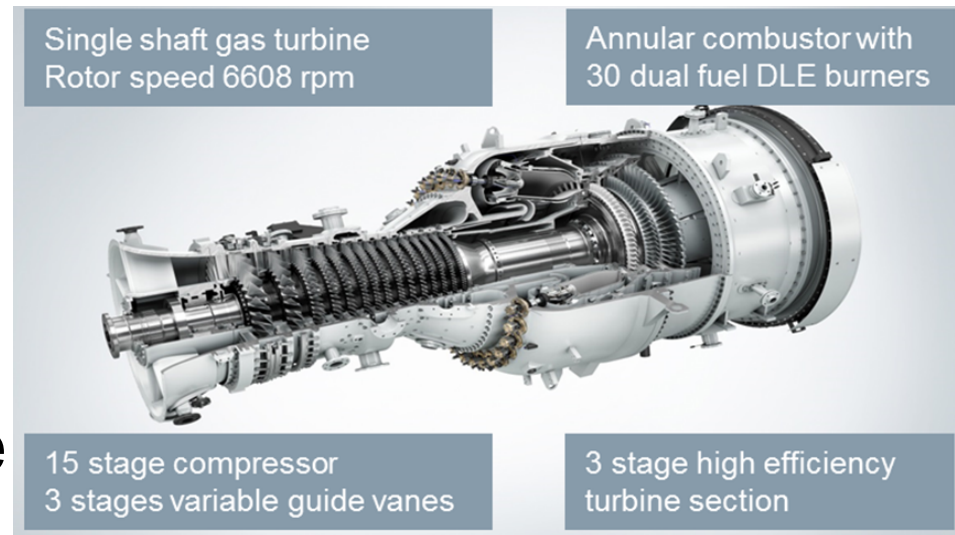


Power Generation / Mechanical Drive

Industrial
 Aero-derivative
 Heavy duty 60 Hz
 Heavy duty 50 Hz

SGT-800 Core engine

- Single shaft
- Tilting pad bearings
- Cold end drive
- Welded rotor
- Bolted 3-stage turbine
- Annular combustor



SGT-800 Core engine

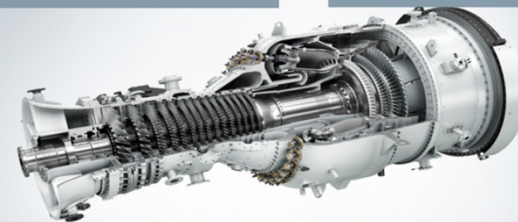
- Robust DLE system
- Flexible in Fuels, Operations, Ambient Matching and Installations
- Excellent Combined Cycle performance

Simple Cycle

| | | | |
|-----------------------|---------------|---------------|-----------------------|
| Power output | 47.5 MW(e) | 50.5 MW(e) | 53.0 MW(e) |
| Electrical efficiency | 37.7% | 38.3% | 39.0% |
| Exhaust gas flow | 132.8 kg/s | 134.2 kg/s | 137.2 kg/s |
| Exhaust temperature | 541 °C | 553 °C | 551 °C |

Single shaft gas turbine
Rotor speed 6608 rpm

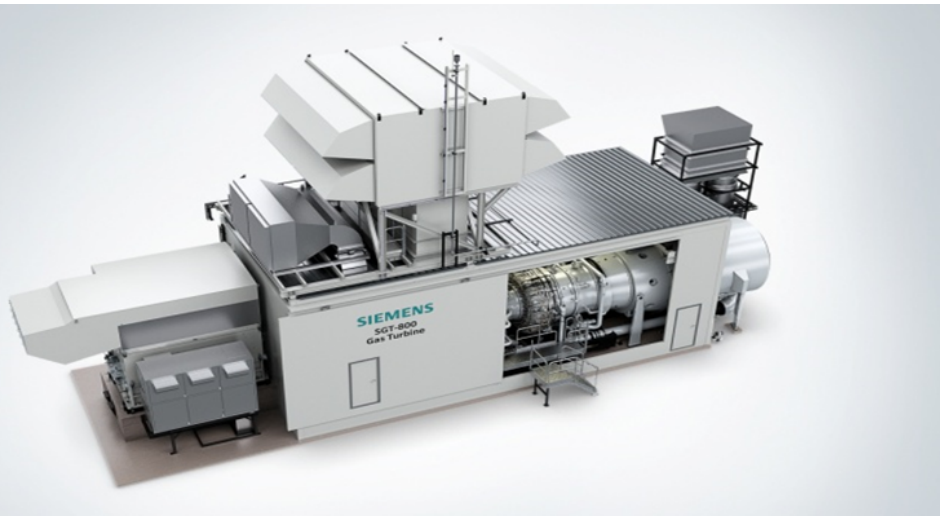
Annular combustor with
30 dual fuel DLE burners



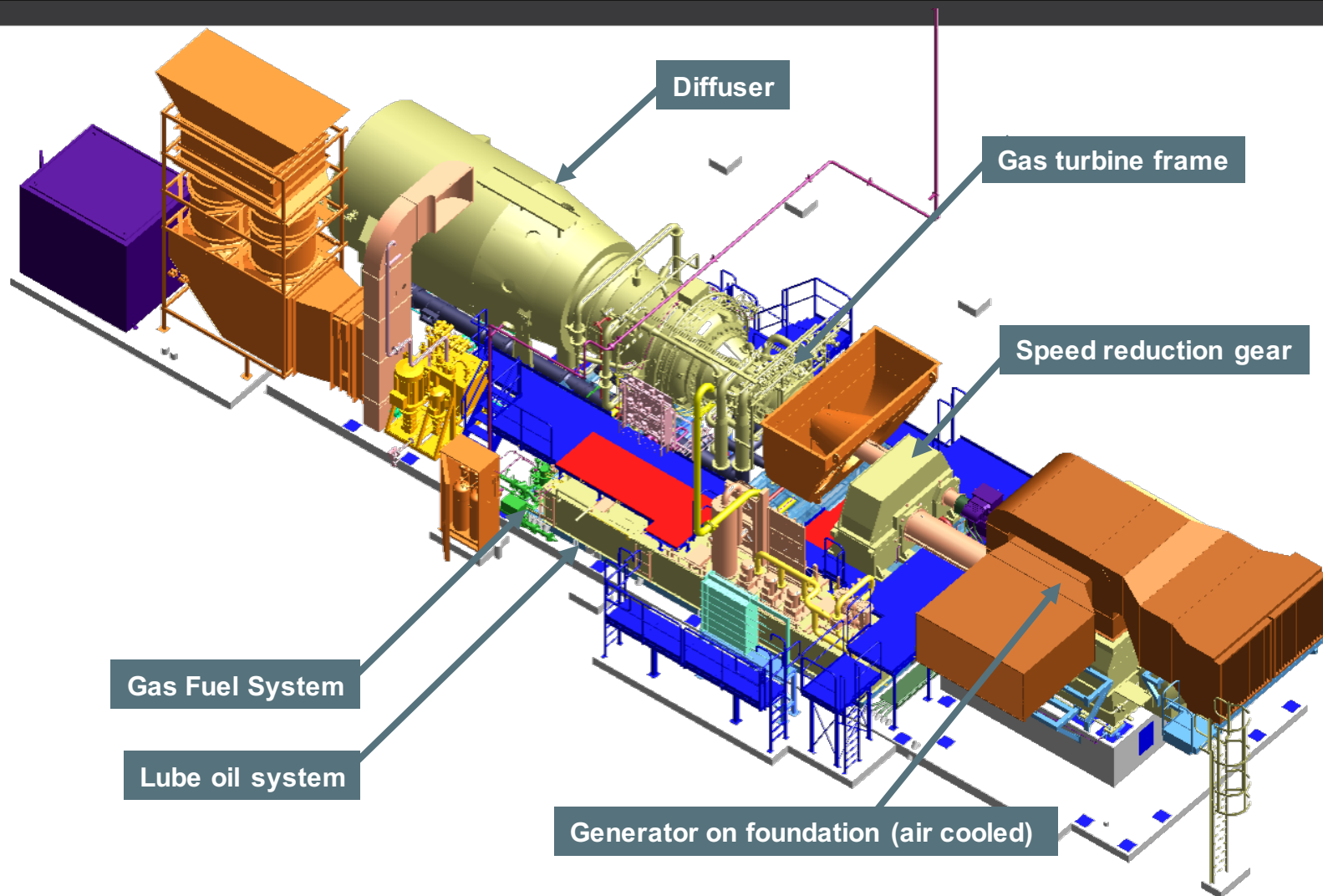
15 stage compressor
3 stages variable guide vanes

3 stage high efficiency
turbine section

Classic package



- Originally developed for IPG market
- Traditional package
- Possible to do in situ maintenance
- Flexible: can operate on a wide range of fuel types

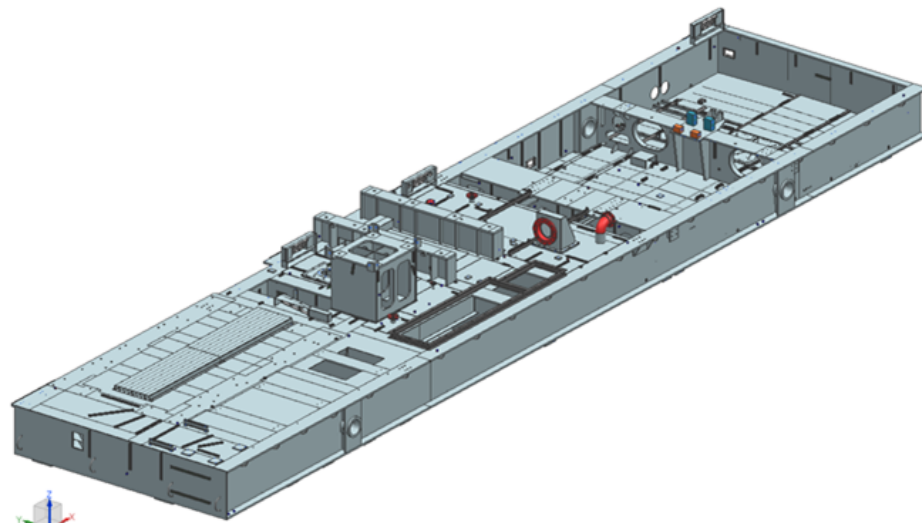


Single lift package

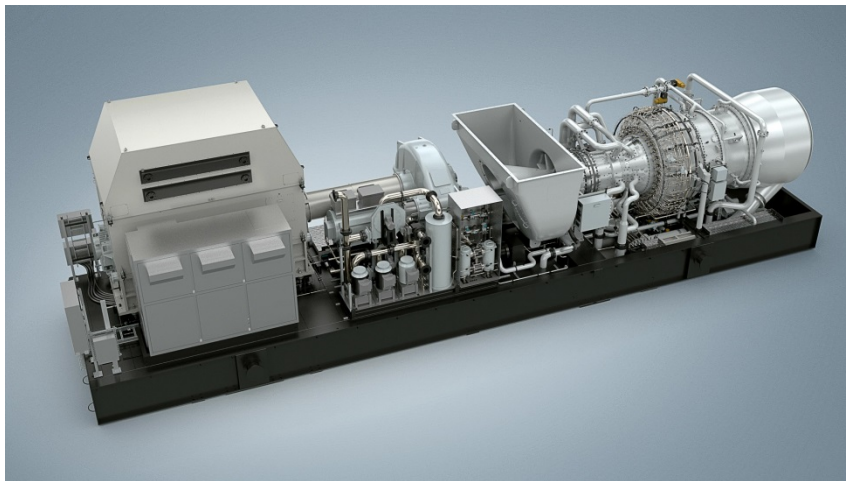
- Smaller footprint
- Improved I&C time
- 48h core exchange (increases availability)
- Enhanced string test possibilities
- No changes to the proven, robust SGT-800



Single Lift Skid

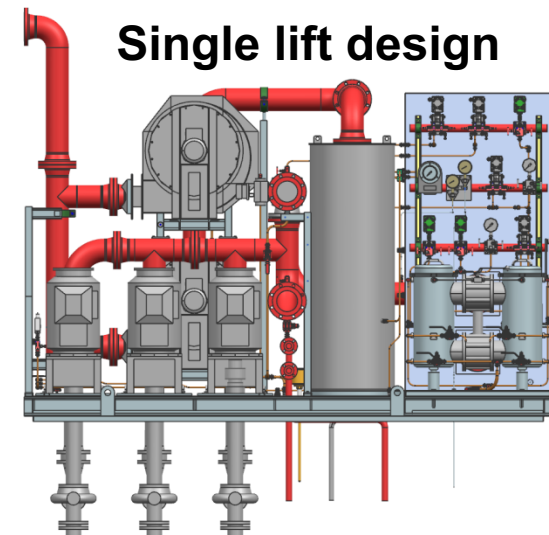
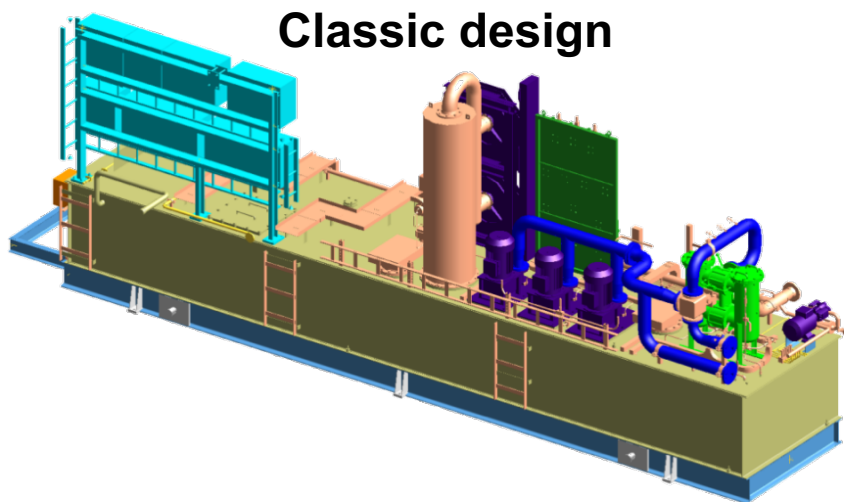


- Welded I-beams
- Lift or slide into position
- Integrated wet skid
- Multi or three point mount



Package systems

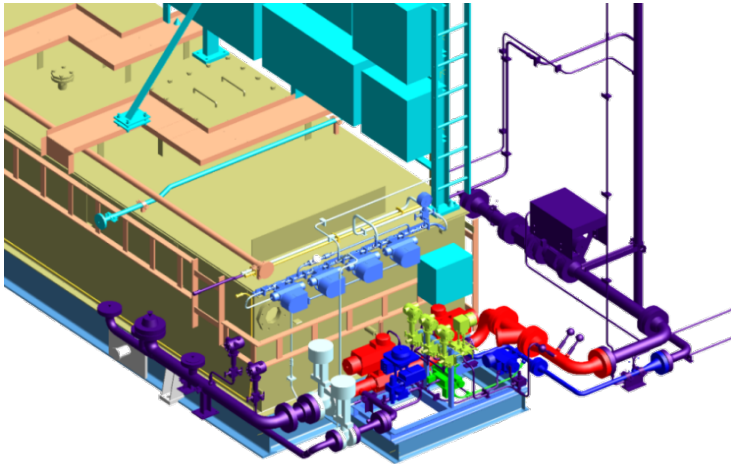
Lube oil supply unit



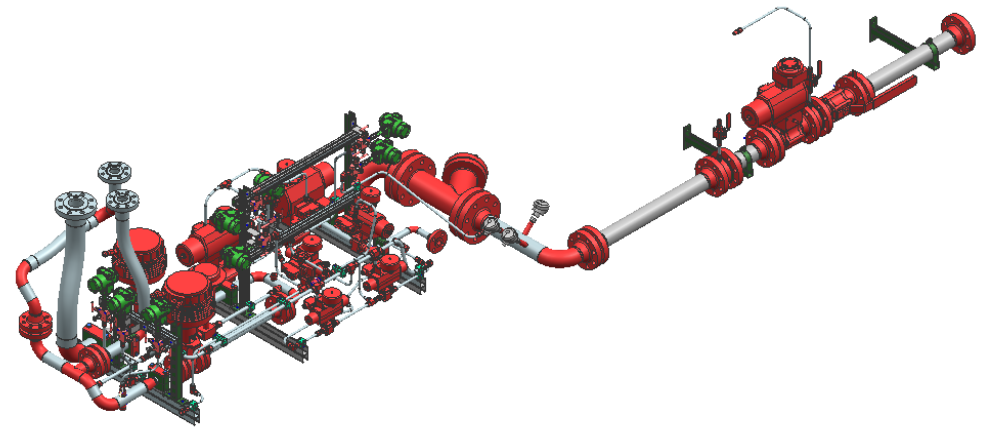
- On top of the wet skid
 - Module
 - Shared components
- Easy access



Gas fuel system



Classic design

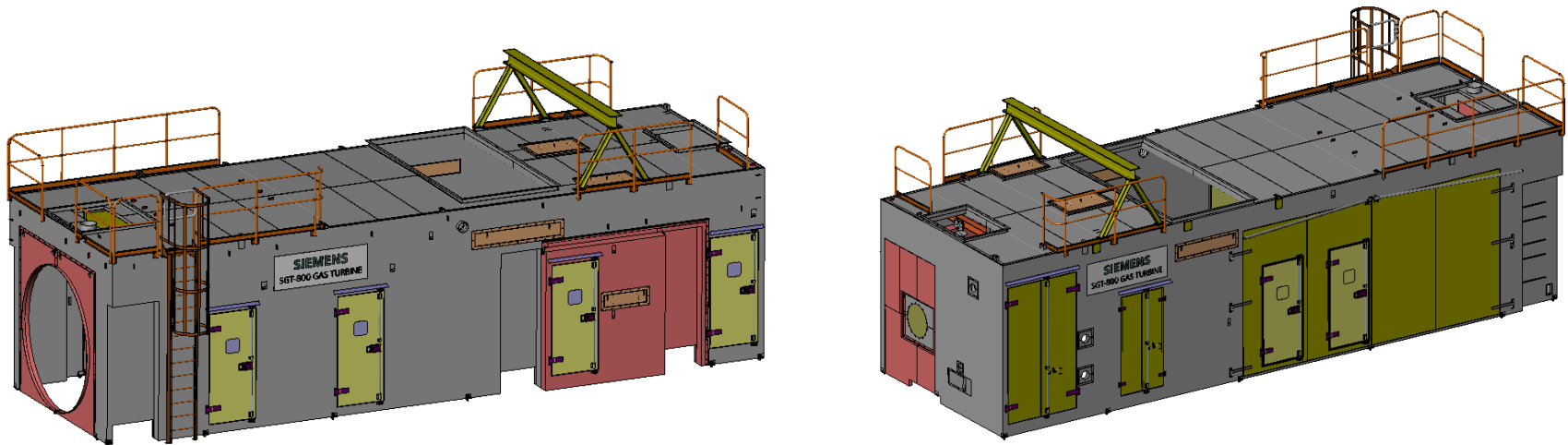


Single lift design

- Common components
- Different installation

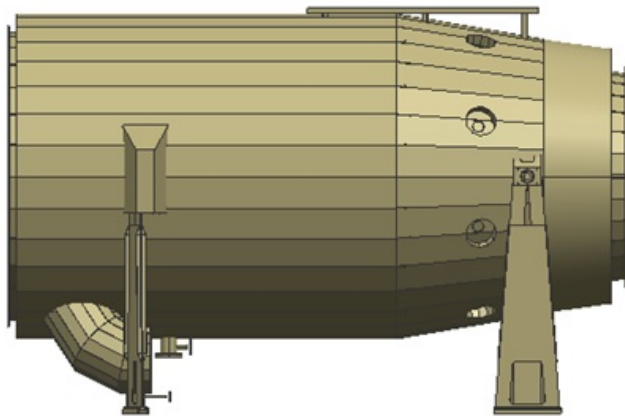


Enclosure

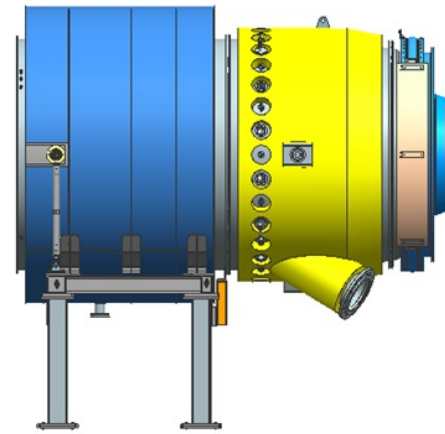


- Enclosure fully assembled
- Flexible engine roll out
- Flexible maintenance

Diffuser



Classic design



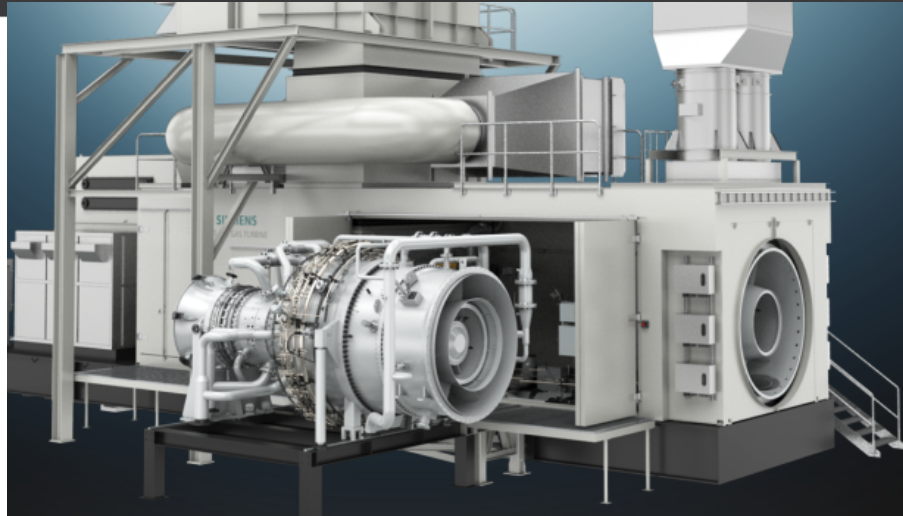
Single lift design

- Shorter and lighter
 - Same efficiency
- Lower thermal losses and lower noise
- Impacts in a positive way the overall package length

High degree of completion

- Auxiliary systems pre built and tested
- Package pre tested
- Customer interfaces outside of the sound enclosure
- Core test (option)



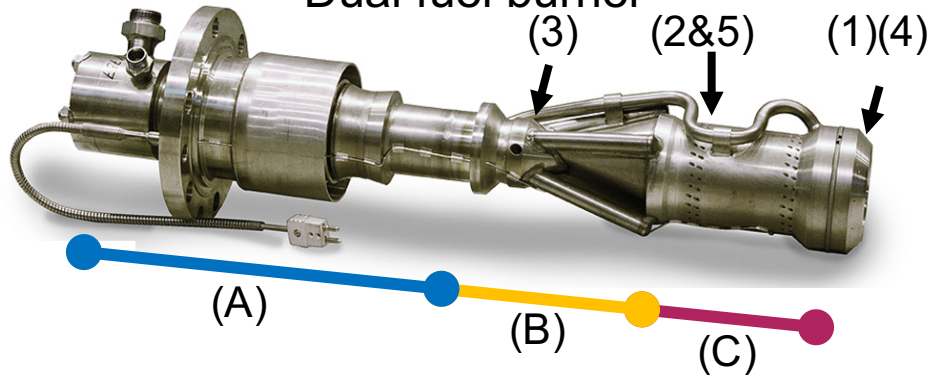


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bility

- Same inherent average fleet availability and reliability as Classic package
- Single Lift features:
 - Quick core engine exchange of 48 hours
 - Turbine slides onto support structure outside the enclosure
- Increases the availability for the customer, less downtime for customer
 - Minimizing downtime to 7 days

Fuel flexibility

3rd Generation Dry Low Emission Dual fuel burner

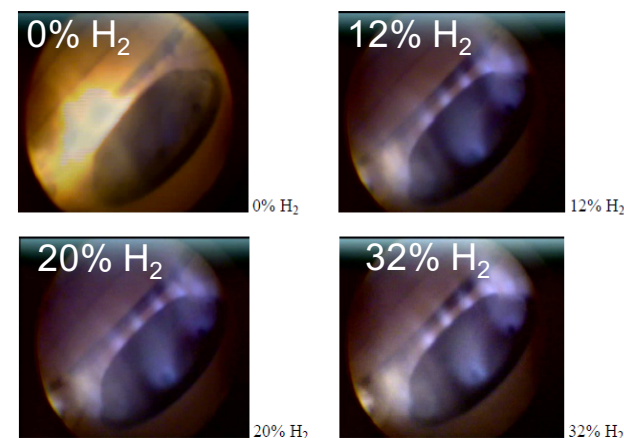


- Fuel transfer section (A)
- Swirl-generator section (B)
- Mixing tube section (C)
- Pilot gas injection (1)
- Central gas injection (2)
- Main gas injection (3)
- Pilot liquid injection (4)
- Main liquid injection (5)

- 3rd Generation DLE* System
- Well proven
- Uncomplicated system
- Load rejection capability

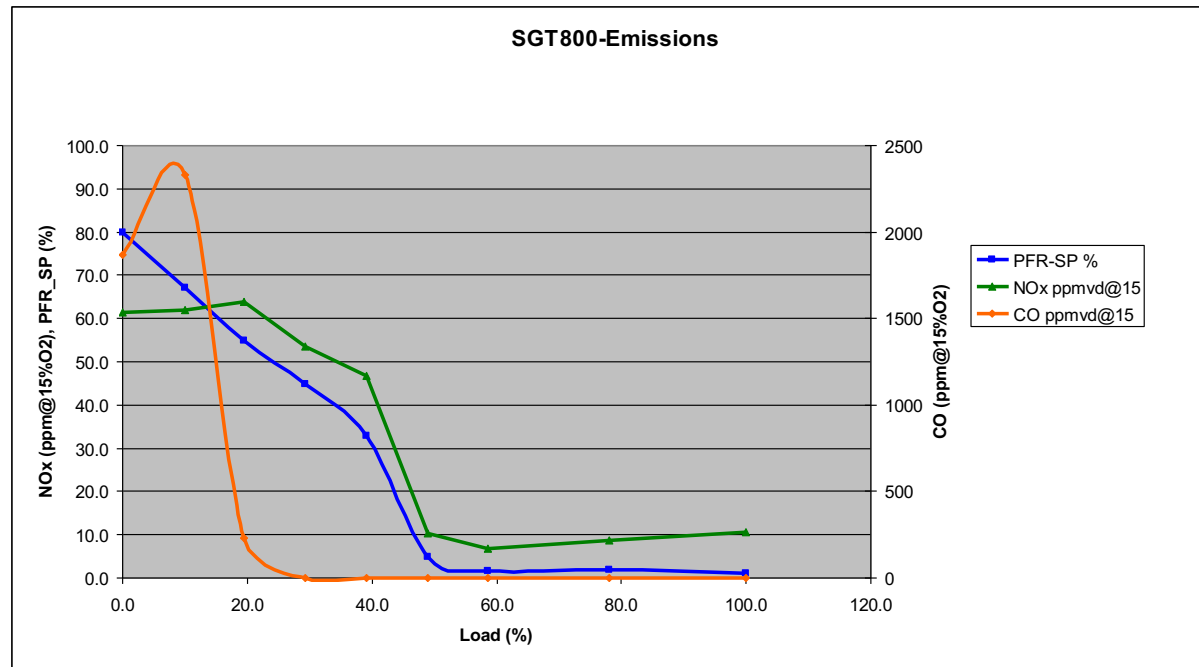
Flexible fuel operation

| Gas Fuel Constituents | | Max | Comment |
|---|--------|-------|--|
| Methane, CH ₄ | mole % | 100 | |
| Ethane, C ₂ H ₆ | mole % | 100* | *Certain conditions required above 30% Ethane level |
| Propane, C ₃ H ₈ | mole % | 100* | *Certain conditions required above 30% Propane level |
| Butanes and heavier alkanes, C ₄ + | mole % | 15 | |
| Hydrogen and carbon monoxide, H ₂ + CO | mole % | 15 | *Higher levels may be considered on a project to project basis |
| Inerts, N ₂ /CO ₂ | mole % | 50/40 | |



Single burner high pressure rig burning increasing H₂ content in Natural Gas

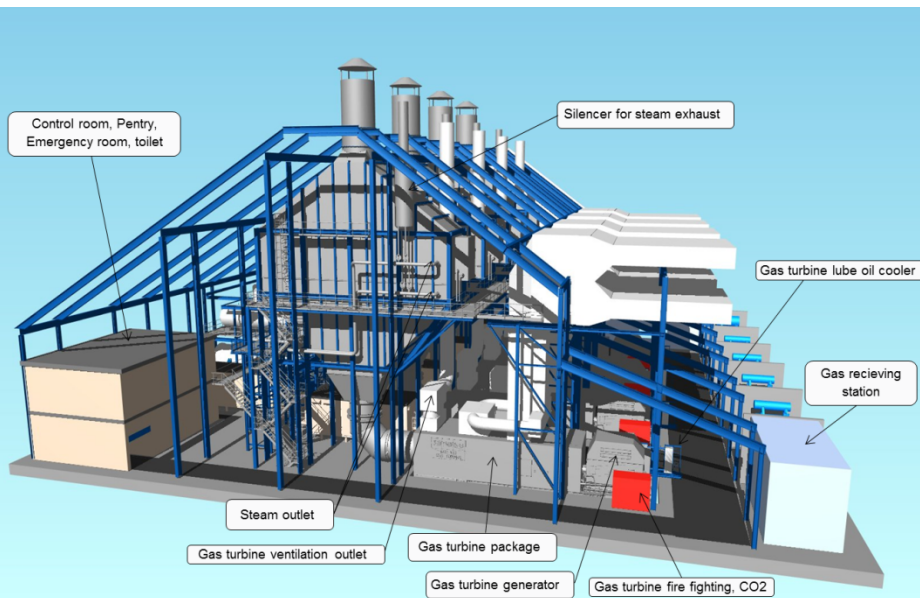
Measured NOx and CO (DLE)



Low NOx and CO performance demonstrated also on part load

Installation examples

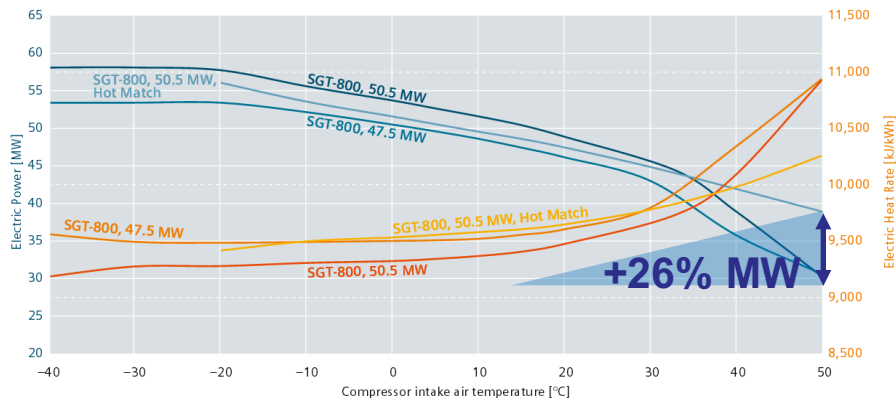
Arctic offshore



Picture of arctic power barge concept based on Single Lift

- 2x1 power block of 150MW, >56% efficiency
- 70x30 meter footprint
- 48 hours core engine exchange
- Plug & Play concept; generate power within 26-30 months from order

150MW case study in the Middle East area



- 4 units instead of 5
- Small footprint
- 10 weeks instead of 19 I&C
- 960 more hours available for power production

Summary / Key take away's

- Siemens offer solutions for the SGT-800 to benefit customers requirements:
 - Reduced footprint: Reduced cost for transportation, excavation, site logistics
 - High degree of completion: Less cost and time for I&C
 - Maintained reliability and improved availability: More production days
 - Fuel flexible DLE system: Operate on unconventional fuel with low emissions
- Ready concept to support different requirements

Thank you!

