



ANSALDO ENERGIA GROUP  
**FIT FOR TRANSITION**

ansaldo | energia

# ANSALDO ENERGIA GROUP

Ansaldo Energia Group is an international **leader in the power generation industry** and a key player in the energy transition. The company is owned by CDP Equity, Cassa Depositi e Prestiti Group, a national promotion institution that has supported the Italian economy since 1850 focusing on strategic investments. Thanks to its transversal skills, Ansaldo Energia Group aims to be a trusted partner for energy security and transition, providing global solutions. Ansaldo Energia Group can supply components (gas turbines, steam turbines, generators), turnkey plants and the most innovative support service solutions to the electricity generation industry.

**Ansaldo Energia's gas turbine** fleet can meet the highest standards in terms of emissions into the atmosphere. The whole fleet is already capable of burning from 40 up to 70% of hydrogen in mix with natural gas, depending on the equipment, with the goal to reach 100% by 2030.

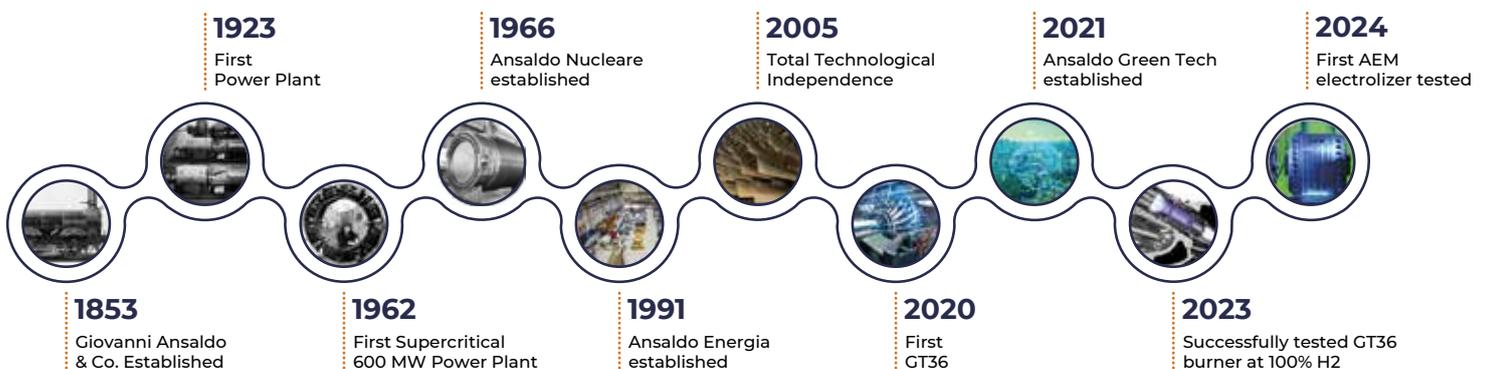
**Ansaldo Nucleare**, a wholly owned subsidiary of Ansaldo Energia, has been active in the nuclear sector globally for over 60 years: it deals with new builds, plant operation assistance, decommissioning and waste management and is at the forefront in the development of small modular reactors and reactors and IV generation reactors.

**Ansaldo Green Tech**, born in 2021 as a spinoff of Ansaldo Energia, is active in the field of transition thanks to its AEM electrolyzers of its own technology and the development of microturbines, ready to run on CO<sub>2</sub> free fuels and to support energy microgrids.

Thanks to its transversal skills, Ansaldo Energia Group can provide its customers with leading-edge solutions for the decarbonisation path. The production plant located in the headquarter of Genoa, Italy, combined with the workshops located in Abu Dhabi (UAE) and Wolverhampton (UK), can support the manufacturing needs of the entire Group.

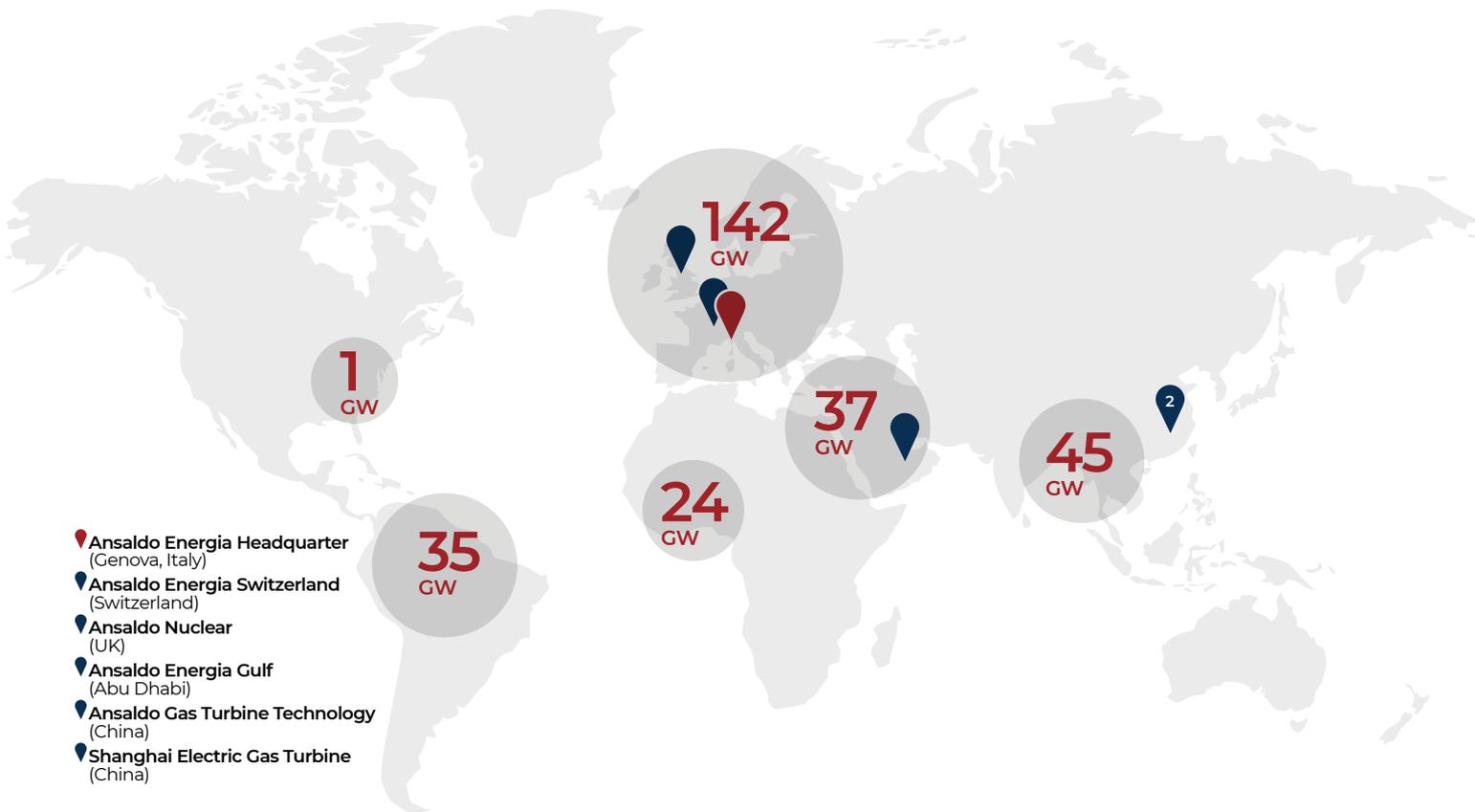
Ansaldo Energia Group currently **employs over 3,300 people** and has an international presence through local companies and branch offices in **over 30 countries**. Its broad-based presence allows the Group to quickly react to customers' needs and to better offer them its rich value proposition.

With its portfolio encompassing simple cycle plants as well as combined cycles, geothermal, nuclear power plants, microturbines and solutions for hydrogen production, Ansaldo Energia Group proposes itself as a multi-regional, trusted partner for the energy security along the transition path.



## Main markets for turbomachinery

More than 280 GW as equipment supplier



# POWER PLANTS

Ansaldo Energia designs and supplies full Power Plants, providing Customers with engineering, project management, procurement, construction, and plant commissioning. This all-inclusive approach is based on robust design, state-of-the-art turbines and generators, and a full set of advanced, sustainable technical solutions.

All our products are fit for **transition, emphasizing our commitment to future energy needs**. Our gas turbines are ready to burn high levels of hydrogen, and we are targeting 100% hydrogen capability across our entire fleet. Additionally, we can retrofit existing power plants to upgrade them for burning high percentages of hydrogen. Not only hydrogen, but our technology also supports the combustion of liquid green fuels such as HVO, methanol, and ethanol.

Once the plant is in operation, Ansaldo Energia ensures all maintenance and repair activities, supported by remote diagnostic tools. Existing plants can also be upgraded to improve sustainability and efficiency, or even fully revamped with the substitution of the power island and the renovation of all balance of plant auxiliary systems.

**Flexibility** is at the heart of Ansaldo Energia's proposal. Pre-engineered modules are integrated into fully specific solutions, tailored to customers' needs (load operation, peak demand, or cogeneration), grid requirements, local opportunities, and constraints. Time-to-market flexibility is also offered with fast-track solutions for quick turnkey delivery.

To promote plant acceptance, all facilities are designed to respect the local socio-cultural framework and minimize environmental impact. Ansaldo Energia Group's offerings encompass simple cycle plants as well as combined cycles, geothermal, nuclear power plants, solutions for hydrogen production.

# HEAVY DUTY GAS TURBINES

Ansaldo Energia offers E-, F-, and H-class heavy-duty gas turbines with output ranging from **78 to 560+ MW (ISO Power) for Simple Cycle**, and from **120 to 800+ MW for Combined Cycle** and Combined Heat and Power applications. Fit for transition, our gas turbines are designed to support the evolving energy landscape with low emissions and high efficiency, capable of burning high percentages of hydrogen.

All engines are characterised by well-tested design and **advanced technology**, featuring **high performance, top flexibility**, and easy and reliable operation with low environmental impact. Their main working parameters can be controlled and adjusted remotely, ensuring optimal performance. The control system and auxiliary equipment are designed to meet increasingly compelling eco-standards while optimizing maintenance plans, minimizing lifecycle costs, and maximizing the return on investment.

Extraordinary flexibility and low minimum environmental load allow these turbines to operate as real balancing units, taking full advantage of their wide range of operation to compensate for the intermittence of renewables in the grid. Our gas turbines can endure frequent starts and stops or run in Reserve/Stand-by Mode with rapid ramp-up to Peak Mode, making them the optimal solution for grid stability and the ideal support for renewable power generation.

Type	ISO power (MW)		Frequency (Hz)
	Simple cycle	Combined cycle (depending on configuration)	
<b>GT36-S5</b>	560+ (43%)	800+ (62.6%)	50
<b>GT26</b>	370 (41%)	540 (61%)	50
<b>AE94.3A</b>	340 (40.3%)	495 (60%)	50
<b>AE94.2</b>	191 (36.8%)	287 (55.8%)	50
<b>AE64.3A</b>	78 (36.4%)	120 (55.7%)	50/60



# FLEET DECARBONISATION

At Ansaldo Energia, we are dedicated to hydrogen as the primary vector for zero-emission power generation. Our belief in hydrogen's potential has driven us to make substantial investments in our machinery to achieve high levels of hydrogen combustion. Our flagship turbine, the **GT36**, is a testament to our innovation, capable of burning **up to 70% hydrogen**. The rest of our fleet can handle between 40% to 45% hydrogen. As pioneers in the industry, we were the first company to successfully test an H-class turbine burner, achieving 100% hydrogen combustion. Our ambitious goal is to offer 100% hydrogen capability across all our gas turbines by 2030, reflecting our commitment to a sustainable future.

Our innovative philosophy centers on a combustor design that allows for seamless switching between hydrogen and natural gas without the need for hardware changes. This adaptability ensures that our technology remains at the forefront of efficiency and environmental responsibility. Moreover, we are expanding our green fuel capabilities.

Our technology also supports the combustion of liquid green fuels such as HVO, methanol, and ethanol. This versatility not only supports our hydrogen initiatives but also enhances our overall environmental strategy.

Gas Turbine	Current capability* H <sub>2</sub> in volume up to	Tested on ring
GT36	70%	100% (burner)
GT26	45%	
AE94.3A	40%	60%
AE94.2	40%	
AE64.3A	40%	

**Committed to reach 100% of H<sub>2</sub> burning capability on all our fleet**

\*Dry premix combustion, No dilution

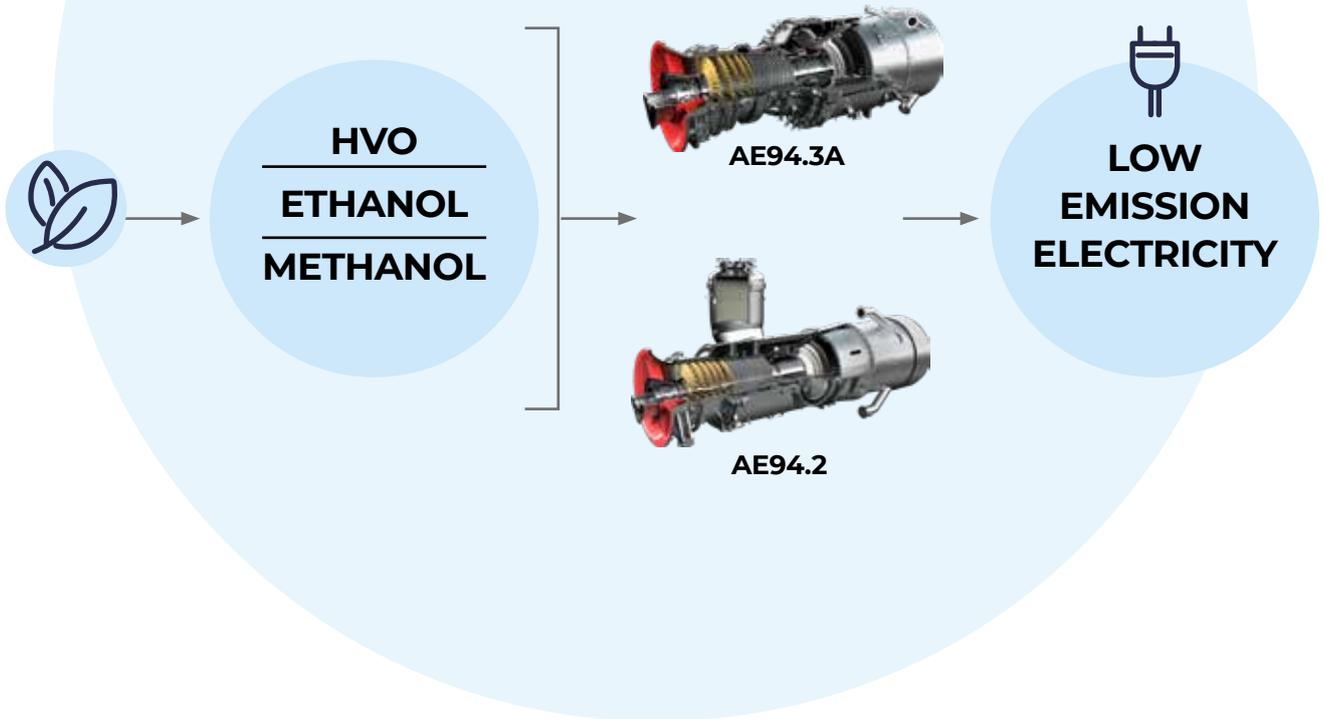
## MICROTURBINES

Our Microturbine AE-T100 can be operated on pure hydrogen fuel since May 2022, when the first application was implemented through a collaboration between the University of Stavanger (UiS), the German Aerospace Centre (DLR) and our partner Power Service Consulting GmbH (PSC).

A first step toward e-fuel operation was the development and implementation, in collaboration with Silent Power AG, of a version of microturbine powered by synthetic CO<sub>2</sub>-neutral methanol, available for commercialization since 2022. In addition, our microturbine is currently being tested for operation with ammonia at the King Abdullah University of Science and Technology (KAUST), at the Savona campus of the University of Genoa (UNIGE) and at the University of Mons (UMONS).

## Not Only Hydrogen...

We are ready for all the liquid green fuel thanks to high fuel capability of our AE94.2/AE94.3A



### SERVICE

Furthermore, we offer upgrade packages to make existing plants hydrogen-ready, enabling gas-fueled plants to become increasingly environmentally friendly. These upgrades also include the capability to burn HVO, methanol, and ethanol.

Our retrofit solutions make economic sense for customers, ensuring that they can transition smoothly towards greener energy solutions, reinforcing our role as leaders in the transition to a more sustainable and low-emission future.

Ansaldo Energia products and strategies are Fit for Transition, ensuring we lead the way towards a sustainable energy future.

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# STEAM TURBINES

## Current production includes:

- **Large ratings** for reheat applications, respecting the highest steam parameters for supercritical and ultra-supercritical conditions
- **Compact modules** for smaller ratings
- **Single-and two-cylinder models** for non-reheat thermal cycles
- **Geothermal steam turbines** based on impulse design

Each steam turbine model is a combination of pre-engineered, well-proven modules of different sizes, providing a broad range of power ratings and applications in both 50 and 60 Hz markets. Modular design reduces both technical development and manufacturing time. All models are assembled in our workshop – except the large low-pressure sections, which are most conveniently field-installed.

Steam turbines are the foundations on which Ansaldo was built: the Company was established in 1853 to support the development of the then-flourishing steam locomotive industry. Today's Ansaldo Energia steam turbine portfolio has been developed for application in most power generation technologies, from traditional fossil combustion to renewable energy:

- **Steam power plants** and **Combined Cycle plants**
- **District heating, cogeneration, desalinization** and **solar power** facilities, as well as **nuclear plants**

Type	Series	Power range	Applications
Reheat	RT30	150-1,000	Combined Cycles, Fossil, Cogeneration
	MT15	100-300	Combined Cycles, Fossil, Solar
Non-Reheat	MT20	100-350	Combined Cycles, Fossil, Cogeneration
	MT10	40-250	Combined Cycles, Fossil, Solar
Geothermal	GT	15-150	Geothermal
Nuclear	MT10/MT20/ RT30	100-800	Small Modular Reactors (SMR), Advanced Modular Reactors (AMR), repowering of Nuclear Power Plants





# GENERATORS

Ansaldo Energia generators combine **high performance and reliability** with the **worldwide experience** gained in more than 1,300 applications – of which over 1,000 are of air-cooled generators (both round and salient pole rotors) and about 300 of hydrogen-cooled and hydrogen/water-cooled turbogenerators. Their technology is continuously updated and improved by the Company's Research & Development department with the use of virtual design tools and finite-element 3D analysis of mechanical, electrical and ventilation behaviour. These activities resulted in increased power boundary for the specific type of cooling, highly flexible operating capabilities and top reliability.

Ansaldo Energia Generators can be tailored based on project, location and technical requirements, and can suit a wide range of applications:

- **Simple and Combined Cycle power plants**
- **Steam power plants** (including Nuclear plants)
- **Geothermal power plants**
- **Hydroelectric power plants**
- **Synchronous Condensers** with or without flywheel

Type	Range (MVA)	Applications
<b>Hydrogen/water-cooled turbogenerators</b>	Up to 1,200	Gas / Steam turbines
<b>Hydrogen-cooled turbogenerators</b>	Up to 740 MVA	
<b>Air-cooled turbogenerators</b>	Up to 450 MVA	Gas / Steam / Geothermal turbines
<b>Hydrogenerators</b>	Up to 420	Hydroelectric plants

All Generators can operate as **SYNCHRONOUS CONDENSERS**

## SYNCHRONOUS CONDENSERS

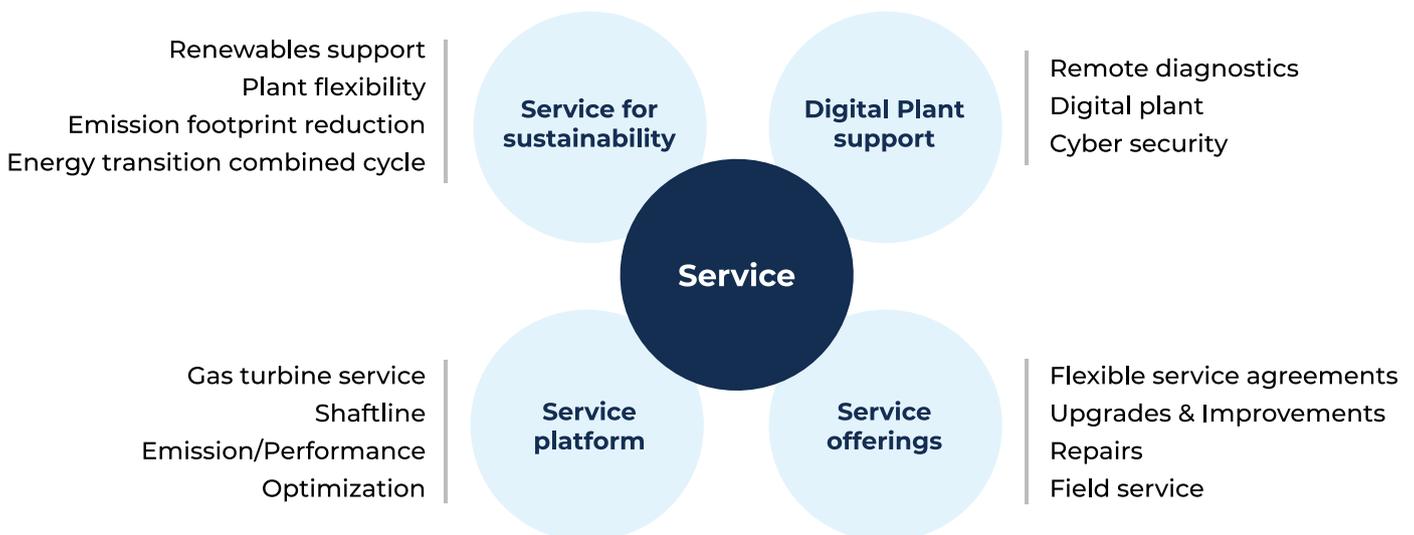
Synchronous condensers provide the grid with voltage regulation, reactive power, short circuit power, and inertia. They play a key role due to the **increased energy generation by renewable sources** and the shutting down of conventional power plants, leading to worsening electricity supply services, voltage quality and grid stability. A strategic deployment of synchronous condensers stabilizes the grid and helps to reduce the risk of blackouts, offsetting the surges due to increased electricity production from intermittent, renewable sources.

# SERVICE

**Ansaldo Energia Service** is a global multi-platform service provider supporting safe, reliable operation and improvements for power generation equipment and plants.

As a proactive partner with access to the entire Ansaldo Energia product portfolio, Ansaldo Energia Service is a “one-stop shop” service provider, offering multi-technology solutions for efficiency, reliability, safety, and emission compliance. Its value proposition is based on the ability to develop the right solution for each specific customer. By optimizing customer profitability, uptime, and expected plant life, Ansaldo Energia services enhance the value of existing assets.

Ansaldo Energia Service **innovative solutions** can be packaged into **service contracts**: from field assistance to repair and part service, from turbine upgrades to comprehensive flexible service agreements. The upgrade packages include the Balance of Plant modifications needed to fully exploit improvement potential and enhance flexibility. Additionally, existing power plants can be retrofitted for burning high percentages of hydrogen and other green fuels.



Service agreements can be structured to embrace different perimeters. Ansaldo Energia Service contract arrangements are as innovative and flexible as the technical solutions proposed: scope and terms, type of warranty, payment structure, performance-oriented incentives, and risk-sharing formulas can be tailored to customer's requirements.

## GLOBAL REPAIR

Ansaldo Energia offers a full spectrum of parts repair services - all backed by internal engineering and leading-edge technology. These state-of-the-art repair services can extend the life of components and optimize the maintenance budget. The Repair Centers at Ansaldo Energia offer **specialized services for the repair and refurbishment of critical components**, ensuring minimal downtime and extending the operational life of power generation equipment.

Global repair service operates by a network of leading-edge technology centers. The repair network includes Ansaldo Energia repair centers located in Genoa Headquarters, Italy, in the Middle East and China, and qualified high-technology partners.



## ANSALDO ENERGIA SERVICE GLOBAL CONTRACT PORTFOLIO

# >220

Gas Turbine under long-term service agreements

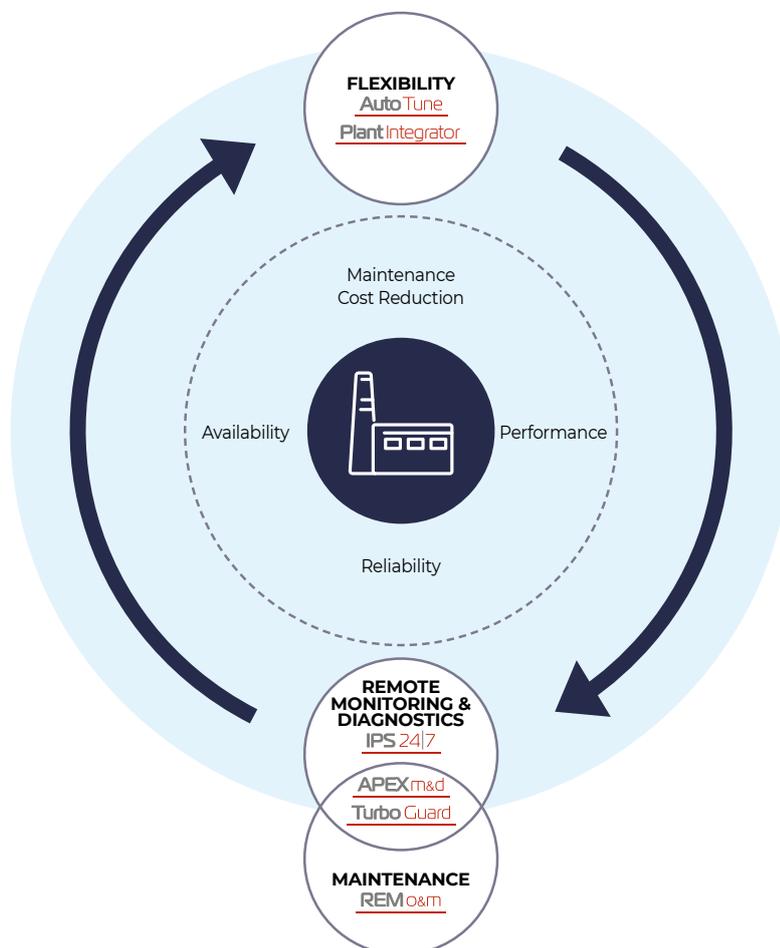
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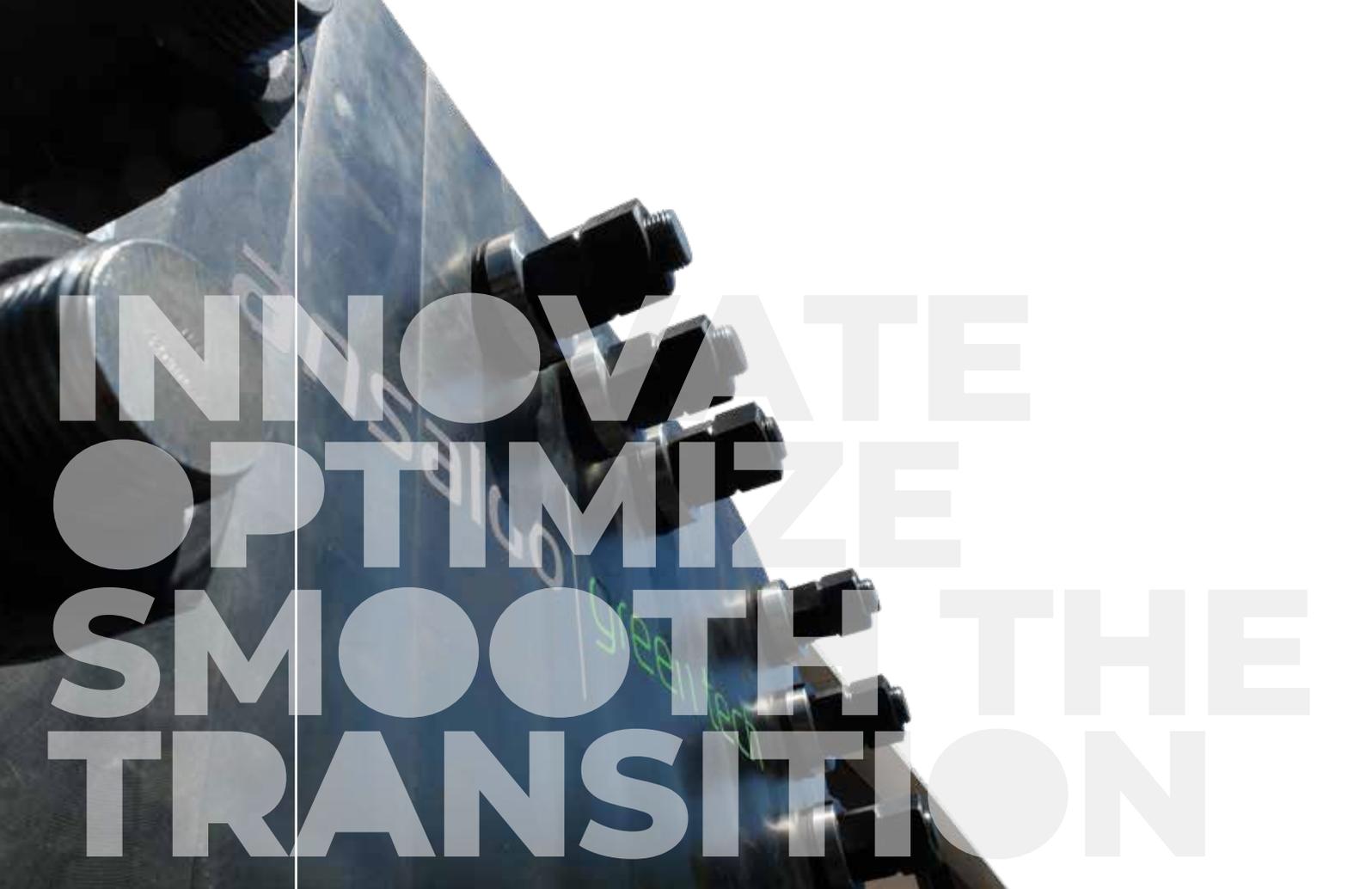
Gas Turbines as selected service provider

### DIGITAL PLANT SUPPORT

Digital Plant Support includes advanced systems and tools to implement remote diagnostics and predictive maintenance, optimize online performances, support remote operation and maintenance activities, and protect sensible operations from cyber-attacks.

Ansaldo Energia's Integrated Plant Support brings together all **Customer Support functions** into a global operating platform. Ansaldo Energia Digital Offering guarantees the real time connection between Ansaldo Energia Original Equipment Manufacturing expertise and the Customer's Power Plant.





# ANSALDO GREEN TECH

The green evolution of Ansaldo Energia portfolio goes hand in hand with product diversification – intended to broaden the Group scope of activity and cover new power generation and energy storage technologies.

This mission is assigned to Ansaldo Green Tech, incorporated in 2021 and fully owned by Ansaldo Energia, which has inherited from Ansaldo Energia specific know-how and capabilities. As the power generation sector undergoes a structural revolution in terms of energy source mix, grid stability and continuity of supply become vital in the years to come, while electrification processes will further increase electricity demand. Hence, the world economy will face a double challenge: increase the overall power output while replacing fossil sources with renewables.

The growing share of renewables and their cyclic availability must be compensated with specific solutions to ensure grid stability and continuity of supply, such as energy storage technologies (including hydrogen) and grid management systems.

To support this new scenario of decarbonization and energy diversification targets, Ansaldo Green Tech activities are focused on three main areas:

- **development** of water electrolyser plants based on an innovative **Anion Exchange Membrane stack**,
- **optimization of our multi-fuel microturbines**,
- **scouting of innovative solutions** for energy transition.

# ANSALDO NUCLEARE

Ansaldo Nucleare SpA, together with the subsidiary Ansaldo Nuclear Ltd (UK), operates as a “One Stop Shop” dedicated to nuclear power.

Nuclear power plays a pivotal role in achieving a low-carbon economy and serves as a key energy resource to meet the European Union’s objectives for 2050. Half of the CO<sub>2</sub>-free electricity generated in the European Union comes from its more than 120 nuclear reactors in operation. The contribution of these plants to the abatement of overall carbon emissions amounts to 700 million tons of CO<sub>2</sub> per year. Established in Genoa in 1966 as Ansaldo Meccanica Nucleare SpA, in 1999 it became a division of Ansaldo Energia, and in 2005 it turned into an independent Company wholly owned by Ansaldo Energia.

Ansaldo Nucleare provides Integrated **delivery model for nuclear power plant products** by matching, combining, complementing systems and components already consolidated in the market for all nuclear activities. Combined with our feed engineering services, Ansaldo Nucleare’s activities range from the production of critical high-tech components to the design and construction of new builds, from decommissioning to advanced research on radwaste management, fusion, generation iv plants and small modular reactors.

Ansaldo Nucleare also has in place collaborations with Research Centers and Universities, offering public/private partnership opportunities to bridge the gap between fundamental research and industrial applications. Ansaldo Nuclear Ltd is the largest independent turnkey provider of nuclear engineering, manufacturing and services in UK, and part of Ansaldo Nucleare SpA. Ansaldo Nuclear Ltd has supplied an extensive range of equipment and solutions most UK nuclear power stations, including fuel route, remote handling, inspection equipment, encapsulation and waste handling. Ansaldo Nuclear Ltd also operates in the defence sector.



# OUR COMPANIES

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- **Power Plants** from the turboset package to the complete turnkey plant
- **Heavy Duty Gas Turbine** for simple and combined cycle power plants
- **Steam Turbines** geothermal and steam turbines for gas, thermal, nuclear, geothermal and solar power plants
- **Generators** including also hydrogenerators and synchronous condensers
- **Service**, a one-stop-shop for power generation equipment

## ansaldo | nucleare

- **New Builds:** Large scale - SMRs - AMRs - Fusion
- **Service** (Plant Life Operation): plant life extension - nuclear safety upgrade - maintenance
- **Decommissioning:** dismantling, waste management
- **Engineering Services:** feed - special components - high specialized analysis

## ansaldo | green tech

- **Green Hydrogen:** electrolyser manufacturing – hydrogen production plants – hydrogen plant maintenance
- **Microturbines:** multi fuel microturbines (H<sub>2</sub>, eFuel or BioFuel ready ) for civil and industrial applications, microgrids, co/tri generation
- **Energy Transition Solutions:** scouting on innovative and sustainable solutions

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