

ICCI 2020

Advancements in the Cogeneration Ecosystem

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Senior Regional Sales Manager
Industrial Solutions

We are Baker Hughes, an Energy Technology Company

Refinery & Petrochemical



We offer a comprehensive range of solutions for the Refinery, Petrochemical and Fertilizing chemical processes, including Hydrotreating, Hydrocracking, Fluid Catalytic Cracking, Continuous Catalyst Regeneration, Ethylene, PDH, LDPE, Nitric Acid, Urea, Ammonia, Methanol, powergen and waste gas energy recovery.

Pipeline & Gas Processing



In the Pipeline & Gas Processing space, we offer a broad range of solutions to transport hydrocarbons and refined products from production sites to consumption territories, through various applications such as oil & gas gathering, boosting, processing and treatment, as well as their storage, metering and distribution.

Onshore & Offshore Production



In On- & Offshore Production applications we provide solutions for hydrocarbon production to help our customers extract, gather, treat and process resources and prepare them for delivery to midstream facilities.

LNG



In LNG we offer a broad range of technology solutions from gas liquefaction to regasification, supplying equipment and/or modules for refrigeration, power generation, flash gas/ boil-off gas compression.

Industrial



For the Industrial sector we offer solutions for conventional and renewable power generation, combined heat and power (CHP), district heating, desalination, energy recovery, energy storage and carbon capture & storage.

We serve customers in metal & mining, pulp & paper, cement, sugar, marine, food & beverage, chemicals, utilities & independent power producers.

Our product portfolio includes:

- Gas turbines
- Steam turbines
- Centrifugal and axial compressors
- Centrifugal pumps
- Process control and safety valves
- Air-cooled heat exchangers
- Gear solutions and bearings
- Control systems
- CO2 Liquefaction
- Turnkey modules for compression and power generation
- Waste heat and pressure recovery systems
- Liquid Air and Adiabatic Compressed Energy Storage
- Plant optimization apps
- Comprehensive services and support

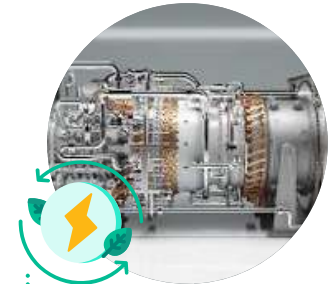
Leading the energy transition

Low carbon solutions

Committed to achieving net-zero carbon emissions by 2050 and to investing in new technologies that help customers lower their emissions.



Reduce flaring, venting, and fugitive emissions



Efficient power generation



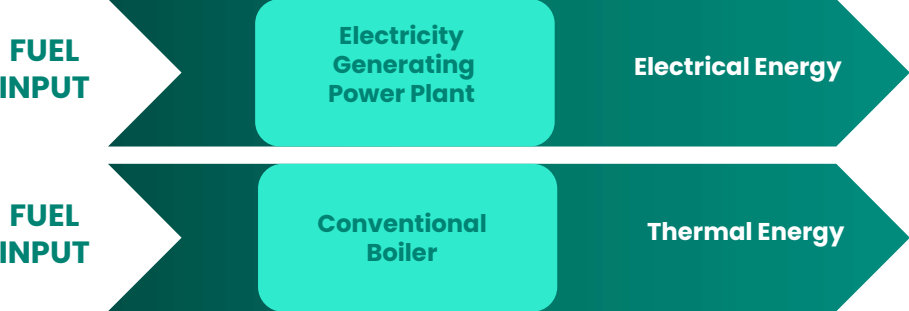
Renewables & alternative energy



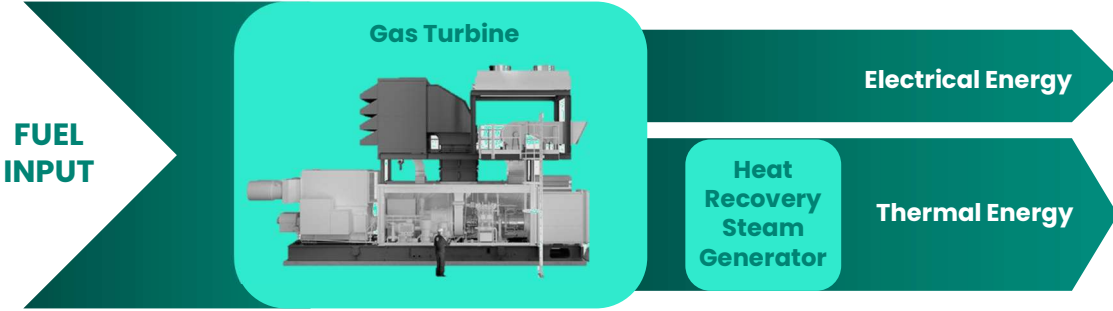
Efficient Oilfield

Gas Turbine Cogeneration System

SEPARATE PRODUCTION



COGENERATION SOLUTION



Gas Turbine Cogeneration Solutions – Industrial Applications

PAPER MILLS

CHEMICALS AND PHARMACEUTICALS

REFINERIES AND FERTILIZERS

TEXTILES

HOSPITALS

RUBBER

FOODS

DISTRICT HEATING AND COOLING

OLEO CHEMICALS

ALUMINUM

MINING

CERAMICS



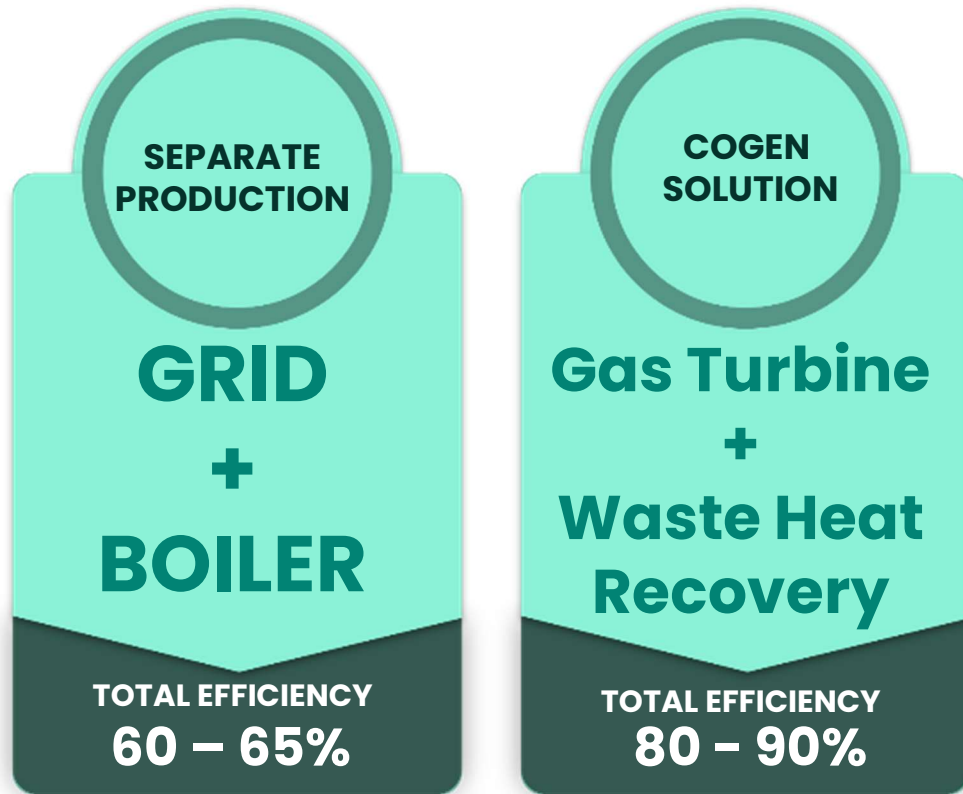
Key benefits

Reduced energy costs

Reliable Power Supply

Reduced CO₂ footprint – Ecofriendly solution

Compared View



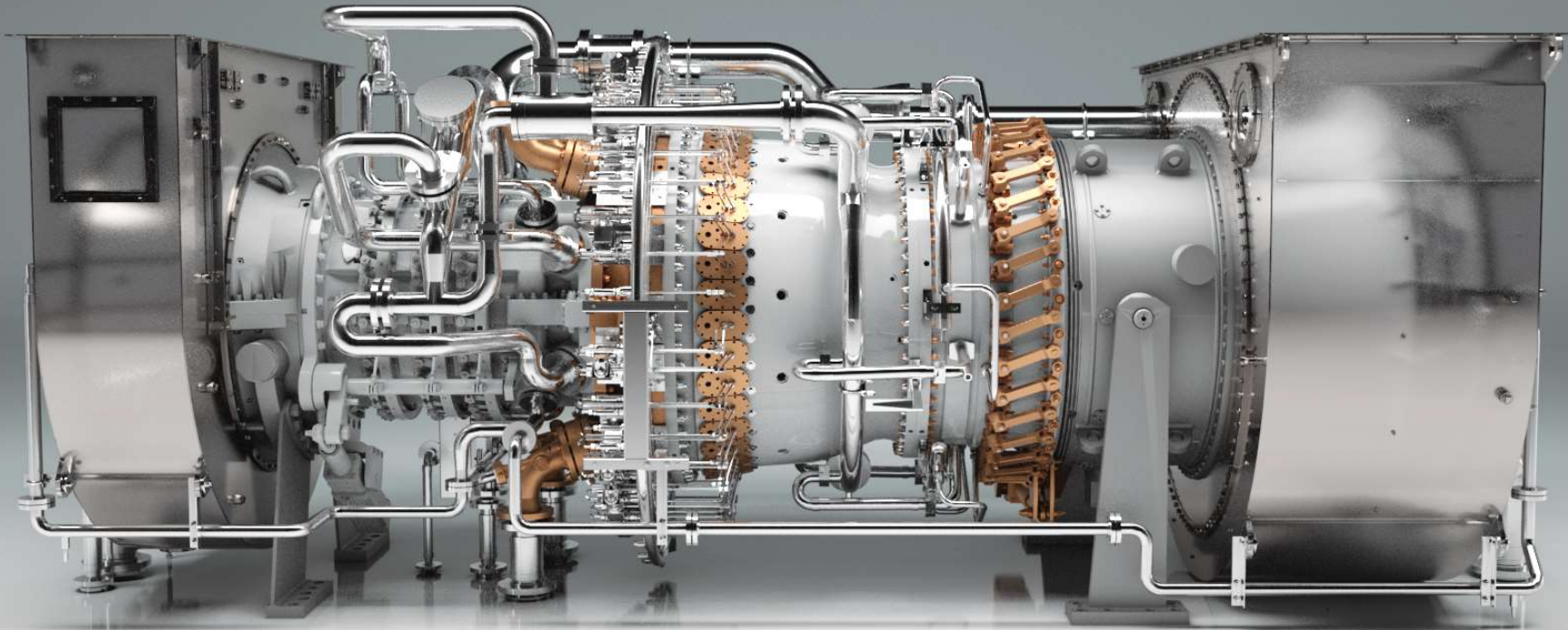
~6M\$/year savings

CHP O&M cost included

**25,000t CO₂/year
reduction**

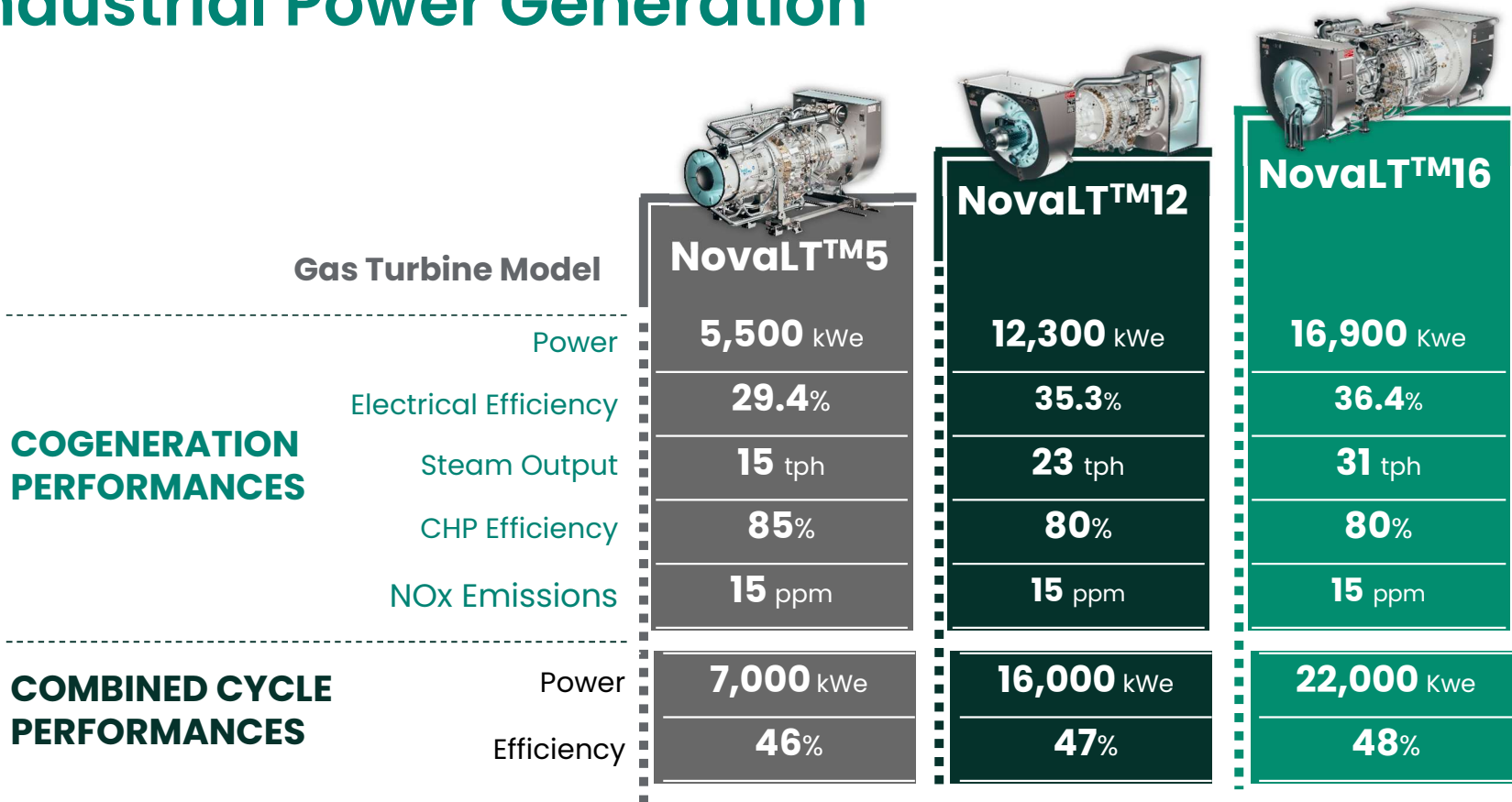
Notes:
Saving based on current electricity and gas prices in Turkey

Baker Hughes Gas Turbines Heritage ...



... 50+ years, 12,500 unit and 570 million fired hours

Designed to Maximize Profitability for Industrial Power Generation



Data based on ISO conditions, saturated steam at 10bar and 1xGT+1xST combined cycle configuration

NovaLT™ Gas Turbine Family ... Brief Summary

Best in class performances

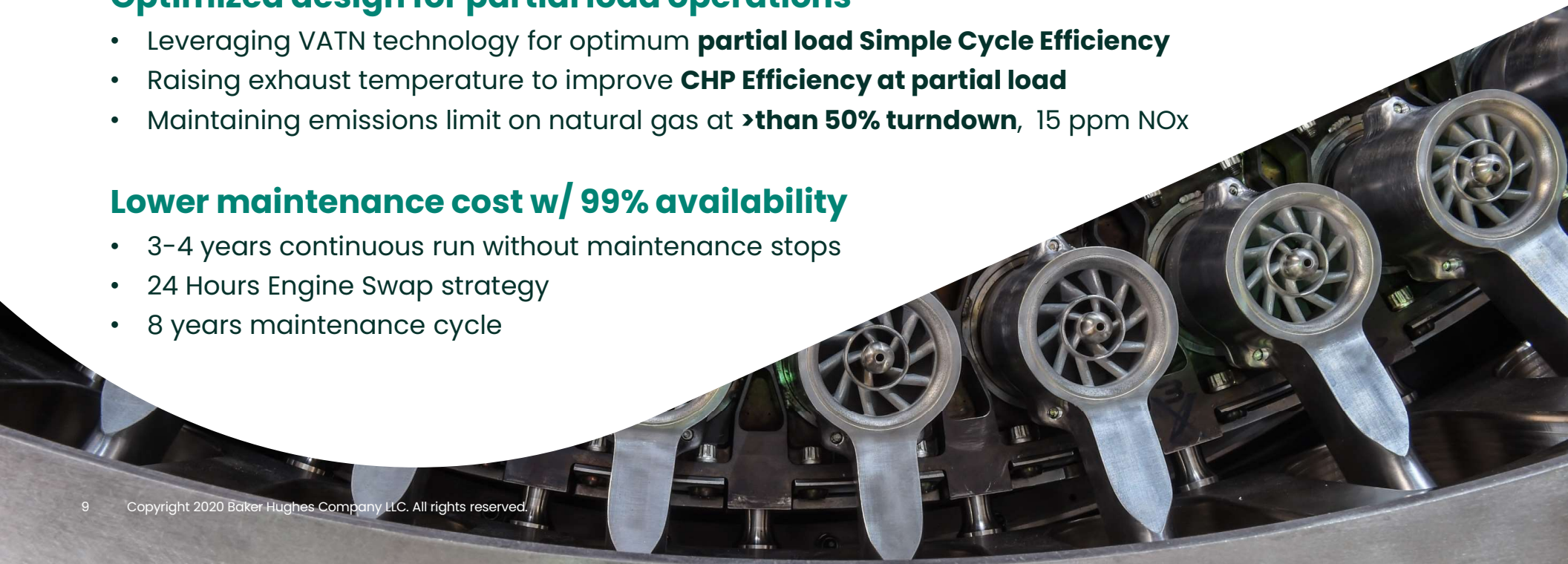
- Above market **Simple Cycle Efficiency** with NovaLT™12 and NovaLT™16
- **High CHP Efficiency** throughout the NovaLT family, reaching peak with NovaLT™5

Optimized design for partial load operations

- Leveraging VATN technology for optimum **partial load Simple Cycle Efficiency**
- Raising exhaust temperature to improve **CHP Efficiency at partial load**
- Maintaining emissions limit on natural gas at **>than 50% turndown**, 15 ppm NOx

Lower maintenance cost w/ 99% availability

- 3-4 years continuous run without maintenance stops
- 24 Hours Engine Swap strategy
- 8 years maintenance cycle

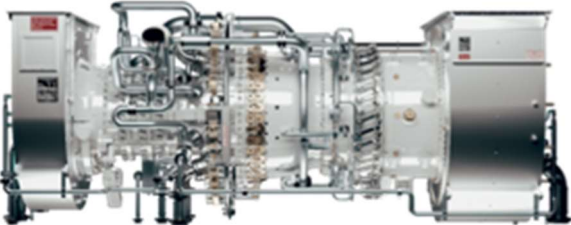


Hydrogen Experience

Industrial Gas Turbines H₂ Roadmap



Challenge / Effort



**Today –
100% H₂ Wet
Combustion**

NovalT™ family is able to:
Start up & Burn gas blends up to 100% H₂.
Switch from NG to gas blends up to 100% H₂ on fly.

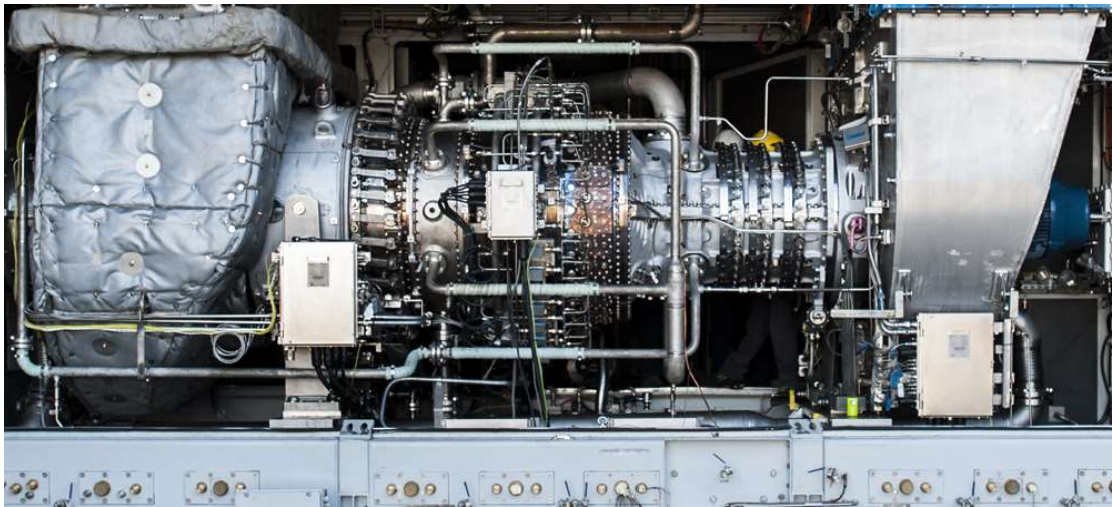
**Near Future –
H₂NG Blend DLN
Combustion**

NOx emission reduction strategy based on multi-fuel burner.
Preliminary tests for DLN combustion system down selection.

**Next –
100% H₂ DLN
Combustion**

Full Annular Rig verification.
Engine test verification.

SNAM AND BAKER HUGHES TEST WORLD'S FIRST HYDROGEN BLEND TURBINE FOR GAS NETWORKS



Powered by a **variable blend of up to 10% hydrogen**, the NovaLT12 turbine was designed and manufactured by Baker Hughes in Italy and will be installed at **Snam's** gas compressor station in Istrana (Italy).

Sources:

www.bakerhughes.com/company/news/snam-and-baker-hughes-test-worlds-first-hydrogen-blend-turbine-gas-networks
https://www.snam.it/en/Media/Press-releases/2020/Snam_Baker_Hughes_test_first_hydrogen_blend_turbine.html

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Baker Hughes' Nova LT Hybrid Turbine Creates a New Energy Future

**GAS PROCESSING
& LNG**
Technology and Business Information for the Global Gas Processing Industry

Snam and Baker Hughes test world's first hydrogen blend turbine for gas networks



Snam sceglie la turbina a idrogeno di Baker Hughes

la Repubblica

Snam testa con Baker Hughes la prima turbina "ibrida" a idrogeno al mondo per una rete gas

Baker Hughes

Questions