IGT25

INDUSTRIAL GAS TURBINE

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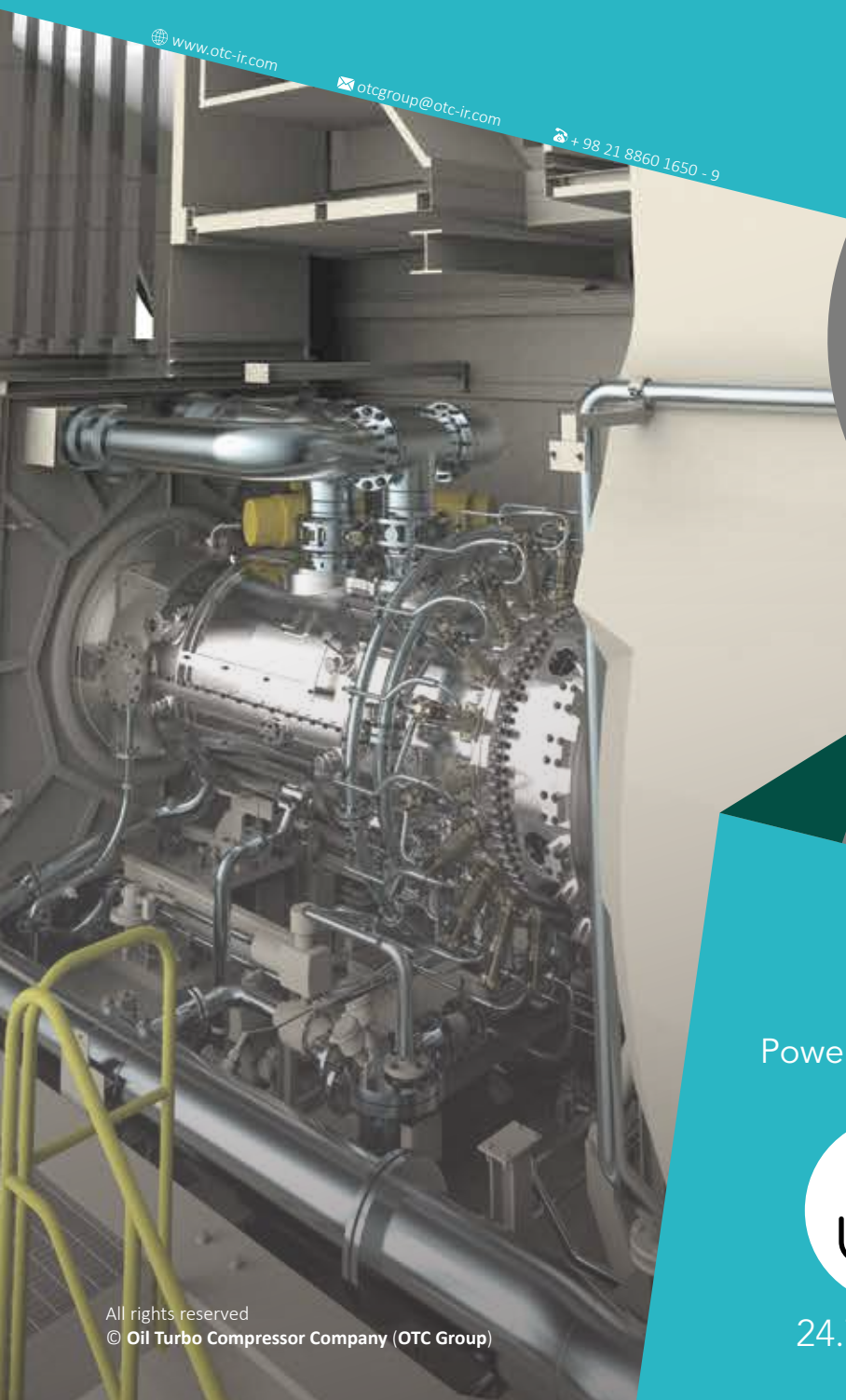


OTC
OIL TURBO COMPRESSOR CO.

Power Generation (ISO)

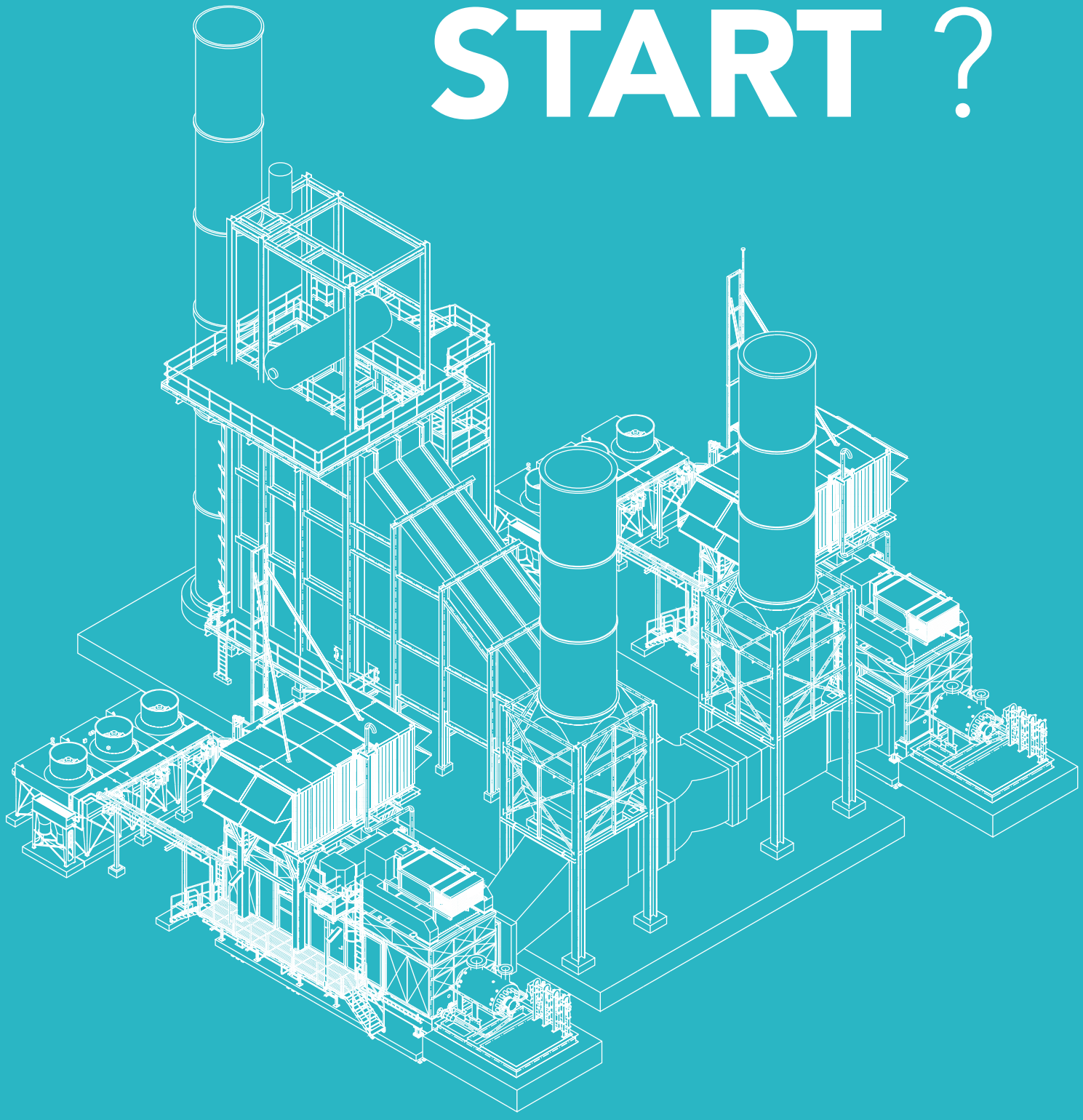
24.77 MW(e)

Mechanical Drive (ISO)

25.40 MW

GET **READY TO**

START ?



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COMPANY INTRODUCTION

OTC Profile

Oil Turbo Compressor Co. was established in Jan. 2001 in Tehran, Iran. The main goal of this establishment was to reach technology to manufacture turbo compressors in 25 MW in Iran. Besides to establish some equipped and well-furnished workshops, OTC succeeded to make some supply chains consist of more than 50 local vendors. OTC manufactures Turbo Compressors in 25 MW with transferred technology from SIEMENS, with European quality.

• Manufacturing:

- Turbo Compressors & Turbo Generators manufacturing in 25 MW.

- Electro Compressors as Ethylene Gas, Refrigerant and process applications in 2-8 MW.

- Gas Engines equipped with CHP in 1-1.2 MW.

• EPC Projects:

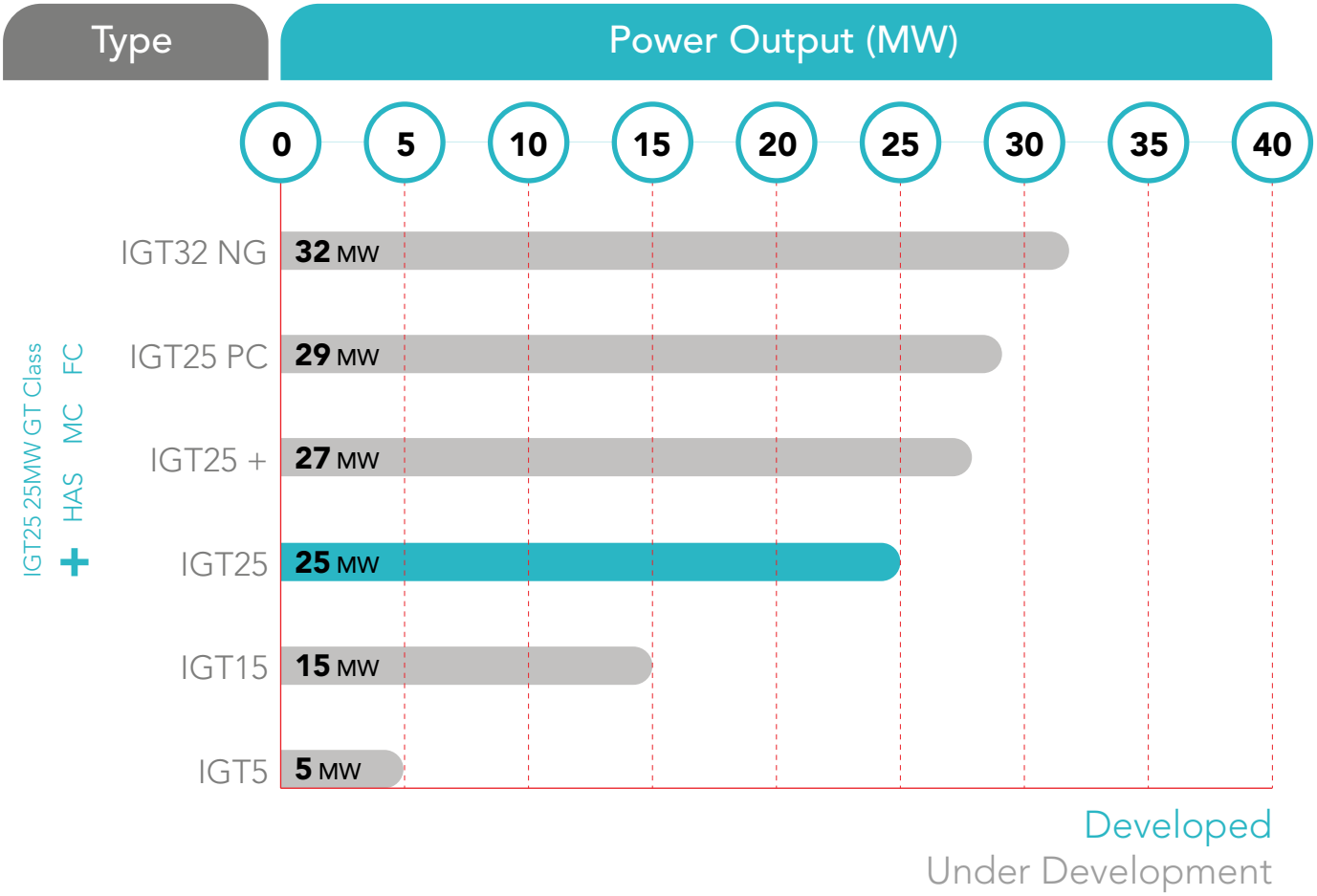
- Gas Boosting and Transporting Stations.
- Small and Medium Size Power Plants.
- Refineries Utilities.

• Services:

- Installation, Pre Com. and Commissioning of Turbo Compressors and Turbo Generators.
- Maintenance and Overhauling of Turbo Machineries.
- After Sales Services.

PRODUCT PORTFOLIO

Types of gas turbines



Executable Plan for OTC Vision

- Gas Turbines Up to 40 MW (4 Series of Products for Oil & Gas and DG)
- Compressors (wide range and applications of Oil & Gas Ind.)
- Steam Turbines Up to 100 MW (M.D. and P.G.)
- Gas Engines for D.G. & M.D. (0.5 MW – 10MW)

Joint Venture for Design, Manufacturing & Packaging

- Joint Design & Development (e.g. 16 & 25 MW GT)
- Joint Manufacturing for main components (e.g. 16, 25 & 50 MW GT's)
- Packaging of some products (e.g. gas engines)

DESCRIPTION

IGT-25 Heavy Duty gas turbine

Designed and built to satisfy the need for heavy-duty equipment able to meet the requirements for low life-cycle cost, i.e. low first cost, low fuel costs and low costs for operation and maintenance.

The IGT-25 was initially designed as a mechanical drive in compressor and pumping applications, and was later adapted for power generation because of its robust design and its operating economy. The turbine is delivered with a Dry Low Emission (DLE) combustion system as standard. A gas turbine with this system offers an additional advantage in maintaining low specific fuel consumption in all applications. The uncomplicated DLE-system does not add to the already low service costs for the IGT-25. The combination of using less fuel and generating fewer emissions makes the IGT-25 arguably the most environmentally friendly gas turbine in its power range. Industrial gas turbines from OTC offer long lifetime on oil platforms, in hot deserts, in arctic cold and in aggressive industrial environments. in other words, wherever the operating conditions are particularly tough. The IGT-25 has had a long history of successful operation in such environments and has already achieved some six million operating hours, with field experience constantly being fed back into the design for continuous improvement. OTC offers flexible maintenance solutions, enabling significant contribution to the plant operational profit arising from the optimization of preventive Maintenance planning.

GENERAL SPECIFICATIONS

Further information

KEY FEATURES

- Robust industrial design
- Excellent operational availability
- Excellent reliability
- Low emissions, **NOx ≤ 25 ppm**
- Wide range of fuel capability
- Low life cycle cost

MAINTENANCE

- No need for special workshop maintenance
- **24-hour** gas generator exchange or Onsite maintenance
- Modular build-up for easy maintenance on site
- Standardized concepts for maintenance planning
- Condition-based maintenance
- Extended time between overhaul
- Horizontal split compressor casing

TECHNICAL SPECIFICATIONS

Overview

- Mechanical drive: **25.40 MW**
- Shaft efficiency: **33.5 %**
- Heat rate: **10,258 kJ/kWh**
- Turbine speed: **7,700 rpm**
- Compressor pressure ratio: **14:1**
- Exhaust gas flow: **83 kg/s**
- Exhaust temperature: **543° C**
- NOx emissions
  (with DLE corrected to **15 % O2** dry) - Gas fuel: **≤25ppmV**
- Liquid fuel ≤ **42 ppmV** (wet)

1	**Axial Compressor:**	- 10 stage axial flow compressor - 2 stages variable guide vanes - Electron-beam welded rotor
2	**Combustion:**	- 18 dual-fuel 2nd generation - Dry Low Emissions (DLE) burners - Welded annular sheet metal design
	Compressor Turbine:	- 2-stage axial flow compressor turbine - Both stages are air-cooled
3	**Power Turbine:**	- 2-stage free power turbine, uncooled - Electron-Beam Welded Rotor
4	**Emissions control:**	- DLE combustion system liquid fuel operation - Fuel System - Natural gas – Liquid fuel – Dual fuel - Combustion chamber by-pass system for part load operation emission control
	Bearings:	- Tilting pad radial and thrust bearings with Vibration and temperature monitoring

FLANGE-TO-FLANGE

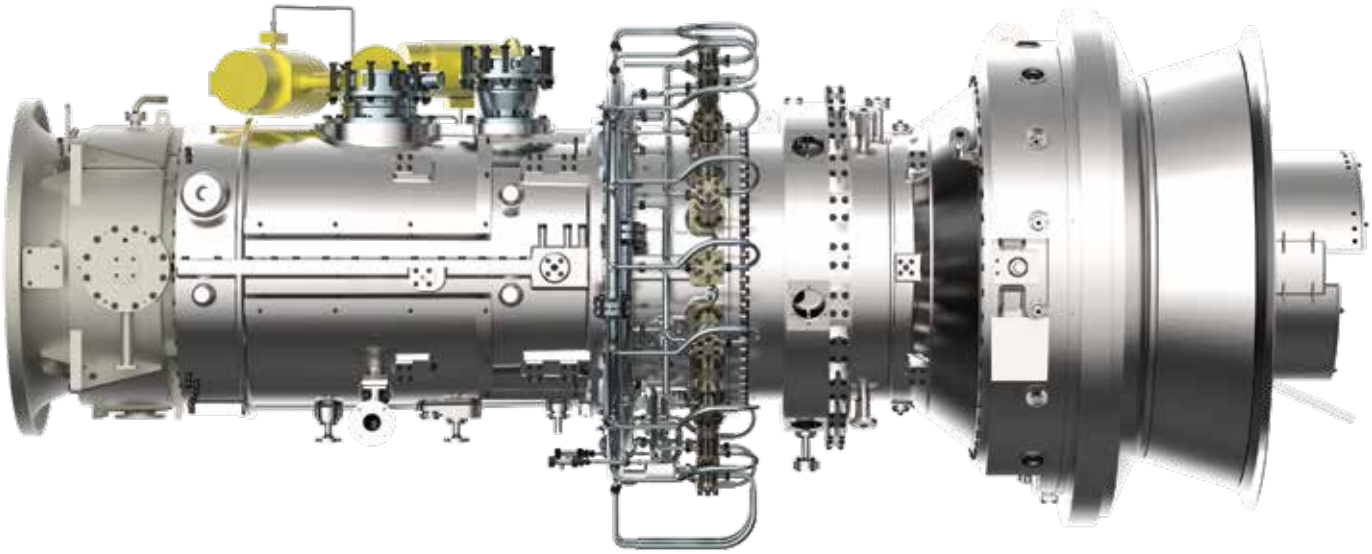
Solution

Strengthen reliability and recapture performance, cost-effectively
In today's budget constrained environment, OTC recognizes your need to deliver on market demands for reliable, flexible power by leveraging the most value from your existing plant assets. A gas turbine Flange-to-Flange upgrade can be a more cost-effective solution to increase your site's reliability, extend maintenance intervals, reduce emissions, lower fuel costs and increase output, according to your specific operational needs.

New unit performance/reliability within your existing footprint
A Flange-to-Flange solution encompasses full replacement of an existing gas turbine core engine with a new production engine. This scope includes a new rotor, casings, compressor blades, vanes, combustion system and turbine section, along with any specific modifications that may be required to accommodate an existing installation.

A Flange-to-Flange upgrade also features complete unit assembly, ready for installation into a variety of packages. Additional options including OTC's most advanced Dry Low Emission (DLE) combustion technology, and Integrated Control system, can further enhance performance, and backstop operational reliability.

Short-cycle installation to protect your bottom line
As a reliable power provider, you can also realize value with a Flange-to-Flange solution by leveraging local OTC resources for on-site expertise to reduce your outage time and installation cycle. Addressing multiple operational needs through a single Flange-to-Flange upgrade can be far more cost-effective than replacing turbine components and systems across multiple outages.



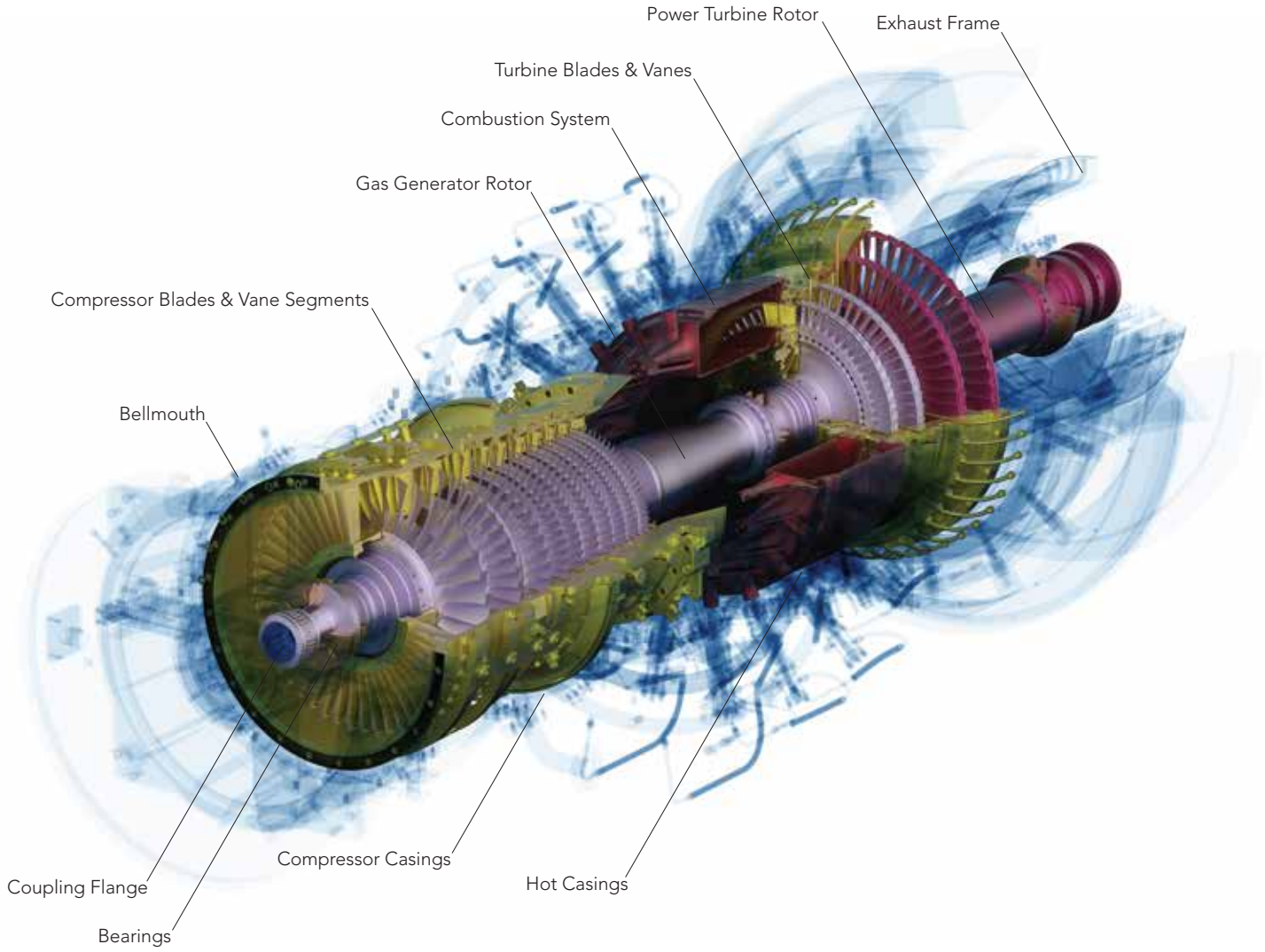
FLANGE-TO-FLANGE

Upgrade Scope

- Unit rotors
- Combustion system
- Casings
- Exhaust frame
- Bearings
- Bellmouth
- Turbine Blades and Vanes
- Compressor blades & Vane Segments
  - Upgrade options
- Performance Upgrading (IGT-25 PC)
  - Mechanical drive: 27 MW
  - Shaft efficiency: 36 %
- Maintenance Upgrading (IGT-25 MC)
  - 1.1 Life Time Extension in Hot Parts
- Flexibility Upgrading
  - Integrated Control system
  - Fast Start/Loading Option

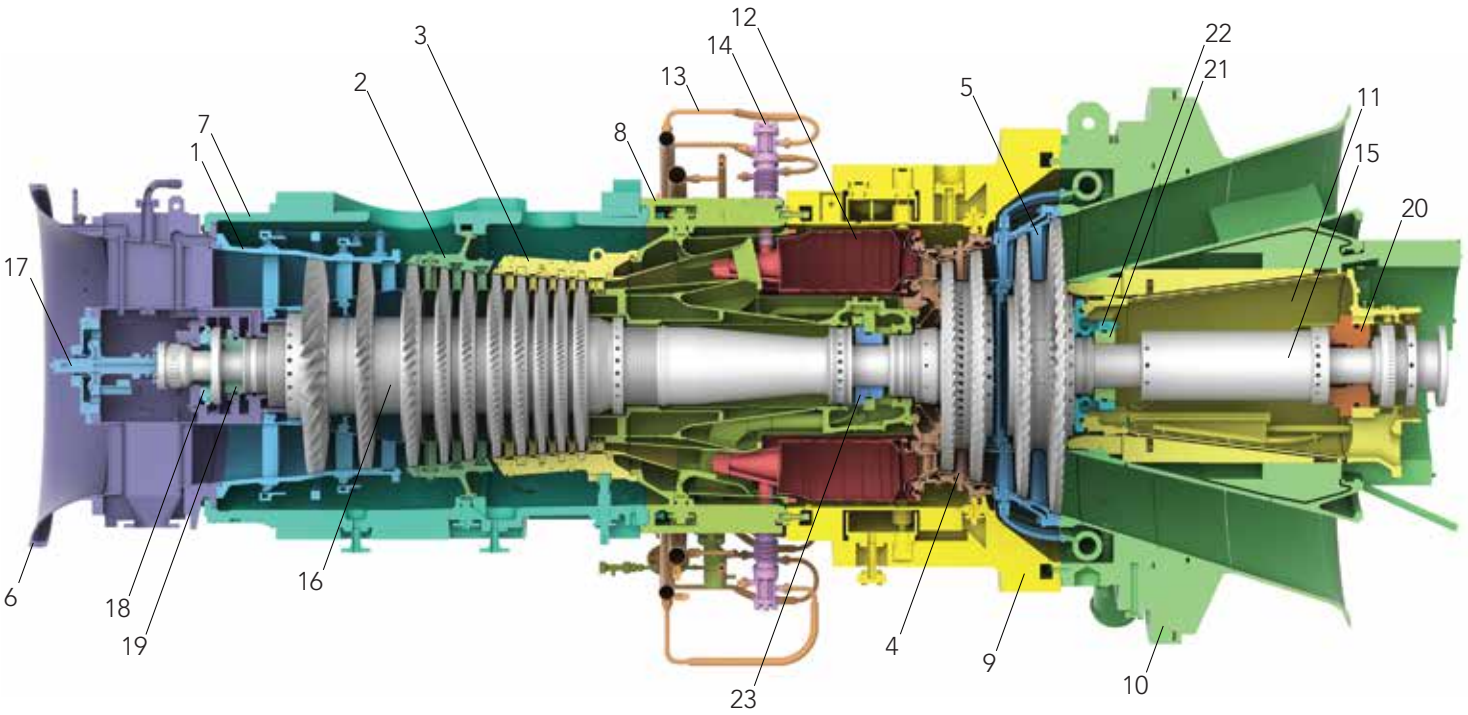
Benefits

- Improve reliability and extend maintenance intervals
- Expand flexibility to operate in peak and cyclic environments
- Lower fuel costs through reduced heat rate
- Lower maintenance costs and extend asset/plant life
- Recapture lost performance
- Alleviate rotor end-of-life concerns
- Reduce emissions



ENGINE

Subsystem



PACKAGE

Specifications

Modular fluid systems incorporating: .....
- Two main lube oil circuits
- low pre ssure and high pressure
- **3x50% HP** and **3x50% LP** - AC drive
- Lube oil pump with DC backup
- Lubricating oil system
- AC motor-driven auxiliary pump

Control system: .....
- Siemens SIMATIC PLC-based with distributed control and processing capability installed on package
- Optional Allen-Bradley system
- Optional off-package systems

Fire and gas detection equipment
Fire suppression equipment

Combustion-air inlet-filtration options: .....
- Pulse cleaning

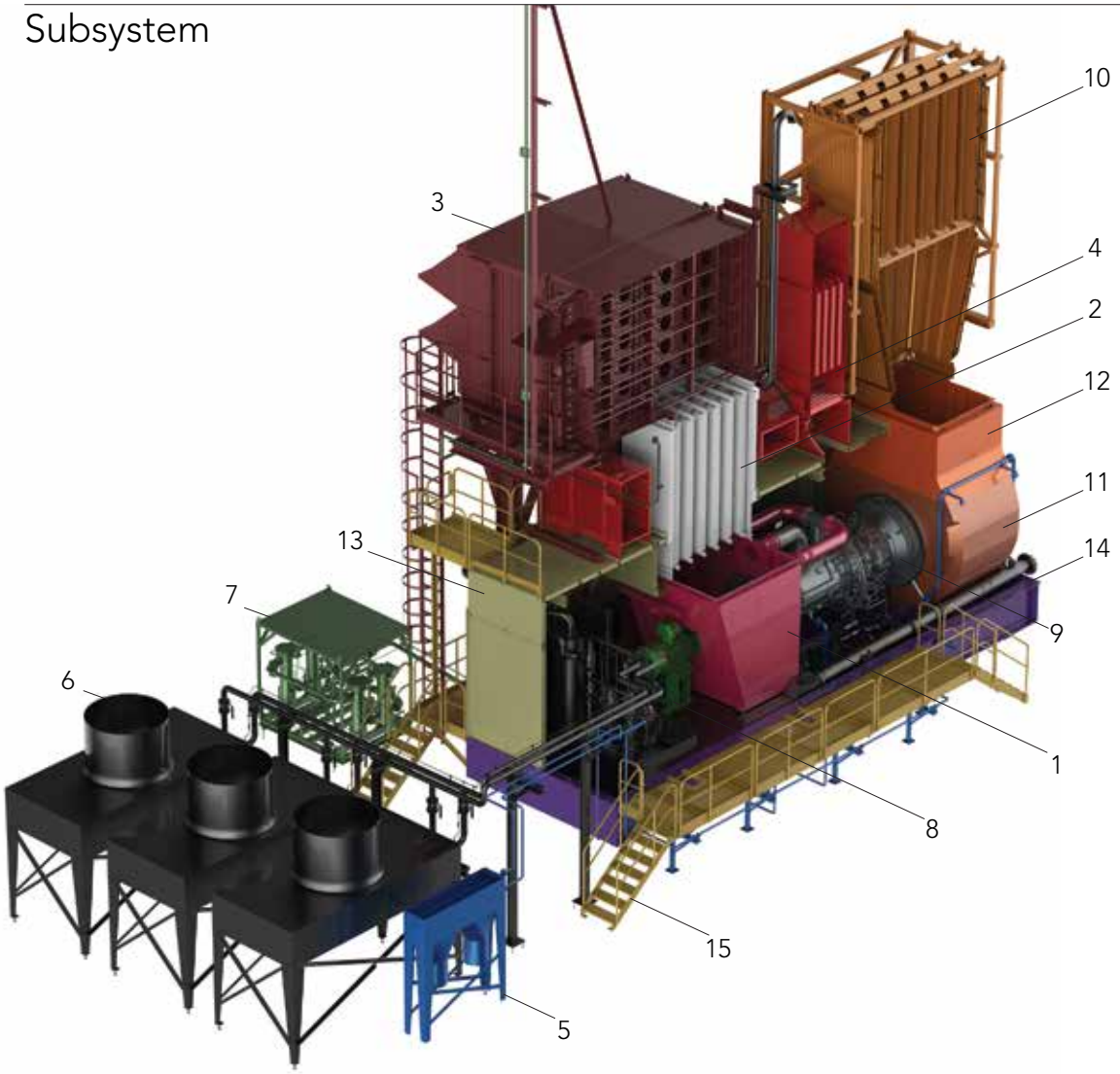
Enclosure: .....
- Painted carbon steel or stainless steel
- Noise level options (**85 dB**(**A**) standard)

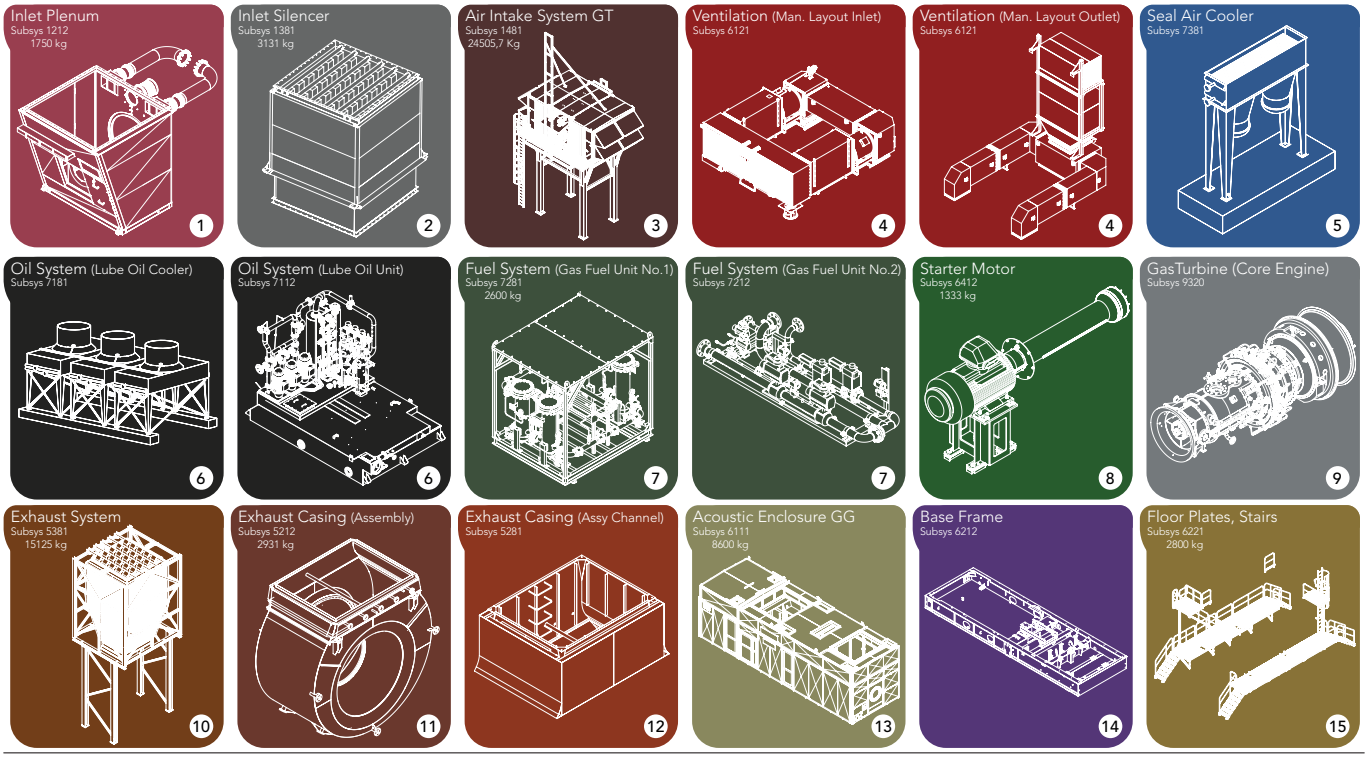
Factory testing:
- Core engine
- Functional testing of modules as standard
- Pre-commissioning of package
- Optional core customer-witness test
- Optional complete package test

Minimized customer interfaces

PACKAGE

Subsystem

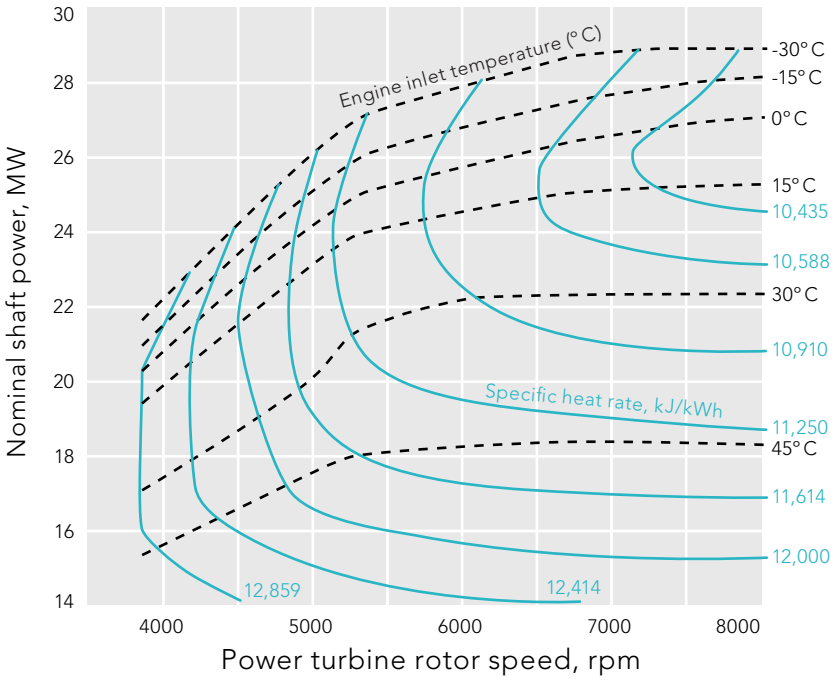




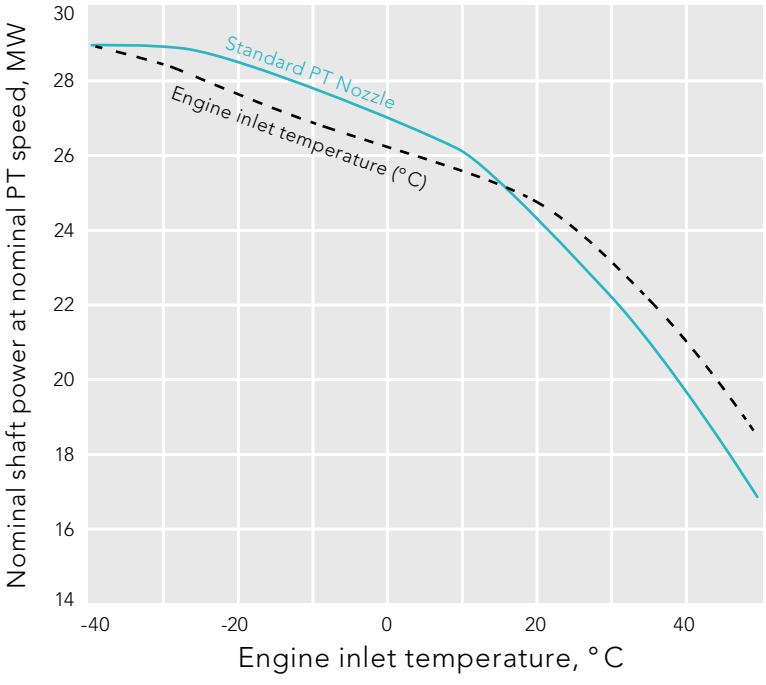
PERFORMANCE

Power generation & mechanical drive

Nominal performance
Output power, specific heat rate and PT speed



Output power at turbine coupling and engine inlet temperature



Mechanical Drive Performance

Conditions/assumptions:
Direct drive – no output gearbox.

Altitude: ..... **Sea level**

Inlet ducting loss: ..... **0 kPa**

Exhaust ducting loss: ... **0 kPa**

Natural gas fuel.

Ambient pressure: ..... **101.3 kPa**

Relative humidity: ..... **60 %**

Power turbine design speed: ..... **7,700 rpm**

Specific heat input is drawn for base load but is approximately correct for part load at corresponding speed/temperature.

MAINTENANCE

Proper maintenance and operating practices

- No need for special workshop maintenance
- 24-hour gas generator exchange or Onsite maintenance
- Modular build-up for easy maintenance on site
- Standardized concepts for maintenance planning
- Condition-based maintenance
- Extended time between overhaul when running on part load
- Low deterioration and service cost
- Gas turbine can be removed on rollers through the maintenance doors
- Horizontal split compressor casing

UPGRADING PACKAGE

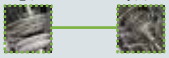
Benefits

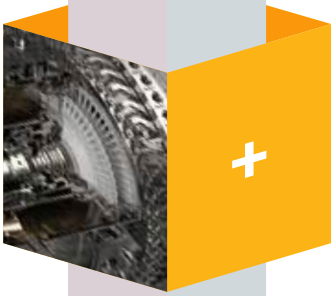
What You Gain

Hot Ambient Solution

- Increase Production
- Higher Efficiency
- Environmentally Friendly
- Reliability and Availability
- Life Extension

- Up to **2 MW** power increase at 50°C ambient temperature
- Up to **0.4%** efficiency increase at 50°C ambient temperature
- **No change** in reliability, availability and maintenance plan
- Implementation in **level B** or **C** of maintenance plan with no extra downtime
- **Suitable** for hot climates

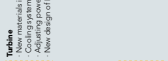


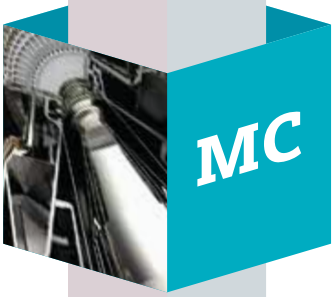


Power & Maintenance Concept

- Increase Production
- Higher Efficiency
- Environmentally Friendly
- Reliability and Availability
- Life Extension

- More than **2MW** power increase in base load
- More than **1%** efficiency increase in base load
- Available for ambient temperatures between **-10**°C and **50**°C
- Maintenance interval extension up to **25000 EOH**
- Engine Life Time extension up to **150000 EOH**

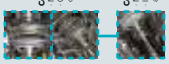


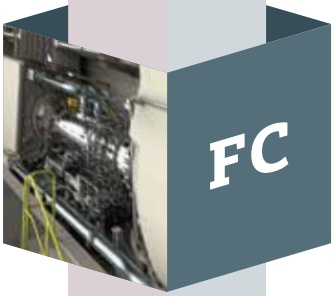


Maintenance Concept

- Increase Production
- Higher Efficiency
- Environmentally Friendly
- Reliability and Availability
- Life Extension

- Maintenance interval extension up to **35000 EOH**
- Engine Life Time extension up to **175000 EOH**
- **No change** in reliability and emission level
- Lower expected **Downtime** and higher **Availability**
- **Applicable** for all the IGT25 gas turbines
- **Replacement** of new design hot parts during maintenance level





Operational Flexibility Concept

- Increase Production
- Higher Efficiency
- Environmentally Friendly
- Reliability and Availability
- Life Extension

- **Low Load Turndown** improvement for emissions and cost control
- Start and **Loading Time Reduction Up** to **50%** of normal condition (fast start and loading)
- **Cool Down Time Reduction** for improving operational availability up to **50%** of normal condition
- **Barring Block Time Reduction Up** to **20%** of normal condition
- More than **2%** increase in **Start Reliability**
- **High Reliability** About **99.5%** and **Availability** Over **95%**

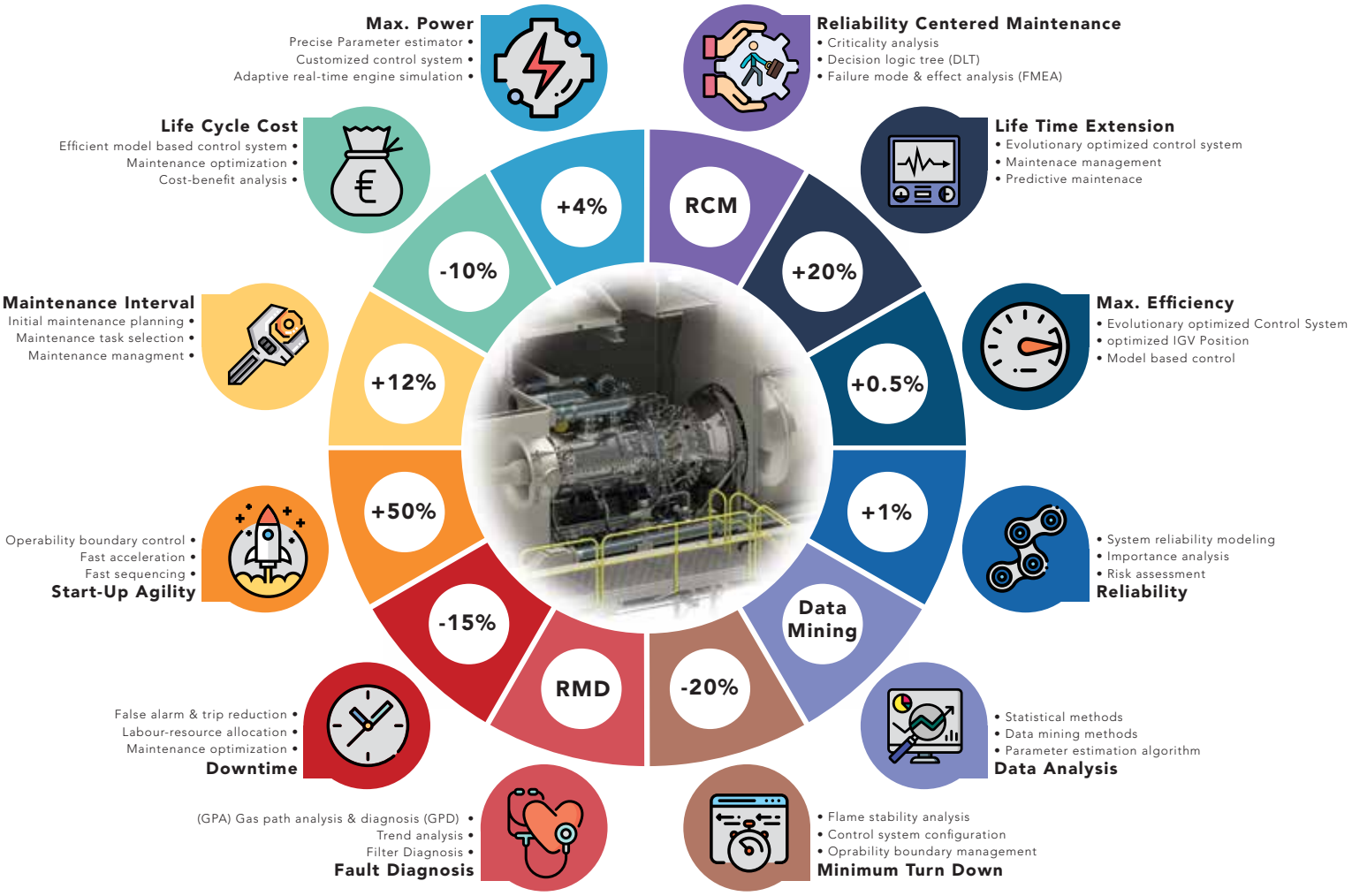
Power Concept

- Increase Production
- Higher Efficiency
- Environmentally Friendly
- Reliability and Availability
- Life Extension

- More than **7MW** power increase in base load
- More than **2%** efficiency increase in base load
- **Low** life cycle costs
- **High** Fuel flexibility
- **High Reliability** and **Availability**
- **Low Emission**

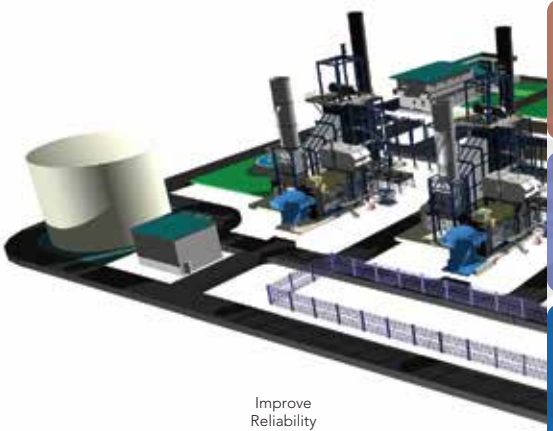
INTEGRATED ASSET MANAGEMENT

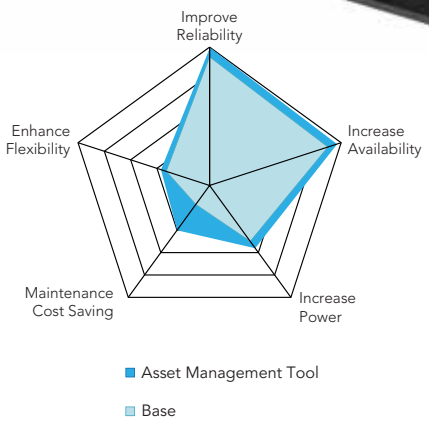
Gas Turbine Core Engine



INTEGRATED ASSET MANAGEMENT

Gas Compressor Station





Performance Maximization
- Full Load Power
- Full Load Heat Rate
- Full Load ISO Corrected (Power)
- Full Load ISO Corrected (Heat Rate)
- Increase Flow Capacity

Capability
- Turndown
- Ramp Rate
- Start-up Time
- Low Emission
- Start-up Fuel Consumption

Dispatch Optimization
- Incremental Capability with Incremental Cost
- Optimzation of Load Sharing in Stations

Availability Improvement
- Commercial Availability
- Equivalent Availability

Reliability Improvement
- Equivalent Forced (Outage Rate)
- Starting Reliability

Intelligent Load Sharing
- Model Predictive Control
- Economic-Wise Control Decision

Flexibility Enhancement
- Start Flexibility
- Fuel Flexibility
- Maneuver Flexibility

Outage Planning
- Outage Decision Analysis
- Maintenance Event Management
- Commission and Decommission Planning

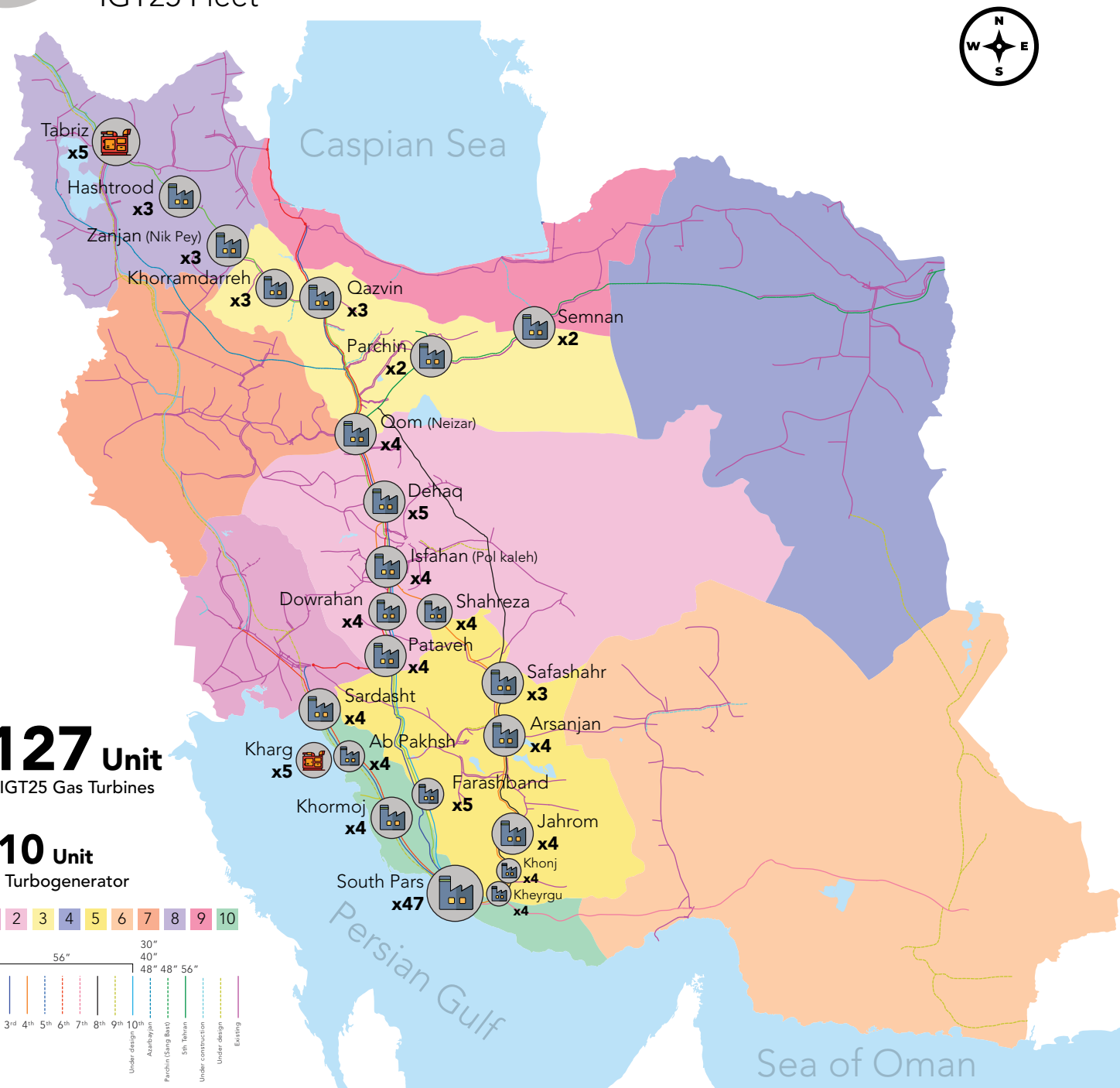
Performance Indicators
- Operational Flexibility Indicator
- Thermal Performance Indicator
- System Reliability Indicator

Plant-level Diagnostic Tools
- Root Cause Analysis
- Operating Insights
- FMEA
- RCM

Benchmarking
- Ideal Baselines for Performance : Availability, Reliability, Dispatch, Emissions and Financial Performance
- Economic Analysis
- ROI Estimator
- Cost/Benefit Analysis

INTEGRATED ASSET MANAGEMENT

IGT25 Fleet

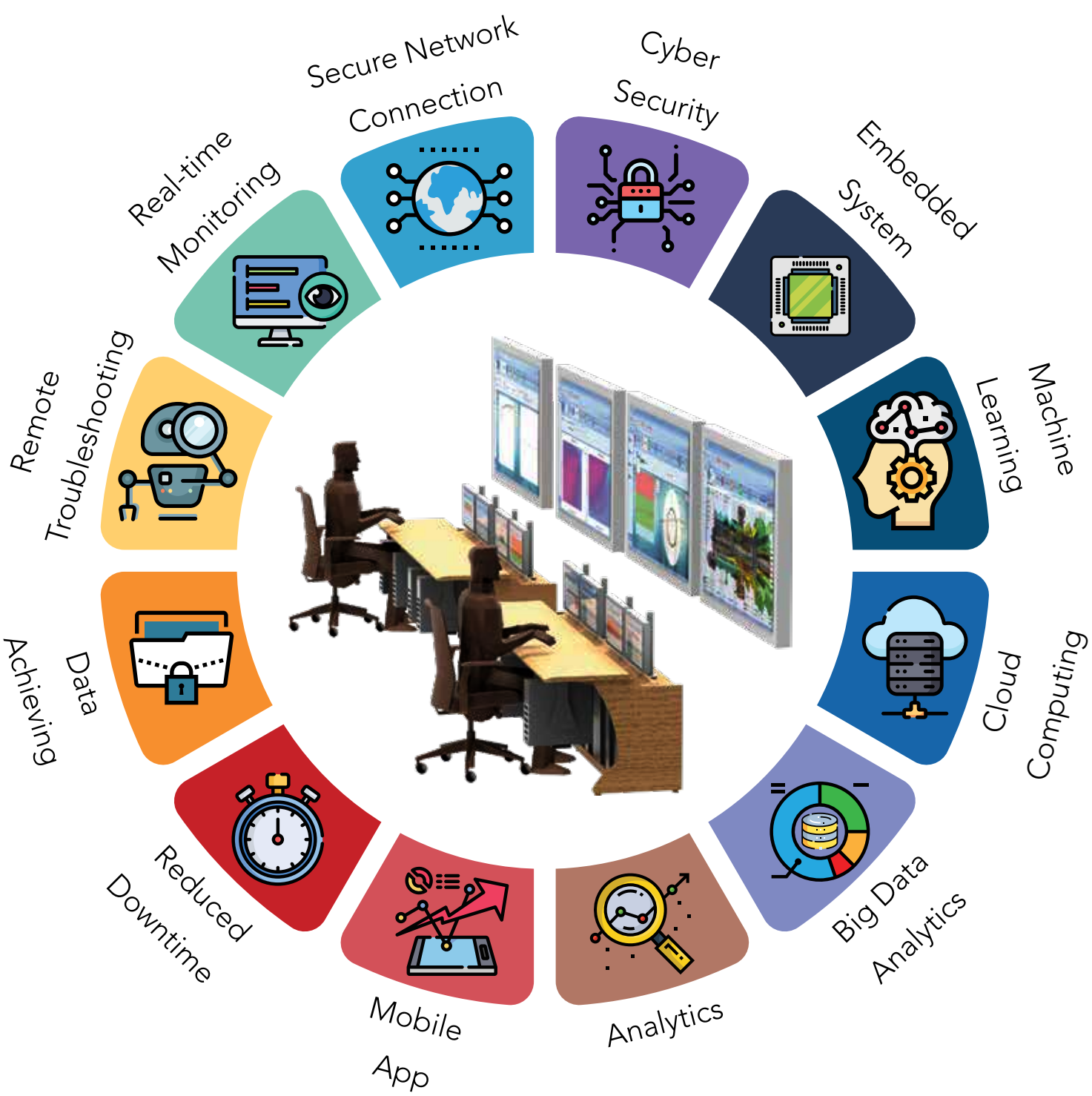


127 Unit
IGT25 Gas Turbines

10 Unit
Turbogenerator

Max. Power	Max. Efficiency	Life Time Extension	Advanced Analysis	Life Cycle Cost	Reliability & Availability Improvement	Dispatch Optimization	Economic Analyzer	Engine ChangeAbility	Engine Manoeuvr Ability	Flexibility	Capacity Enhancement
• 24 + 1 Extra	• 0.5%	• 5 + 1 Extra	• Data Mining • RCM • RCA • RMD	• 10 + 1 Extra • Fuel Saving • Start-Up Agility • Minimum Turn Down	• +1% • Maintenance Interval • Fleet Availability • Risk Assessment	• Incremental Capability with incremental cost • Optimzation of load Sharing in Stations	• ROI • Maintenance Cost Reduction		• Fast Start • Minimum Load Reduction • Maximum Power Increase	• Manouvre Flexibility • Fuel Flexibility • Start Flexibility	• MPC • Advanced Analysis

SOLUTION CENTER



REMOTE MONITORING & DIAGNOSTICS CENTER

Compressor Fouling & Erosion Detection
Hot Gas Path Component Degradation
Metal Corrosion Detection
Burners Fault Diagnosis
Online Life Monitoring
Vibration Analysis

How It Works?

- Connect
- Visualize
- Analysis
- Predict
- Optimization

24/7 Online Monitoring

Connectivity to Any Facility Devices

- SCADA/DCS
- PLC/Instrument systems
- IT devices
- Alarm systems

Visualize

- Time Series
- Frequency Domain
- Time Domain
- Business Intelligence

Analytics and Machine Learning

- Industrial analytics library
- Machine learning models
- Detect anomalies
- Direct controls
- Predict maintenance

Predict

- Industrial analytics library
- Machine learning models

Optimize Asset Performance

- Applying machine learning analytics
- Applying model based methods

Provides monitoring and fault diagnostic of Gas turbines with daily checks, automatic alarm notifications with powerful automatic data collection and analysis tools

Provides continuous remote monitoring and historical trending for practically limitless operating parameters

Formulate recommendations that assist gas turbine customers in making informed business maintenance and repair decisions

Achieve superior equipment availability, performance, and lifetime ownership cost

Supports asset management solution and keeps power plant's conditions under control

CONTACT US

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OTC

TURBOTEC

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OTC
OIL TURBO COMPRESSOR CO.

THANKS FOR YOUR ATTENTION.