Sustainability is also at the forefront of Triveni's development efforts. Its CO_2 turbine is designed and manufactured to power mechanical ESS, of the kind that the Company is geared to build for NTPC. Triveni Turbines is also primed to manufacture and test CO_2 Heat Pumps & Chillers at its facility in Peenya, Bengaluru. It is further developing solutions to accelerate the energy transition journey of its customers by utilising low grade heat – either in the thermal form (e.g. waste heat) or in gaseous form (e.g. steam, other fluids, etc.) – into power.

Technology, Research & Development

Triveni Turbines is among the global leaders in terms of providing solutions to address energy sustenance. The Company innovates cutting-edge solutions for various segments of the process and energy industries across the globe. Triveni's products are also deployed in thermal renewable sectors – installations in Solar Fields, Waste Heat Recovery (Steel, Cement), Waste-to-Energy (Biomass, Refuse Derived Fuel (RDF)) and Municipal Solid Waste (MSW), ensuring sustainability in energy generation. Triveni Turbines has ramped up turbine installations in Process Industries such as Oil & Gas, Chemicals, Textile, Paper & Pulp industries, Pharma, Sugar, Distillery – all of which have demonstrated benchmark efficiencies and reliability.

The focus of Triveni's R&D division in FY 25 was on:

- Expanding the product portfolio for high-speed applications & enhanced efficiency
- Offering advanced aero-solutions to the industrial turbine market
- Customising existing products for user industry process needs
- Accelerating commercialisation of sustainable technology programmes

Expanding product portfolio for high-speed applications & enhanced efficiency

Triveni Turbines has developed high speed condensing machines, incorporating upgraded LP modules – a key differentiating factor for its machines. These product portfolio additions offer reduced footprint and improved efficiencies. Triveni has installed several of these machines in India and across the world.

API 612 turbines for global oil & gas market

Triveni Turbines offers backpressure and condensing direct drive machines for oil & gas applications. These machines have a power range between 0.1 MW – 100 MW, and incorporate the latest advancements in steam turbine technology to achieve the minimum specific steam consumption.

Notable wins

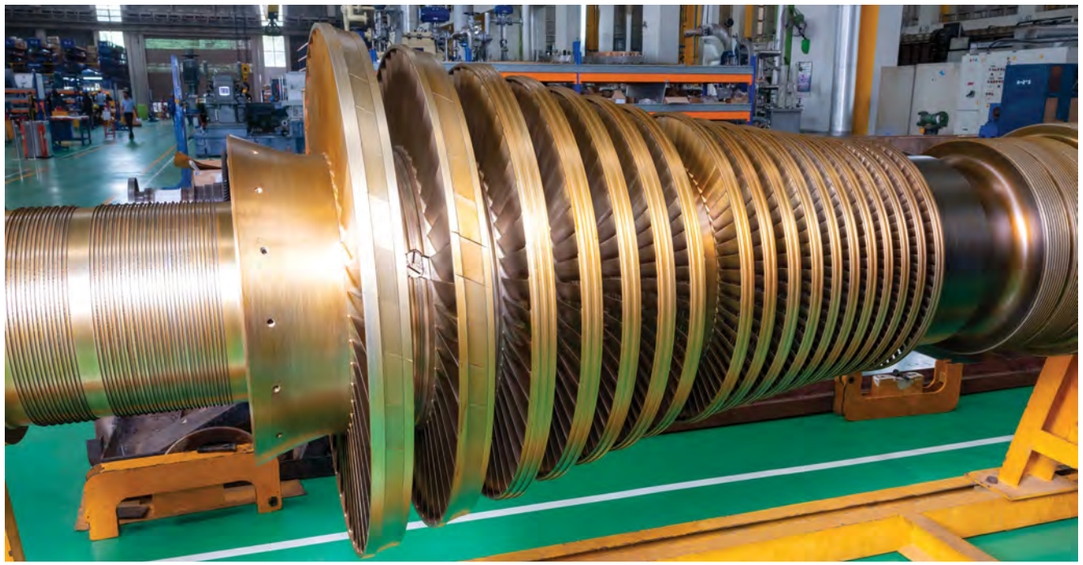
- The Company continues to win significant orders in Oil & Gas segments across the globe
- The Company has won several customised axial exhaust turbines in the European renewable and process industry market
- The Company has leveraged its expertise in modernising ageing power generation equipment by winning retrofit upgrade orders
- For European customers, Triveni has installed and commissioned a replacement turbine-generator package, to be mounted on columns with spring support system. This novel mounting arrangement reduces the civil cost for the customer substantially, allowing for greater suitability for Triveni's replacement product offerings.
- The Company has secured several axial exhaust turbine orders for district heating in Europe
- The Company has won several global orders for sub-zero applications

Expanding Triveni Subject Matter Expert (SME) panel in Europe

During the year, Triveni expanded its SME Panel in Germany and Switzerland with experts in Aerodynamic, Thermodynamic, Blade Mechanics, Valves, and Rotor dynamics domains. Along with university collaborations, this puts the Company on a strong footing for technology advancement in the turbomachinery domain of steam turbines, gas expanders and compressors. Product audits and process audits were also carried out by the SME panel during the year.

Accelerating commercialisation of sustainable technology programmes

- **Testing of subcritical CO_2 turbine for energy storage application:** The first CO_2 turbine of 20 MW capacity for the European market was designed, manufactured and tested by Triveni Turbines during the year. This is a major milestone for the Company as it expands into the energy storage solutions market for non-steam based renewable energy generation. The second-of-its-kind subcritical CO_2 turbine of same size shall be integrated into the turnkey ESS for NTPC.
- **Thermal battery solution for NTPC:** This project is a landmark development in the domain of Long Duration Energy Storage (LDES), and will be a first of its kind installation in Asia. Triveni Turbines will not only integrate and implement the solution for NTPC, but also manufacture and supply some of the key components, such as CO_2 turbine.



- **Heat pumps & chillers for heating and cooling solutions:** Triveni Turbines continues to expand its development work in heat pump and chiller solutions with natural refrigerants like CO_2. These solutions are being developed with sustainability in mind, to provide a low global warming potential (GWP) alternative for heating and cooling of industrial applications without the use of ozone depletion substances (ODS). The Heat Pump market is nascent, and has seen good traction in Europe after the Ukraine-Russia conflict. Efficiencies achieved with trans-critical CO_2 based heat pumps, and the environmental benefits it offers against other heat pumps, are attractive value propositions. The Company is now geared to fully unlock this value for customers. Led by this conviction, Triveni Turbines has invested in setting up a Heat Pump & Chiller Test Centre at its Peenya facility. The Test Centre will be fully commissioned by the end of Q1 FY 26, and shall be ready to test all heat pumps and chillers manufactured by Triveni Turbines.
- **Super-critical CO_2 turbine:** Triveni has made significant strides in the supercritical CO_2 turbine technology by getting its design validated by a USA-based independent, applied R&D organisation based for industrial application.

Offering advanced aero-solutions to the industrial turbine market

- **Twisted 3D IP Blades Development for HP & IP Section:** These tailor-made twisted 3D IP blades help improve the overall efficiency of the turbine. They are aerodynamically shaped to extract the maximum amount of work potential from the flow.
- **LP Module Testing:** Testing and validation of low-pressure module for stage performance and structural integrity is being conducted in a leading university. The test turbine features hundreds of internal measurement points to capture high resolution stage-wise flow data, and further aid deeper analysis of the module behaviour at both design and off-design operating environments.
- **In-House Testing & Validation Centre for Turbomachinery:** To maintain its leadership in offering proven high thermal efficiency products, Triveni is engaged in cutting-edge laboratory testing programmes. The findings & analysis are a validation of predicted performance and will pave the way for further enhancement of conversion efficiency. Triveni Turbines' expansion of in-house test facility accelerates the performance validation programme, and a new Load Test Centre, with capacity up to 15 MW, is also being set up.
- **Heat Pump & Chiller Test Centre:** For validation of its sustainable product portfolio, Triveni Turbines is setting up India's first commercial, high temperature CO_2 heat pump and chiller test facility. This will be used to test and validate heat pumps and chillers that shall be built by the Company. To establish the concept of CO_2-based heat pump, the Company is also building a full scale heat pump as a demonstration unit for its potential end users.

Power upgrades with Triveni blade path and conversion from extraction condensing to back pressure application for various OEM installations were undertaken in both domestic and global markets.

New Aftermarket Solutions - Triveni REFURB (Any Make, Any Age)

Refurbishment has emerged as a strong growth segment for Triveni Turbines in recent years, and the Company has undertaken several critical projects in the refurbishing market.

- Triveni has a refurbishing, rotor repair and spare development capability of utility turbines up to 250 MW
- HP and LP blades and stationary components were supplied for two geothermal turbines in the Asia-Pacific
- Spare large size LP blades were supplied to a utility customer in USA for Geothermal Applications
- Power upgrades with Triveni blade path and conversion from extraction condensing to back pressure application for various OEM installations were undertaken in both domestic and global markets
- Replacement of rotor supplies for various Japanese and European OEM turbines were provided during FY 25. This involved the development of blade roots and establishment of new blade shroud riveting practices.
- Efficiency upgrade of turbines up to 30 MW and conversion of extraction condensing turbine to a very high back pressure turbine were successfully completed on Triveni Turbines' old fleet
- Replacement rotors were also supplied to customers in USA & European geographies
- With the API market in focus, Triveni has supplied a new rotor for a 27 MW compressor drive turbine. It has also successfully performed High Speed Balancing of 25 turbine and compressor rotors of other OEMs.

Intellectual property rights

The Company has strong innovation expertise, and is engaged in research activities that generate vital Intellectual Property (IP) – an essential lever for preserving its competitive edge. To ensure complete protection of Triveni's valuable IP, a specialised team of IP experts works closely with the R&D department, safeguarding innovations from the initial conception phase to the final production stage.

The Company's robust IP strategy is designed to maintain its leadership in technology. The strategy involves proactively seeking patents and industrial design registrations across the globe, with a particular focus on strengthening the Company's presence in India. Triveni Turbines has obtained IP protection in various jurisdictions, including India, Europe, Southeast Asia, the United Kingdom, and USA. Additionally, as the Company grows its operations, it aims to extend this protection to new international markets.

As of March 31, 2025, the Company has achieved considerable success in securing Intellectual Property Rights worldwide, with 400 global IPR filings, including a notable number in India. These filings cover diverse areas, such as turbomachinery and CO_2-based power systems.

IT and Digitalisation

Triveni Turbines was on an exhilarating digital transformation journey during FY 25, with its digitalisation efforts dedicated to crafting a comprehensive digital strategy roadmap. The roadmap was designed to speed up the adoption of cutting-edge technological innovations, refine the Company's processes, maximise its IT investments, and establish a robust data security framework – all with its eyes focussed firmly on the opportunities of the future.

In FY 25, Triveni Turbines launched several key initiatives to boost efficiency, foster collaboration, and enhance organisational decision-making as part of its digital transformation. These initiatives helped streamline the Company's enterprise communication, and fostered collaboration in a more integrated and secure ecosystem. Triveni also modernised its IT infrastructure through a shift from traditional servers to the Nutanix platform, dramatically enhancing its systems' scalability, reliability and performance.

In a significant leap in its Customer Relationship Management (CRM) proposition, the Company implemented CRM Assets 360 on Salesforce. This unified, data-driven approach towards customer interaction has equipped Triveni to better serve its clients. Additionally, the introduction of Case Management and Knowledge Management solutions on the Salesforce optimised its customer support efforts, leading to quicker issue resolution and improvement in information management across the organisation.

Cognisant of the immense potential of data-driven decision-making, the Company also focussed on developing advanced dashboards and analytics, using Power BI for its HR, Sales and Project functions. These insightful tools have empowered Triveni Turbines' leadership teams to make informed decisions that drive positive business outcomes. The Company continues to enhance its cybersecurity framework alongside these innovations by implementing Single Sign-On (SSO) and Two-Factor Authentication (2FA). These features bolster access control while ensuring that its sensitive information remains protected, creating a seamless and secure digital experience for all involved. A special focus was on introducing security policies across applications for effective data management, and strengthening control and compliance to safeguard from cyber-attacks and data leaks.

During the year, the Company also worked on analysing turbine log sheets, and harnessing data analytics to amplify operational efficiency. By studying key performance indicators, it successfully secured valuable insights into turbine performance and predictive maintenance needs, setting the stage for enhanced equipment reliability and reinforcing the organisation's commitment to innovation in manufacturing.

As Triveni advances on its digitalisation journey, these exciting initiatives will set a robust foundation for enhanced agility, efficiency and growth in an ever-evolving industrial landscape.

Human Resources

People strategy: Driving excellence, innovation and customer-centricity

Triveni Turbines' people strategy is the cornerstone of its organisational excellence. The Company is focussed on building a future-ready workforce, aligned with its customer-first mindset and innovation-driven agenda. It has adopted a focussed approach to internal talent development, external hiring, continuous learning, diversity, and industry collaboration.

In FY 25, Triveni Turbines successfully integrated its talent strategy with its business priorities, namely strengthening capability, ensuring leadership continuity, and setting a strong foundation for sustainable future growth.

Ensuring adaptability: Nurturing internal talent and integrating external expertise

In the contemporary dynamic business environment, adaptability is vital to sustained and sustainable growth. In FY 25, Triveni Turbines significantly increased its learning person-days – a testimony to its deep investments in internal capability building. At the same time, it successfully filled key leadership positions across Sales & Marketing, Manufacturing, and Business Excellence, strengthening its operational agility.

Building excellence: Strategic talent acquisition approach

Triveni's strategic hiring approach ensures strong alignment with its business needs and cultural values. In FY 25, the Company strengthened its strategic workforce planning to align talent acquisition with critical growth areas, such as global delivery and API-compliant turbine technology. A healthy increase in employee headcount, from 819 in FY 24 to 928 in FY 25 (standalone basis), reflects the organisation's readiness to scale, while its dual emphasis on internal growth and external hiring keeps the talent pipeline agile and competitive. Triveni Turbines has streamlined its Young Engineer programme (GETs), aligning with the business requirements, and optimising classroom training with on-the-job training on the principle of 70:20:10.

Early talent integration: From campus to capability

In FY 25, the Triveni Learning Centre continued to play a vital role in onboarding graduate engineers. The curriculum offered comprehensive exposure through: