



**TURBODEN**  
**GAS EXPANDER**

Cod. 19-COM.P-5-rev.16

DON'T WASTE THE POWER OF GAS PRESSURE REDUCTION. EXPLOIT IT.



## WHY EXPANDERS?

Confident in our know-how, we aim to provide cutting-edge technologies to enhance the adoption of decarbonisation initiatives in the natural gas sector.



# INTRODUCTION

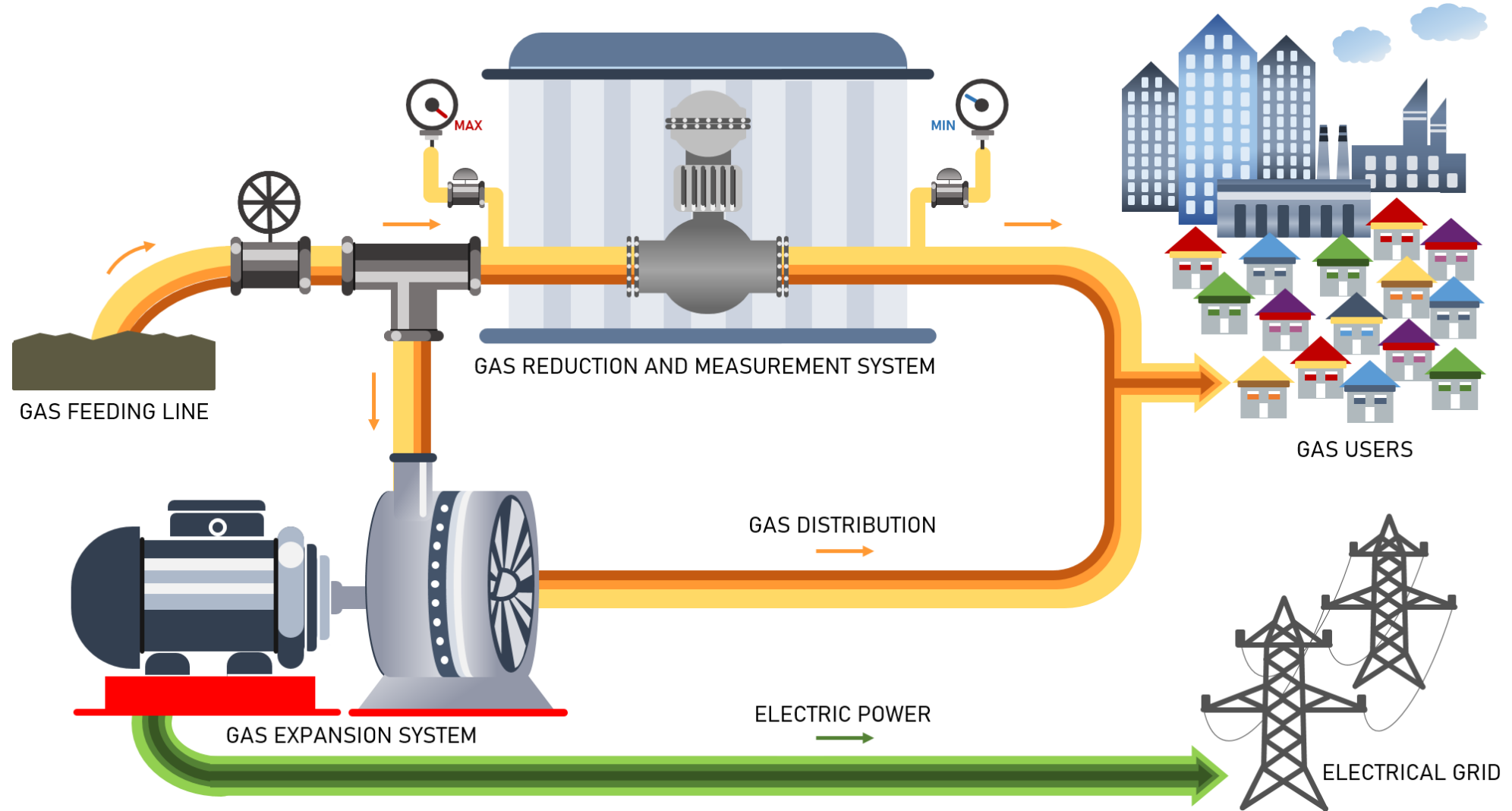


Turboden gas expander is a solution to enhance the energy efficiency of a natural gas network infrastructure, producing electricity by taking advantage of the reduction of gas pressure from the delivery level to the one required by users, be they residential or industrial.

## KEY POINTS

- Design based on 40+ years of experience, leveraging Mitsubishi Heavy Industries support
- Long experience in the energy efficiency sector
- Profit generation while reducing the gas pressure
- Solution for natural gas network decarbonisation
- Unmanned installations, thanks to specific technology features
- Turn-key equipment capabilities
- Over 60 Turboden turbine models within the 400 power plants fleet

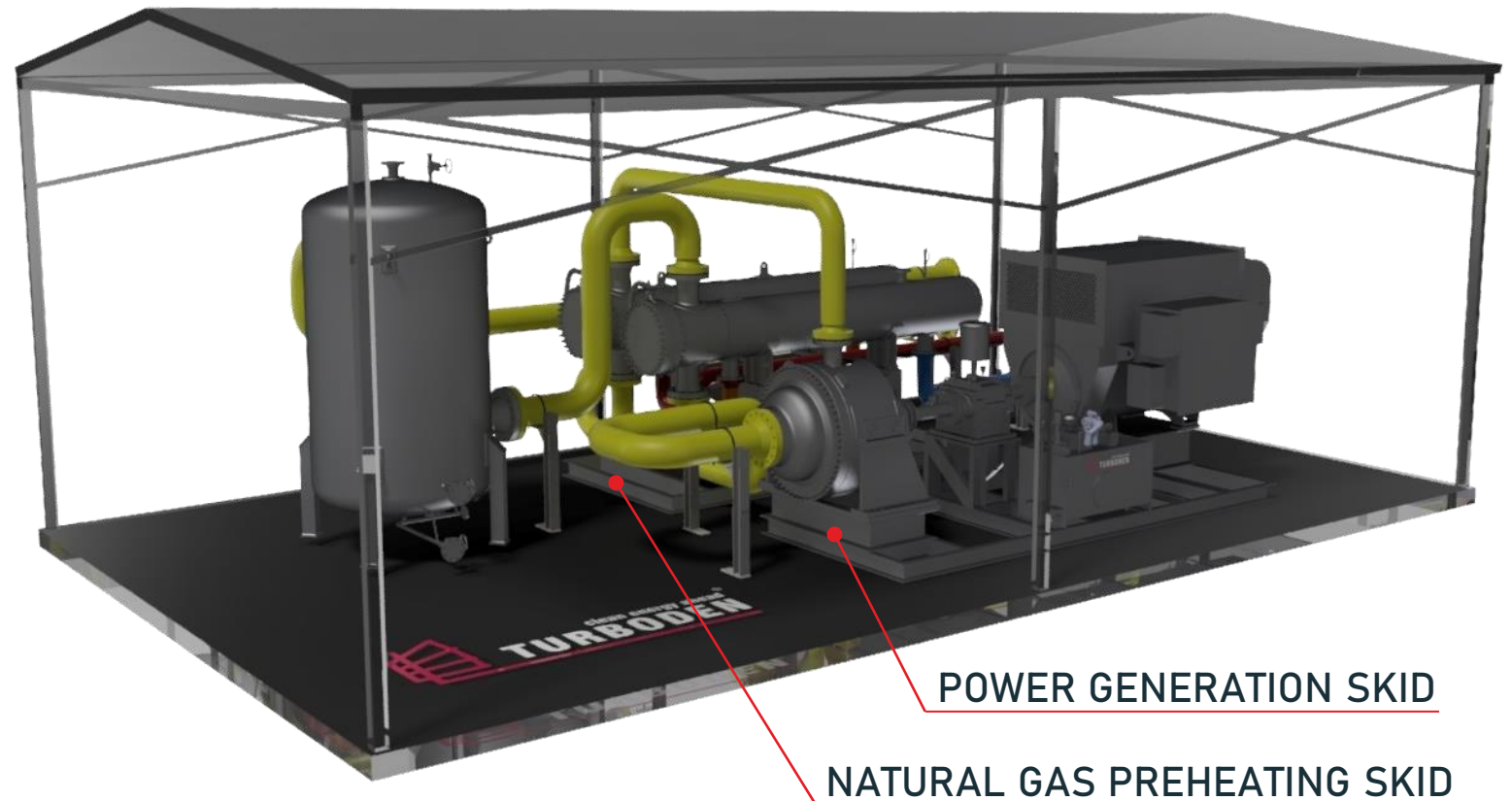
# THE CONFIGURATION



# THE SOLUTION

Natural gas turboexpanders **reduce gas pressure** from the delivery level to the one required by users, be they residential or industrial.

Unlike the reduction stations (still present in by-pass to the turboexpander, for safety reasons, as a redundant system), the turboexpanders exploit the pressure drop to **produce electricity, improving the energy efficiency** of the entire gas distribution system.



# FEATURES



## Simplicity

- ✓ Skidded solution of the complete expansion system
- ✓ Simple and robust power set with proven track record
- ✓ No major overhaul



## Flexibility

- ✓ Wide range of solutions, starting from 100 kWe
- ✓ Ease of integration into existing gas network facilities
- ✓ Simple and automatic handling of partial loads



## Experience

- ✓ Over 60 Turboden turbine models within the 400 power plants fleet
- ✓ 40+ years in the design and production of turbomachinery
- ✓ Long experience in the energy efficiency sector



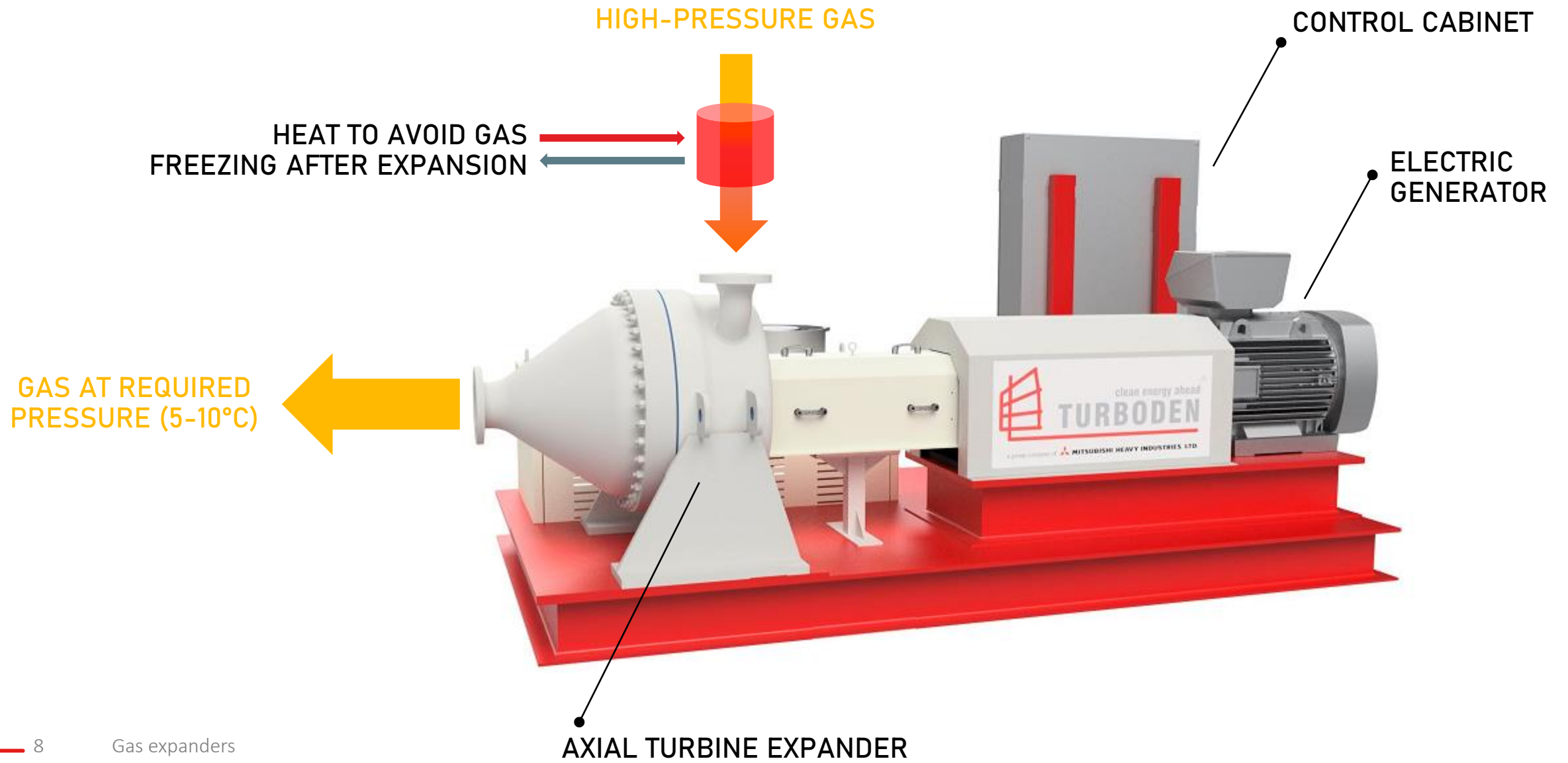
## Operation & Service

- ✓ High availability
- ✓ Designed to last over time (> 20 years)
- ✓ Structured after sales team, prompt assistance, personalized services

# TURBODEN RATING

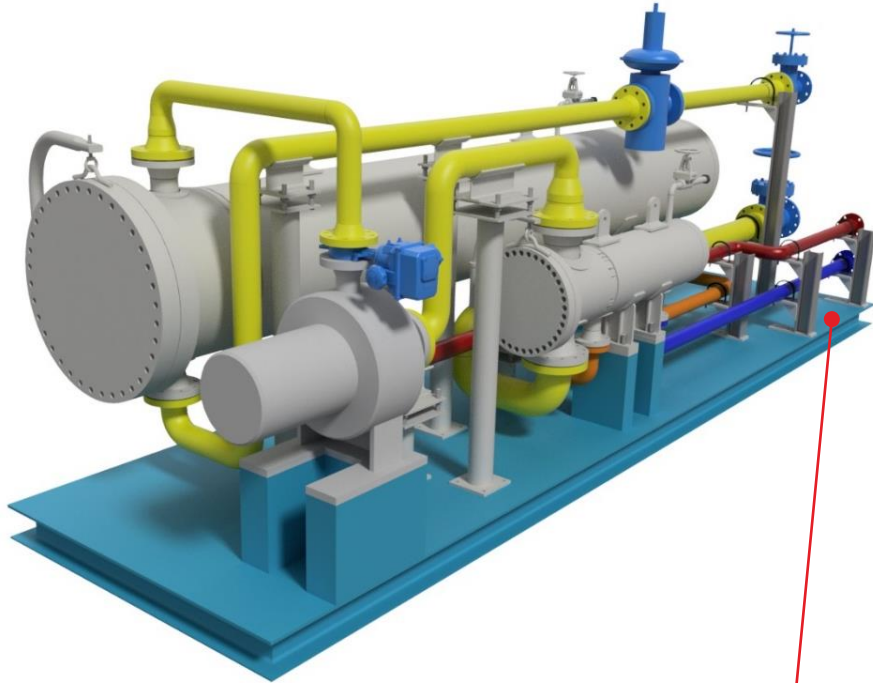
EXPANDERS SIZES	EXP 400	EXP 600	EXP 900	EXP > 1 MW
✓ Turbine stages/admission	Single stage radial turbine	Multi stages axial turbine		
✓ Flow rate	>5000 Sm <sup>3</sup> /h	20,000 – 100,000+ Sm <sup>3</sup> /h		
✓ In - out gas pressure range	70 - 1 bar(g)			
✓ Bearings	Rolling bearings	Self-lubricated rolling bearings		
✓ Seals	Single tight casing for impeller and generator	Mechanical		
✓ Generator	Permanent Magnet generator	A/Synchronous LV - Eff. 97%		
✓ Containerization	Sandwich panel REI 120 if 10m gate distance possible; or concrete if 2m gate distance possible. Necessary to segregate electrical panel and hot water boiler.			
✓ Gas pre-heating	Hot water boiler fed by natural gas and shell&tube heat exchangers + possible combination with electrical heaters and heat pumps – custom based on project specific.			

# SYSTEM LAYOUT

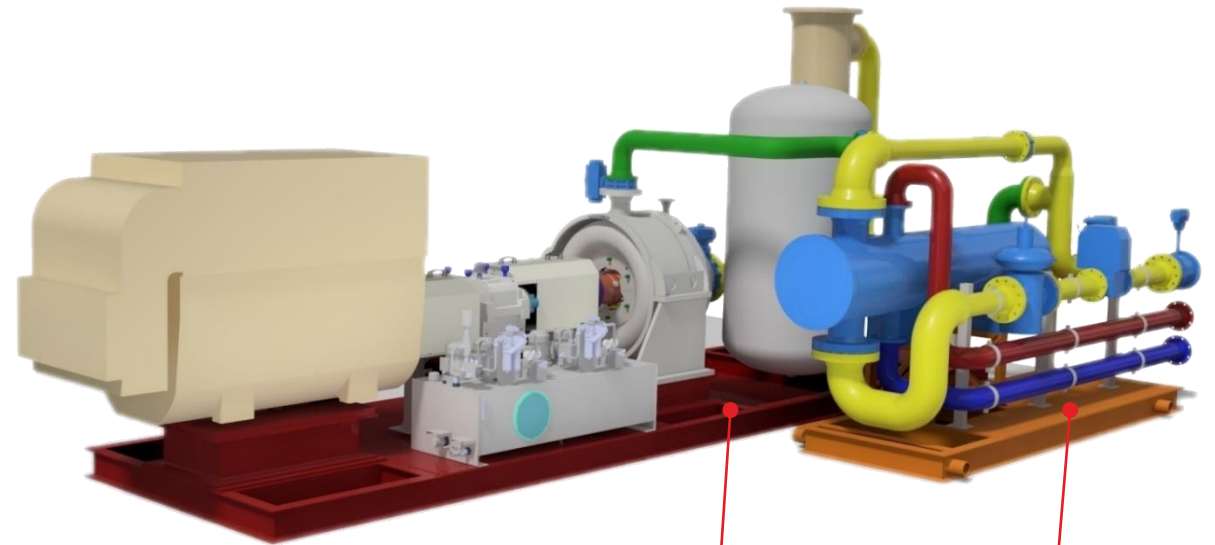




# GENERAL ARRANGEMENT



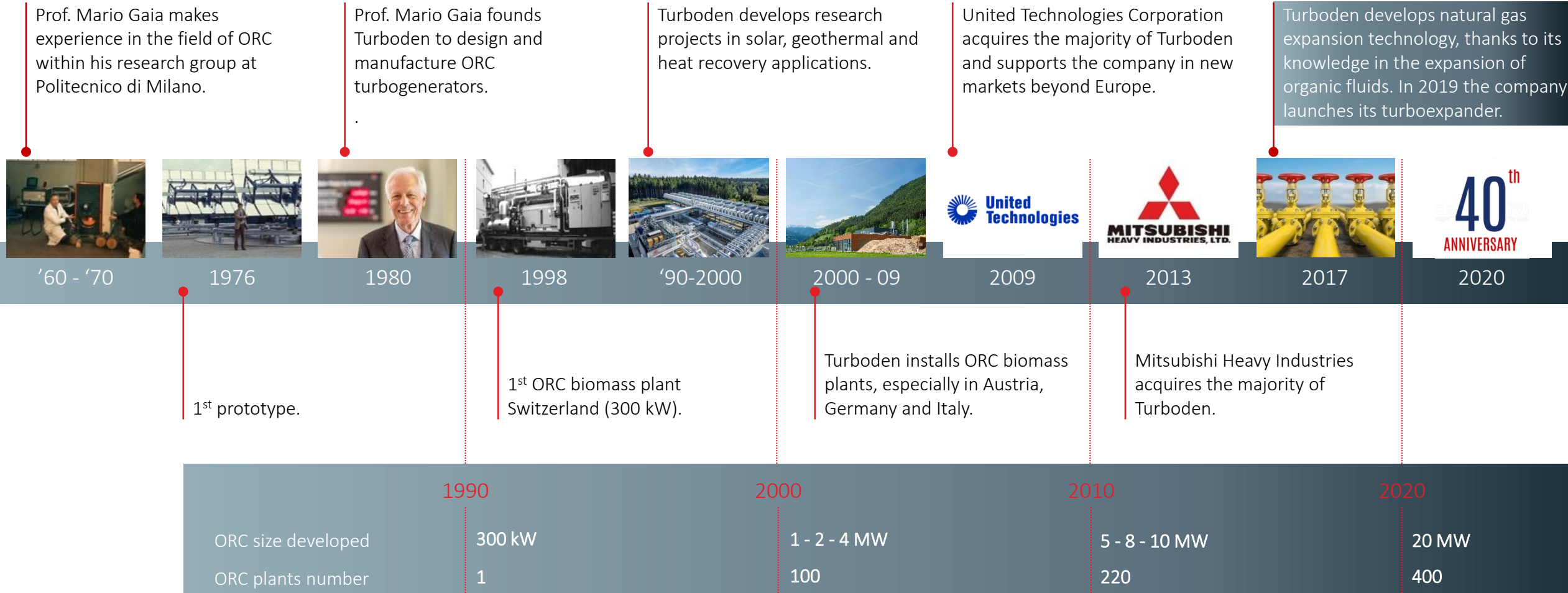
COMPACT PRE-ASSEMBLED SINGLE SKID



POWER GENERATION SKID

NATURAL GAS PREHEATING SKID

# TURBODEN MILESTONES



Prof. Mario Gaia makes experience in the field of ORC within his research group at Politecnico di Milano.



'60 - '70

Prof. Mario Gaia founds Turboden to design and manufacture ORC turbogenerators.



1980

1<sup>st</sup> prototype.

Turboden develops research projects in solar, geothermal and heat recovery applications.



1998

1<sup>st</sup> ORC biomass plant Switzerland (300 kW).



'90-2000

United Technologies Corporation acquires the majority of Turboden and supports the company in new markets beyond Europe.



2009

Turboden installs ORC biomass plants, especially in Austria, Germany and Italy.



2000 - 09



2013

Mitsubishi Heavy Industries acquires the majority of Turboden.



2017

Turboden develops natural gas expansion technology, thanks to its knowledge in the expansion of organic fluids. In 2019 the company launches its turboexpander.



2020

# WHY TURBODEN



## MITSUBISHI HEAVY INDUSTRIES GROUP

- Turboden fully embraces the values, philosophy and vision of its parent company MHI
- Turboden leverages the financial stability of its parent company and the technical support to satisfy customer needs



## CAPABILITIES & EXPERIENCE

- With 40 years of experience, Turboden holds the know-how of the ORC technology
- Excellence in R&D and turbine design
- Total capacity of 750+ MWe, 400+ plants, 50 countries
- Global presence



## CUSTOMER ORIENTATION

- Always dedicated to the success projects of the customers
- Prompt assistance and customized after-sales service
- Ready to provide optimized solutions for the clients
- High availability
- High customer satisfaction

# DEDICATED AFTER-SALES SERVICE

Qualified staff is exclusively dedicated to the customer assistance, both from remote and on-site, with the aim of optimizing the management of the plants. The customer can choose the most suitable service package thanks to the wide range of services offered.

Customer request or  
Turboden planned  
checks



Trend analysis with  
local operator  
support

Focused teamwork  
and technical  
decisions



Reaction plan: remote  
or on-site

Satisfied  
customer



## COVERAGE

2 service subsidiaries and 5 international service partner companies.

## ASSISTANCE

Turboden 24/7, the call center service h24, 7 days per week.

## CUSTOMISED SERVICES

- single contact for requests for support
- staff dedicated to on-site and remote technical support
- assistance of an international network of companies able to provide technical support
- wide range of services provided
- prompt assistance and customized after-sales services
- remote technical support using innovative tools (TOS – Turboden Online Service)
- dedicated spare parts warehouse



An aerial photograph of a gas expander facility. The facility consists of a large, light-colored rectangular building with a corrugated metal roof, situated in a cleared area. To the right of the building, a large black pipe runs across a field. In the foreground, there are several vehicles, including a white truck and a red truck, and some workers. The background shows a lush green landscape with rolling hills, scattered trees, and a few houses in the distance. The sky is clear and blue.

# TWO GAS EXPANDERS FOR ITALGAS

# GENERATORS

650 kW<sub>e</sub> EACH



# ELECTRIFICATION OF ITALGAS GAS NETWORK

**CUSTOMER:**

Italgas

**COUNTRY:**

Italy

**STATUS:**

under construction

**GAS EXPANDER SIZE:**

1.3 MWe (2 gas expanders, 650 kWe each)

**DESCRIPTION:**

power generation from gas pressure reduction in a natural gas network infrastructure

**OVERALL SOLUTION:**

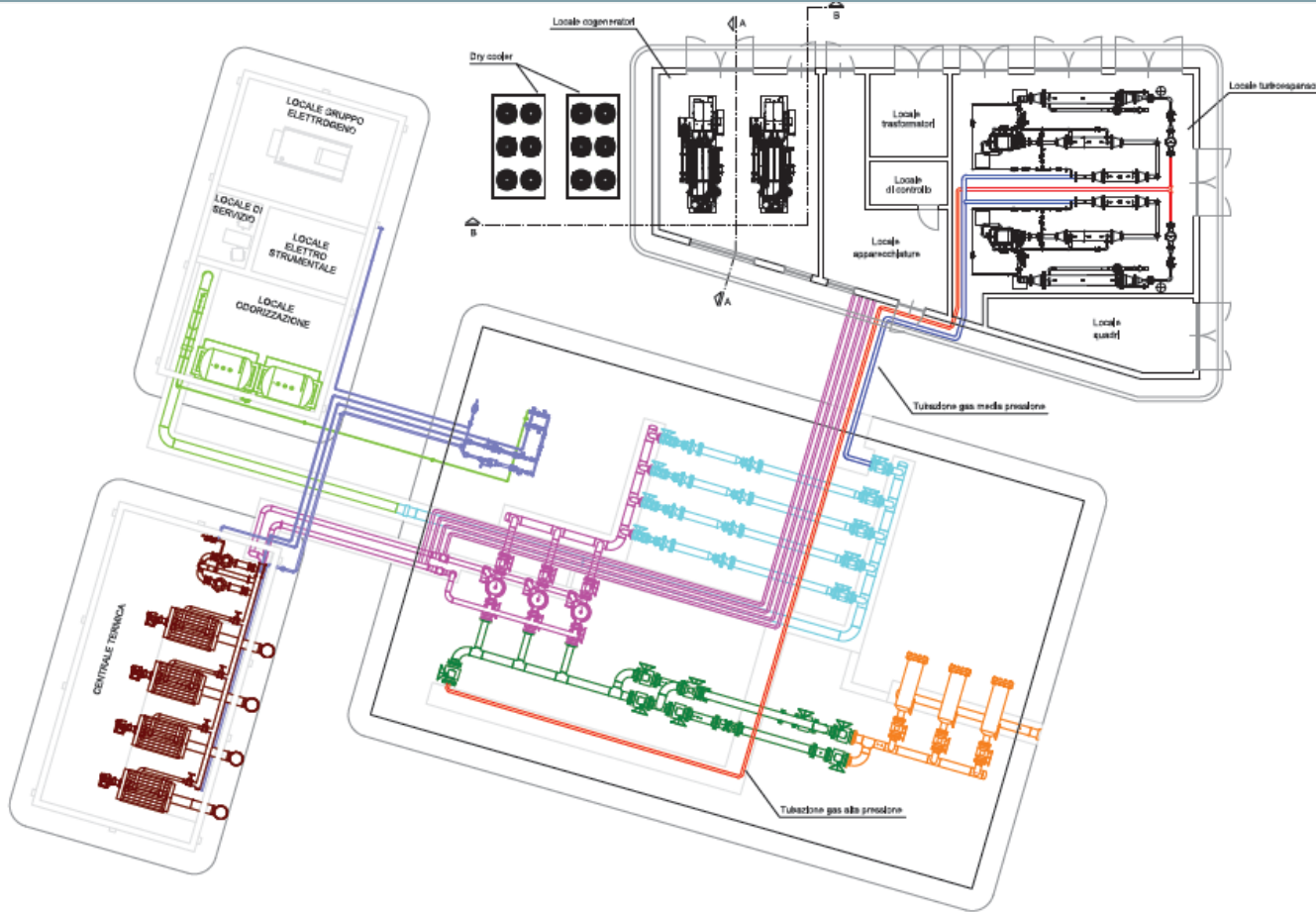
comprehensive project of a greenfield high efficient natural gas pressure reduction station, electrified by means of two turboexpanders and two cogenerative gas engines

**HIGH EFFICIENCY**  
of the pressure  
reduction station

**COMBINATION**  
of gas expander  
and gas engines



# THE SITE



# OUR EXPANDER

# PROJECT DETAILS

## GAS REDUCTION STATION

✓ Station size	280,000 Sm <sup>3</sup> /h
✓ In - out gas pressure	~ 50 (max design 75) - 24 bar(g)
✓ In - out gas temperature	5±15 - 5 °C

## SINGLE EXPANDER

✓ Flow rate	80,000 Sm <sup>3</sup> /h
✓ In - out gas pressure	50 - 24 bar(g)
✓ Expander power output	650 kWe
✓ In - out gas temperature	40 - 5 °C heated up with a hot water/natural gas heat exchanger





FIND OUT MORE



OUR EXPERIENCE. YOUR POWER.