

Management Discussion and Analysis



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GLOBAL ECONOMY

The pandemic-catalysed economic contraction in the global economy, which was at 3.4% in 2020, has led to a scale-down of the global growth projections. The Russia-Ukraine war has further impacted growth, with the International Monetary Fund (IMF) recently projecting global growth forecast for 2022 and 2023 at 3.6%. In fact, the war is seen as a major setback to global economic recovery while also exacerbating the inflationary pressures. Further, continued COVID-19 threat could prompt new lockdowns and production disruptions. Growth could also slow down further if sanctions are extended to Russian energy exports. Inflation is expected to remain elevated for much longer, prompting aggressive monetary policy tightening. Economic risks have risen sharply and policy trade-offs have become even more challenging. Risks of a sharp tightening of global financial conditions and capital outflows have risen.

It is estimated that the advanced economies would grow at a rate of 3.3% in 2022, with USA and Europe expected to grow at 3.7% and 2.8% respectively. Emerging and developing economies are estimated to grow at 3.8%, while the growth forecasts for China and India stand at 4.4% and 8.2% respectively.

GLOBAL POWER SECTOR

The global power generation industry has been witnessing a major transformation in the last few years – a trend that is expected to continue in the coming years as well. The past few years have seen a change in the energy generation mix, mainly from conventional sources to renewable sources. The industry has observed some key trends, like sustainable power development, focus towards various concerns related to climate change, as well as eco-friendly policies. It is largely expected that the industry may witness greater acceleration towards eco-friendly “Green Power” solutions going forward.

TRENDS IN SUSTAINABLE POWER GENERATION

Globally, there is an increase in focus on replacement of existing coal-fired power plants with clean-fuel power plants with the aim of reducing the carbon footprint. This will further augment the demand for renewable power generation in the future. Overall, China is expected to remain the leader over the next five years, accounting for 43% of global renewable capacity growth, followed by Europe, the United States and India. These four markets alone account for 80% of renewable capacity expansion worldwide.

The **Renewable Energy** industry comprises non-thermal (such as Hydro, Solar Photovoltaic (PV) and Wind) and thermal energy (such as Bio-Power, Waste to Energy (WtE), Waste Heat Recovery (WHR) Concentrated Solar Thermal Power and Geothermal Power) sources.

In the case of thermal energy sources, the **Bio-Power** industry turns many potential feedstocks into solid fuels (biomass or wood pellets, sugarcane residues and palm oil residues etc.), liquid biofuels (ethanol etc.) and gaseous fuels (biogas, landfill gas), which are then used to produce electricity, heat and transport fuels. The drive to utilise locally available agricultural and forest residues has enabled generation of power closer to the point of consumption, which in turn has facilitated the setting up of biomass-based independent power plants.

The industrial use of biomass, particularly from sugar and palm oil mills, as well as wood waste from pulp and paper mills, is conducive to the production of power for captive consumption. About 70% of the biomass power globally is currently co-generated with process heat, as seen in the use of heat sources for district heating in European countries and for industrial process heating applications the world over.

Waste-to-Energy (WtE) refers to a variety of treatment technologies that convert waste to electricity, heat, fuel or other usable materials, as well as a range of residues. There are several primary waste streams in urban areas; with Municipal Solid Waste (MSW) is one among them. MSW streams are disposed of in municipal landfills, followed by Commercial and Industrial Waste (CIW). Thermal WtE utilises energy value in waste to generate electricity and/or heat. In Europe alone, WtE could prevent the production of up to 50 million tonnes of CO₂ emissions that would otherwise be generated by burning fossil fuels, according to an article on sustainability published in MDPI, an international open access journal.

Thermal treatment of waste is an environmentally acceptable alternative method. Thermal WtE, also known



Aftermarket is another area of huge potential growth for the Company and, as you will read in other sections of this report, we took major steps during the year to strengthen our offerings in this segment. /

Triveni Turbines has installed its 1st Waste-to-Energy (WtE) steam turbine plant commissioned in Germany.

as incineration with energy recovery, is a major waste treatment method in some developed countries, and by far the most widely adopted technology that dominates the global WtE market. The Refuse Derived Fuel (RDF) production involves separating, sorting, drying and compressing the combustible portion of the waste, resulting in a product which can be used as a feedstock for any of the three thermal processes, or combusted in an industrial application.

ADVANTAGES OF COMBINED HEAT AND POWER (CHP)

Triveni Turbines provides steam turbine solutions that use low pressure steam, generated through extraction turbine for heating application by producing both heat and electric power. The cost of power generated through this process is 14-15% lower as against that of power generated through IPPs.

While solar renewable energy is used as a utility power plant only during the day, power produced through CHP/ Cogeneration benefits the plant throughout the day by addressing its combined heat and power requirements. This gives the latter a strong edge. As a result, the ongoing rapid increase in electricity consumption, coupled with growing focus on electricity generation through biomass energy sources, thermal treatment of waste and recovery of waste heat, is expected to unleash sustainable power generation through the cost-effective approach of combining both heat and power.

INDIAN POWER SECTOR

The past few years have seen India's energy needs go up exponentially on account of rapid economic growth as well as overall industrialisation and urbanisation. As of March 2022, India has total installed power generation capacity of 395 GW – a growth of 4% over March 2021. Of this, 38% share, i.e. 152 GW, is renewable power generation capacity as of March 2022*.

*Source: Ministry of New & Renewable Energy (MNRE)



As per the Central Electricity Authority (CEA) strategy blueprint, the country is aiming for an even more ambitious target of 57% of the total power generation capacity from renewable sources by March 2027. According to the 2027 blueprint, India is striving for 275 - 350 GW of electricity from renewable energy by FY 27. This, in turn, will boost the demand for thermal renewable energy in the country, and concurrently trigger greater opportunity for installation of steam turbines in the future.

Increasing focus on the industrial sector, driven by the 'Make in India' initiative, rising input costs (energy) and electricity prices, coupled with stringent Government regulations, are expected to drive investment in the establishment of captive power plants for continued uninterrupted power supply, leading to sustainable industrial operations.

Captive power generation is emerging as a key requirement for many manufacturing industries in the country, where grid disturbances in power supply can affect the operations. Improvement in coal supply, growing awareness about renewable energy, and eco-friendly power generation policies will enhance the captive power additions in the country.

Captive power generation units can be fired using both fossil fuel and renewable fuel. The largest market for captive power generation in the country is the industrial

sector, mainly on account for the increasing demand for electricity from energy-intensive industries such as Cement, Steel, Petroleum Refineries and Chemicals.

INDIAN MANUFACTURING SECTOR

The Indian manufacturing sector, fast emerging as one of the high growth sectors, is being driven by the Government's 'Make in India' programme aimed at placing the country on the world manufacturing map. The sector comprises of Sugar, Distillery, Cement, Steel, Food Processing, Pulp & Paper, Petroleum Refineries, Chemicals, Petrochemicals and Fertilisers.

OPPORTUNITIES FOR STEAM TURBINE GENERATORS

The residues from **Sugar** mills in the form of Biomass (Bagasse) are used as fuel to generate power that is sustainable. Aided by the National Policy on Biofuels and the incentives offered by the Government of India, India is witnessing huge investment by Sugar companies in both Greenfield and Brownfield expansions of sugarcane-based and grain-based **distilleries**. This is opening a large opportunity for steam turbines in the future.

The **Pulp and Paper industry** constantly focusses on improving energy efficiency, which is attained through increased use of non-Bagasse (e.g. wood waste) based fuel for power generation, and through appropriate usage



of steam. With many paper companies in India looking at energy conservation through eco-friendly ways, this will lead to more opportunity for steam turbines.

Energy efficiency has become a top priority for the **Cement industry** but adoption of Waste Heat Recovery (WHR) systems in cement facilities still has a long way to go. Large cement companies are primarily considering WHR-based power plants for their Greenfield projects, which will create more opportunities for steam turbines. Triveni Turbines has developed efficient Injection condensing turbines that use medium pressure steam as turbine inlet and low pressure as injection steam.

The **Steel industry** is characterised by high load variations on account of many on and off conditions of furnace and kiln, causing load fluctuations, and thus affecting the stability of the grid and quality of power supply. Therefore, it is extremely critical to have a constant and reliable source of power. Power has been one of the major cost components of the steel industry. Hence, the availability of captive power becomes crucial for continuous operation of a steel plant. The opportunity for steam turbines from integrated steel plants in India for Direct-Reduced Iron (DRI) processes is quite significant. The waste heat recovered from the DRI plant will meet the captive power requirement of the steel plant.

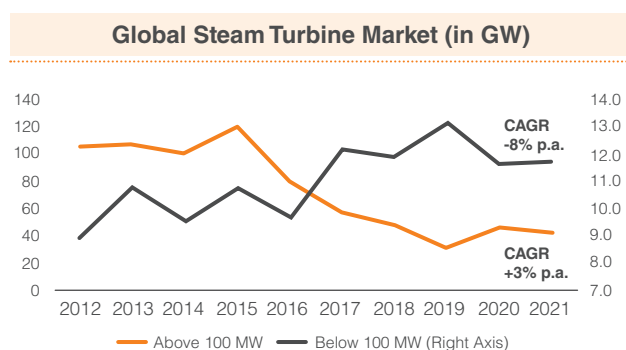
The **Oil & Gas Industry** is facing multiple challenges due to the modern energy refining processes, causing customers to scout for ways to maximise energy efficiency and to also reduce the carbon footprint as well as the operating costs. The cost-competitiveness and constantly evolving nature of the end-users have prompted them to achieve plant efficiency enhancement through energy recovery technologies, thus reducing the wastage of energy. In this context, the opportunity for steam turbines can be realised by offering power generation turbine, to turbines driving almost all rotating equipment.

Government Initiatives for the Manufacturing Sector

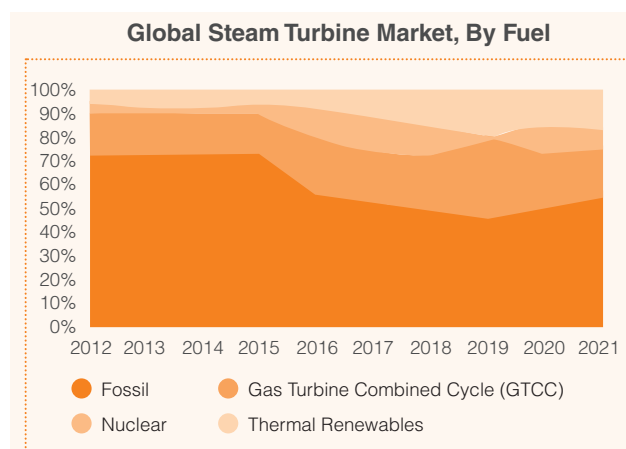
On July 22, 2021, the Government announced a production linked incentive (PLI) scheme for manufacturing speciality steel that helps in production of capital goods like turbines and boilers. This financial support would strengthen the sector with increased availability of speciality steels - a crucial input for the production of turbines and boilers. It will also reduce the industry's reliance on imports, and increase efficiency as well as productivity, thus helping them cater effectively to the growing domestic demand.

GLOBAL STEAM TURBINE MARKET ANALYSIS

The global steam turbine market has witnessed a decline of 8% per annum, from 115 GW in 2012 to 54 GW in 2021. Based on international power reports, this is largely attributable to the decline in the >100 MW market category (utility turbines), which currently accounts for higher share of the overall market. However, the 5-100 MW segment has increased from 8.9 GW in 2012 to 11.7 GW in 2021, which is an annual increase of 3% over a period of 9 years. This growth is due to the increasing demand for steam turbines in power generation as well as combined heat and power applications from industrial customers. However, this does not cover Triveni's entire addressable market as the Company operates up to 100 MW i.e. including the below 5 MW segment not covered in these reports.



In the last 10 years, fossil fuel-based power generation, previously the main source of fuel, declined from 74% in 2012 to 58% in 2021, whereas thermal renewable fuel-based power generation increased from 4% in 2012 to 15% in 2021.



INDIAN STEAM TURBINE MARKET OVERVIEW

In 2021, the Indian Steam Turbine market for <30 MW range grew 137% (in MW) over 2020. The demand for heat and power from the industrial segment was the key factor contributing to the rebound in the Steam Turbine market to the 2019 levels.

The market was primarily driven by thermal renewable based power plants (including biomass, waste heat recovery and WtE), followed by fossil fuel fired power plants. Majority of the steam turbines' requirement in 2021 came from power generation applications (using MSW, Biomass, Waste Heat and Fossil as the fuel) and from energy-intensive segments like Steel, Cement, besides segments like Sugar, Distillery, Food Processing, Pulp and Paper, Chemicals and Oil & Gas for Combined Heat and Power applications.

With the manufacturing sector on a growth trajectory, and industries like Sugar, Distillery, Steel, Cement, Pulp and Paper and Chemicals expected to increase production, the demand for steam turbines is expected to remain robust in the future.

PRODUCT BUSINESS REVIEW

Despite adverse impact of COVID-19 and the uncertainty in the global economy, the Company performed well in terms of overall order booking in FY 22.

The Combined Heat and Power (CHP) or cogeneration system constituted higher order booking share in FY 22. Finalisation of orders from segments such as Distillery, Cement, Pulp & Paper, Sugar Chemicals, Food Processing and Fertilisers led to the higher order booking growth YoY.

The overall product order booking for FY 22 went up by 113%, compared to the previous fiscal. At ₹ 9.4 billion, this is the highest order booking ever in the history of the Company, with the previous high of ₹ 6.6 billion achieved in FY18.

In the domestic market, the Company registered product order booking growth of 86% compared to FY 21. Key segments of this order intake in FY 22 were Sugar, Distillery, Food Processing, Pulp & Paper, Chemicals and Waste Heat Recovery (comprising Steel and Cement).

In the international market, the Company was able to close some key milestone orders in 30.1-100 MW power range and Sub-30 MW power range from countries like South Korea, Turkey, France, Mexico, Colombia, Argentina, Hong Kong, to name a few. As a result, international product order booking grew 166% YoY.

Enquiry Generation

Although the COVID-19 threat still persists, many developing and developed nations have introduced vaccination programmes and are moving towards “business as-usual” scenario. This is manifest in the overall enquiry growth of 36% YoY in FY 22.

Domestic enquiry generation increased by 57% YoY, with the West region garnering the highest enquiry base followed by the South and North regions. In terms of segments, Process industries comprising Food Processing, Distillery, Pulp & Paper, Chemicals contributed the most to the enquiry base, followed by Cement, Sugar and Oil & Gas segments.

International enquiry generation increased by 25% YoY compared to FY 21. Southeast Asia generated more enquiries, followed by Europe and Turkey regions. Among industry segments, IPP segment was the biggest contributor of the enquiry base, followed by Process industries and Oil & Gas segment.

Approach to Market

The Company’s enquiry pipeline looks healthy due to its strong presence in the **sub-30 MW** business segment and dominant share in the Indian market.

The Company was successful in winning orders in API business segment in FY 22 due to its ability to supply energy-efficient **API (American Petroleum Institute) 611 and 612 compliant Steam Turbines**, ranging from 10 kW to 100 MW. These turbines are designed to meet every challenging requirement of the Oil & Gas industry, comprising Petroleum Refineries, Chemicals, Petrochemicals and Fertilisers.

The Company’s newly developed **Sub-3 MW** products will cater to the demand for PRDS (Pressure Reducing and De-superheating System) replacement in Rice Mill, Palm Oil Mill and other industries. This product range, to be marketed through the Company’s channel partners, secured some significant orders in Q4 FY 22 from both domestic and overseas markets.

Following the termination of the Joint Venture with GE parties on September 6, 2021, both parties were free to approach the **30.1-100 MW** market independently. Thus, the Company approached this segment with renewed vigour from Q3 FY 22, and focussed on larger machines business segment. The Company has since gained good initial traction with orders both from India and overseas.

Triveni Turbines was successful in finalising an order in the Steel segment in South Korea. The customer awarded orders for three (3) steam turbines - 2 of 35 MW and 1 of 41 MW, during FY 22. This order was won against stiff competition from international players. (Refer to the page no 14 of the annual report for more details on this order)

Triveni Turbines currently has orders/installations in over 75 countries and will be focussing on underserved markets such as North America and East Asia in the coming years.

Triveni Turbines provides its customers a complete solution for sustainable power requirements. The Company offers total solutions for the Turbo generator operation (i.e. supply of steam turbine, steam piping, fire fighting system and entire cables), thereby providing an end-to-end solution.

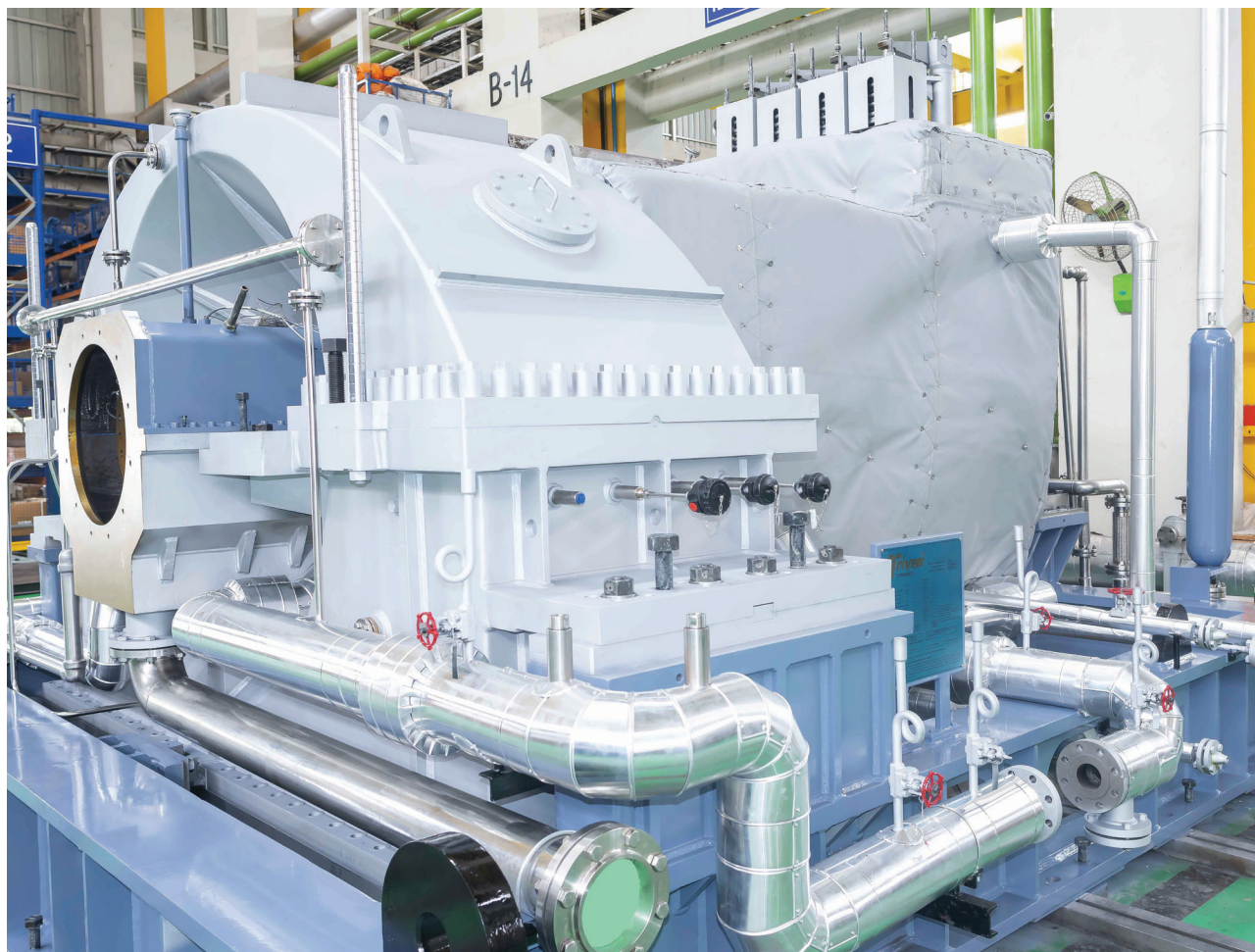
The Company believes that the outlook for product order booking in the near-term is strong, on the back of its healthy enquiry pipeline.

AFTERMARKET BUSINESS REVIEW

The Aftermarket business of Triveni Turbines is a customer focussed business unit (BU), entrusted with strengthening the Company’s relationship with its customers over the entire lifecycle of the turbine, spanning several decades. This BU has the key responsibility of promoting customer retention and building loyalty through various modes, such as increased product efficiencies and machine uptime. Aftermarket business endeavours to do this not only for the products supplied by the Company but also for rotating equipment of other makes. Being an OEM of steam turbines, the services provided by the Company to turbines of other makes lend high levels of credibility as perceived by customers.

Aftermarket business has been further strengthened in FY 22 with new technology-backed modernisation, upgrades, refurbishing and efficiency improvements solutions for all makes of turbines. These enhancement packages guarantee adequate Return on Investment (RoI) for end users, thus creating value for them and augmenting their relation with the Company.

The Company has consistently strengthened and grown its field service force across all offices in India and abroad, to effectively establish strong customer connect and promote brand awareness, thus reinforcing customer-centricity as the core of its business philosophy. The financial year under review saw the Company acquire a stake in a service company, TSE Engineering Pvt. Ltd. with an existing workshop facility in South Africa. This would



greatly enhance its ability to provide faster response to its customers in the SADC (South African Development Community) region and build relationships with new customers requiring service and upgrades on turbines of other makes.

The Company continues to leverage rapid gains in digitisation and remote connect, necessitated by the pandemic, to bolster its service support. Its team of highly trained and experienced engineers utilise the latest and most advanced communication tools for live and secure customer engagement with actual face time via screens of personal devices, irrespective of distances and varied time zones. This has helped the Company provide its customers with added comfort that expert guidance is available at the click of a button.

During FY 22, the Aftermarket business consolidated its foray into new industrial segments such as Geothermal, by bagging repeat orders from prestigious customers in Southeast Asia and East Africa. Buoyed by this success, the Company initiated brand building efforts in Europe,

where Geothermal is a significant source of renewable energy. Further, the reference created in the Utility turbine repair space has helped acquire new customers in India and even generate enquiries from international markets.

The revenues from Aftermarket business in FY 22 grew 18% over the previous year. The order booking from Aftermarket business rose 21% in FY 22 on a YoY basis. The Company will continue to invest in this profitable business unit to build local presence overseas and generate a higher share from international markets.

MANUFACTURING

Triveni Turbine's manufacturing facilities at Bengaluru and Sompura are successfully maintaining their certifications for Quality Management System (AS 9100D / ISO 9001:2015), Environmental Management System (ISO 14001:2015) and Occupational Health & Safety Management System (ISO 45001:2018) implementation.



In order to facilitate remote factory acceptance testing (FAT), the Company provides option to its customers of live streaming of the test bed SCADA screens with all relevant parameters. /

Going beyond these certification requirements, the Company's operations are focussed on continuous improvement across the 3Ps of People, Process and Planet.

- People competencies are developed on a continual basis,
- Manufacturing processes are reviewed and upgraded regularly, and
- Environmental performance is sustained and improved.

Continuous engagement of operational personnel in various cross-functional teams (CFTs), Kaizen, Daily Work Management (DWM) as well as Root Cause Analysis and Corrective Actions (RCCA) keep the entire team involved and motivated. Coupled with application of lean principles and agile manufacturing culture, this ensures faster flow of material and information at all times.

Triveni Turbines is one of the few industrial steam turbine manufacturing companies that has in-house capability for complete manufacturing of critical components such as blades, rotors and casings. Seamless integration of CAD-CAM enables speedy product realisation without compromising on quality. The entire CNC machining shop of the Company is IoT-enabled, which helps in monitoring and continually improving the overall equipment effectiveness (OEE) of the machine shop. Latest CNC machinery (turn mill centres, milling machines, 5-axis blade machining centres), along with testing equipment (high speed balancing tunnels, integrated steam test facility with high pressure and temperature boilers) enable production of turbines from 100 kW to 100 MW, to exceed customer expectations. The Company also stays committed to improving its in-house processes, thus enhancing quality by investing in high precision Co-ordinate Measuring Machine (CMM) with portable scanner, which enables

inspection of blades. The Company conducts prototype testing of blade profiles, with live steam testing, for validation of new designs. It has also installed runout measurement equipment to facilitate specific inspection requirements of its rotating equipment.

In order to facilitate remote factory acceptance testing (FAT), the Company provides option to its customers of live streaming of the test bed SCADA screens with all relevant parameters. While this facility provided the much-needed convenience and safety during the times of pandemic, it continues to help customers to manage business travel restrictions and to rationalise their travel costs even after the easing of lockdowns.

As part of its continued endeavour to fulfil and exceed requirements of environment management system, the Company engages in various initiatives of sustainable operations by conserving electricity, water and providing green cover in both its premises. As a result, the Bengaluru premises are maintaining a Platinum-rated certificate by the Indian Green Building Council (IGBC).

The Company in the past has risen to the challenge of execution and delivery of products from its manufacturing facilities that meet the ever-changing customer expectations (global and domestic) in terms of Quality, Cost and Delivery. Manufacturing remains a core strength for the Company, along with its responsive and agile customer service.

After the pandemic-induced lull in order inflows during FY 21, the Company posted record order booking during FY 22. This posed a positive challenge for its manufacturing to ramp up production in terms of volumes and new products. This is being managed with a two-pronged approach to enhance capacities – both internally and externally.

Additional assembly space of 3,750 sq.m. is already under construction at Sompura facility. This will augment the space for assembly and testing of steam turbines at the Sompura factory. Some of the sub-assemblies are also additionally outsourced to competent sub-contractors to free up in-house capacity on value-added, core activities.

To enhance capacities for sub-contracted activities, 20+ additional sub-contractors and suppliers were introduced during the year. Some of the sub-assemblies are now supplied by successful sub-contractors and by ex-employees, who are operating independently as entrepreneurs. Irrespective of their past association with the Company, all new sub-contractors and suppliers are screened through Supplier Qualification process to minimise risks to the operations with their supplies.

This addition to internal and external capacity is subject to stringent requirements of customer segments (e.g. API). Entire manufacturing value chain is revisited every time to include sector-specific requirements. Increased inspection stages, third-party inspections, additional documentation and testing are implemented with the CFT approach. In order to focus on sector-specific nuances, specialised resources and personnel are deployed, where appropriate.

Similarly, to meet the Aftermarket requirements, new processes such as LASER hardening on blade edges, introduction of high alloy steels etc. are implemented. To increase the speed of execution in Refurbishing, fitment of blade roots on to the existing old rotors is verified through 3D printing instead of physical machining of prototype from steel material.

Necessary resources are aligned to meet the production targets with increased number of turbines.

TECHNOLOGY, RESEARCH & DEVELOPMENT

Triveni Turbines' Research & Development (R&D) function plays a critical role in enhancing product offerings, thus supplementing the value delivered to customers.

In FY 22, the Company's R&D programmes were focussed on:

- i) Developing products & solutions for diverse industrial heat and power applications
- ii) Enhancing energy efficiency of customer plant operations
- iii) Providing value for customers with competitive product offerings

Triveni, through its DSIR (Department of Scientific & Industrial Research) approved in-house R&D facility, is engaged in market-oriented product development and innovation.

The Company's association with globally-renowned research institutes, such as IISc. (Indian Institute of Science, Bangalore), Politecnico De Milano, Cambridge



University, IIT (Indian Institute of Technology, Bombay) in the areas of fluid dynamics, aerodynamics contributes significantly towards advancing its energy conversion efficiency benchmarks.

With engagement of domain experts in turbo machinery, the Company has enabled conversion of academic research contents into cutting edge industrial applications for the benefit of its customers.

During the year, the Company enhanced its steam turbine solutions with high speed applications, which resulted in higher power density models. This also enabled the Company to expand in cold country markets, which predominantly have more vacuum applications.

The Company has made further inroads in the domestic and international Oil & Gas markets. This includes API drive turbines with single stage and multi-stage designs. Triveni's in-house facilities and expertise for carrying out stringent API tests, such as unbalanced rotor response tests and steam run tests including load tests, are instrumental in steering its expansion in the stringent hydrocarbon markets.

The Company continues to execute highly custom-engineered turbine projects, which also include 50 MW double extraction turbine application to chemical processing.

The Company carried out several specialised turbine projects, such as injection turbines for cement industry, high back pressure turbines for Oil & Gas and distillery industries during the year. Triveni's axial exhaust turbines helped customers achieve significant reduction in their power plant footprint and civil cost.

With innovative product solutions, the Company continued its expansion into international markets and diversified segments, which included Waste-to-heat applications, Chemicals, Paper, Cement, Pharma, Distillery and Hydrocarbon industries for both captive and process co-generation applications.

The Company also carried out several projects in the Renewable sector, which included Geothermal projects. In addition, it is also involved in refurbishing of other turbo machinery products such as compressors, blowers and gas expanders.

The Company continues to partner with the Indian Navy for specialised turbo machinery projects. As part of its thrust towards advanced, environment-friendly products and solutions, Triveni Turbine's R&D is engaged in the development of carbon dioxide (CO₂) cooling products and supercritical turbo machinery products.

The Company also carried out several projects in the Renewable sector, which included Geothermal projects. In addition, it is also involved in refurbishing of other turbo machinery products such as compressors, blowers and gas expanders. /

Following the tightening of environmental regulations in North America and Europe, governments are globally pushing for reduction in Hydrofluorocarbons (HFC) based cooling systems. With its academic associations, the Company is developing cooling solution, which will address the upcoming global market needs.

Globally, there has been increased focus on supercritical CO₂ based power generation. This brings advantages of higher efficiency, lower footprint, faster start-ups and easy maintenance. Triveni Turbine, along with IISc, Bangalore, is involved in the development of CO₂ based thermal cycles and power block equipment. This involves development of turbomachinery, such as CO₂ gas expander, compressor and high-pressure heaters, as well as control system to manage quick transients. Triveni Turbine's R&D is working in this futuristic energy area, which will position the Company to be future-ready for the upcoming energy transition scenario.

INTELLECTUAL PROPERTY RIGHTS

Innovations and technological improvements undertaken by the Company through research generate invaluable, in-house Intellectual Property (IP). These innovations and improvements need to be adequately protected for safeguarding the Company's innovative edge in the industry and for preventing potential losses. A dedicated team of IP specialists works closely with the R&D team, from the initial planning and conceptualisation stage to the manufacturing stage, in order to capture and protect the generated IP.

As the creation and protection of the IP portfolio is of utmost importance for the Company and all its stakeholders, TTL has instituted a robust IP strategy for the protection of its long-term IP assets, with the aim to

secure and preserve its technological advantage over its competitors. With its global focus and reach, the Company constantly undertakes patent and industrial design filings in various international jurisdictions, while enhancing its IP portfolio in India. The Company has filed for IP protection via patents and industrial design registrations in India, Europe, South East Asia, and in the United States of America, and plans to protect its IP in the new international markets where it serves. A substantial number of Intellectual Property Rights (IPR) have already been awarded to the Company in India and other jurisdictions. The Company had filed 316 IPR in the market globally till March 2022. These include IPR filings in steam turbines and CO₂ based power systems.

IT AND DIGITALISATION

The Company recognises that digitalisation is the key to achieving excellence in business operations. Its digitalisation process is focussed on:

1. Improving internal operational efficiency of business process.
2. Enhancing product and service value to the customer.

The application landscape has been continuously upgraded to improve productivity - from market enquiry process to revenue receipt stage. Most of the internal business softwares have been largely migrated to cloud platforms, which ensures continuous support and upgrades.

Business operation, from enquiry to order and order to revenue process, has been streamlined with industry standard software viz. Salesforce, SAP and Oracle Primavera. Engineering process is managed through product life cycle management (PLM) software 'Teamcenter' and technology specific high-end tools. Manufacturing and supply chain process is managed on SAP and IoT applications in line with Industry. Digital Mechanical Run Testing (DMRT) helped global customers manage the turbine test protocols during COVID-19 induced travel restrictions. The Company's field service team used the remote application software to manage turbine system commissioning centrally from Bengaluru.

The Company's Aftermarket business, along with its Technology team, has developed IoT (internet of things) applications with leading IT services provider for enhancing customer value in terms of:

- a) Plant operation monitoring and asset base productivity.
- b) Providing extended flexibility and operability advantages.
- c) Preventive and diagnostic services for product life extension.

Triveni uses industry standard cloud-based applications in various business operational areas, such as SAP Order to Revenue, Oracle Primavera for Project management, Teamcenter PLM and advanced CAD/CAE tools for R&D and engineering processes, IoT-based platforms by manufacturing and field services. These have enabled the Company to achieve higher internal productivity and provide value to its customers. During FY 22, the Company set new benchmarks on its IT landscape through its initiatives, which it will further consolidate in FY 23.

SUPPLY CHAIN

A reliable supplier base developed over the years continues to be the key strength for Triveni Turbines. The Company remains consistently focussed on improving the development of its global supply chain by involving suppliers in early stages on new technology and product development, and by leveraging world-class supply chain management processes using appropriate tools and systems across functions. The Company also continues to invest in training and developing leaders to create one of the best supply chains in the industry.

During FY 22, the Company designed and implemented a number of participatory workshops for suppliers, covering health, safety and environment requirements, as well as legal compliances related to labour conditions and COVID-19 protocols. Triveni provided support to its vendors during the entire pandemic period through various interventions, such as vaccination drives for their employees and families, financial assistance as needed and remote inspection.

The Company gives due importance and emphasis to inventory control in order to maintain the essential stock of raw material and other commodities at appropriate levels, for enabling seamless flow of production. At the same time, optimal inventory buffer is created in such a manner so as to enable the Company to navigate through supply chain interruptions due to COVID-19 and other geopolitical changes across the world. This has resulted in smooth and uninterrupted customer experience in terms of product and services support.

The Company undertakes periodic vendor-wise spend analysis and has established adequate control processes with suppliers to ensure compliance standards, desired quality, good ratings and loyal trade relations.

The Company's focus has been on ensuring that its supply chain partners grow in a participatory and mutually beneficial manner, and strives continuously to improve on the customer experience in terms of quality, delivery and cost. And this journey of excellence and customer engagement continues.

QUALITY ASSURANCE

The Company continues with its AS9100D / ISO 9001:2015 certifications, with matured quality management system elements implemented throughout the organisation. Net Promoter Score (NPS®) is one of the key driver for the Company to improve its customer experience on a continual basis. NPS® survey is undertaken by the Company on annual basis to measure the health of relationship with customers. It also helps the Company capture customers' expectations by evaluating their experience and identifying value levers. NPS® has improved by more than 25% during the year and the Company progressed closer to its goal of Total Customer Satisfaction. One of the reasons for this remarkable increase in NPS® is the Company's responsive service to customers. The Company was able to close customer issues faster than in the previous year. This is also evident from the improved Customer Satisfaction Index (CSI) for the Company's Product business for FY 22.

Validation of new steam path designs from recent installations has helped the Company respond to the growing demand for higher efficiency turbines. The success of its indigenous R&D efforts was the result of its quality operating system. The Company's R&D processes are tuned for refinements in turbine technology, in order to deliver world-class product designs to compete with global competition. With these agile yet robust design processes, the Company developed more efficient airfoil designs, using cutting-edge design principles and tools during the year. These designs were realised using reliable and quality conscious supplier base and TTL's in-house manufacturing prowess. Compliance throughout the design realisation stage was ensured with customised quality assurance practices.

The Company is all geared up to cater to customer requirements across segments, including API. Its facilities/resources are further strengthened by:

- addition of Electrical & Mechanical Runout (EMR) machine to ensure electrical runout at higher accuracy,
- installation of customised Magnetic Particle Inspection (MPI) head shot machine, where MPI of longer blades can be done in a single set-up, and
- dedicated Positive Material Identification (PMI) machine to ensure material conformance.

More emphasis is laid on analysing and preventing defects at source – whether that are at suppliers' end or for in-house processes. For protecting TTL products from

incoming defects, if any, multi-layered Quality Assurance (QA) practices are strengthened with digitisation. All QA processes are digitised by integrating them with the Company's Oracle-based, common project execution platform (Primavera). The process of ensuring root cause and corrective action (RCCA) for identified defects has yielded positive returns in terms of increase in first pass yield (FPY) of turbine's Factory Acceptance Testing (FAT) and also kept the CoPQ (cost of poor quality) value under control.

Suppliers have been an integral part of the Company's successful journey. While the Company's Quality Assurance team continues to support the supply chain with collaborative approach of continuous improvements, FY 22 saw an increase in numbers in the supplier base. A digitised supplier evaluation process ensured a balance between risks and opportunities, and helped meet the demand of on-time delivery of products with increase in number of turbines manufactured.

The Company was quick to adopt technology in a bigger way in the pandemic period by offering remote FAT inspection options to customers. This philosophy was also extended to supplier inspections. With completion of digitisation of QA processes, TTL is also poised for improved data-based decision-making for delivering better quality.

The year's theme for World Quality Day celebrations, during November 2021, was "Sustainability: Improving our Products, People and Planet". The response to various events organised on this occasion was immense and the programmes saw huge participation from employees, while maintaining COVID-19 protocols. This, along with the Company's sustained Kaizen programme, ensured that all employees remained engaged in quality compliance, improvements and defect prevention initiatives.

The Company remains consistently focussed on building a robust quality culture at all levels through behaviour-based quality model.

HUMAN RESOURCE

Triveni Turbines has always believed people to be the key differentiator in the success of the organisation. Technology, manufacturing, customisation, optimising solutions are the outcome of their brilliance.

COVID-19 has, over the last two years, impacted industries across the spectrum. The team at Triveni Turbine showed commendable resilience in adjusting to the change and staying focussed on progressing with their journey of learning and contribution to growth. Their perseverance



The Company's employee engagement initiatives are crafted to energise, motivate and create opportunities to remain flexible and agile in order to mitigate the challenges successfully in the VUCA (volatile, uncertain, complex and ambiguous) world. //

and "Never-Say-Die" attitude had a great impact on the Company's efforts to gain back its winning ways, which were endangered by the pandemic.

Triveni Turbine's people strategy is aligned to complement and support its business strategy, keeping in perspective both short and long-term business objectives on value creation for customers and stakeholders. Initiatives and measures drawn from the people strategy are directed towards enriching, enhancing and building competencies in people to deliver consistently and ensure sustainability. The focus lies on creating a high-performance culture by ensuring that the right person is there in each role, enabling employees to experience learning as part of their daily life in pursuit of creating customer-centric innovation, thriving on continuous improvement, and enriching organisational capabilities to stay relevant and competent for the marketplace.

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HR policies are regularly reviewed for relevance and effectiveness to enhance employee experience. The HR processes facilitate augmentation of the organisational capabilities to build a highly engaged, motivated, growth-oriented mindset workforce in the Company. The Company continues its sustained focus on attracting, developing and retaining talent with a "Ready for Future" approach.

Triveni Turbines has been instrumental in putting in place policies, driving measures and sensitising and

orienting the organisation towards ensuring the safety, security and well-being (both physical and mental) of its employees.

It has been the Company's endeavour to nurture homegrown talent to help the organisation navigate its growth journey effectively and successfully. This has provided the Company a strong competitive edge over Technology, Products, Services and Processes. Triveni Turbine's Learning Centre is a dedicated, world-class, in-house training facility, located in the midst of a green environment to make learning more fun and focussed. It has re-aligned its offerings to align with the transforming eco-system, including the pandemic, over the last several months. Uninterrupted learning with fun has excited young employees recruited from various engineering college campuses. Budding engineers fresh from colleges/universities undergo a structured 2-year training programme to empower them to become ready for the work environment before being inducted into various departments. The enthusiasm and energy levels of subject matter experts and in-house training faculties, blended with the employees' appetite for learning, give a new direction to the Learning Centre that is equipped with multiple classrooms, Computer Based Product Training Lab (CBT), a library, as well as a highly trained in-house faculty. The pandemic could not dampen the spirit of the team on their way to build knowledge and skills to be ready for various business challenges.

Building partnerships and drawing synergies with technological and management institutes enable the Company to create talent availability for the future and stay competent to augment future technologies for creating customer value.

Keeping pace with the ongoing change, Triveni Turbines' Performance Management System (PMS) is focussed on the development of conversations to enable employees to accomplish individual and organisational objectives. The rewards and recognition framework has been articulated to sustain the employees' high performance culture and ensure timely appreciation of their achievements. Competency development and job enrichment are an integral part of the PMS, aimed at striking a balance between the employees' career aspirations and organisational growth.

Events such as "World Quality Day", "Triveni Talk", among others, draw rich participation from the employees, reaffirming the Company's beliefs in continuous improvement and collective learning.

ENVIRONMENT, HEALTH AND SAFETY (EHS)

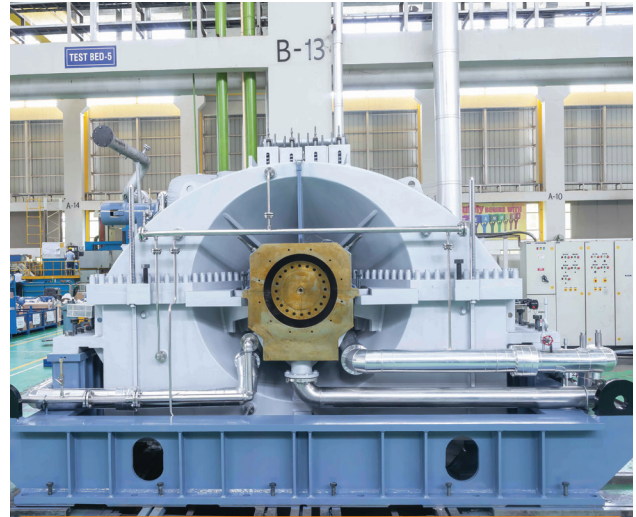
Environment-friendly manufacturing facilities is the trademark of Triveni Turbine. The Company's facilities in Bengaluru and Sompura stand apart in their respective surroundings in terms of upkeep and improvement of environment. Both these facilities have plenty of green cover and are zero discharge plants. These facilities are eco-friendly, with large trees, natural landscaping, rain water harvesting facilities, and solar panels for harnessing renewable energy.

These facilities have been certified for their Environmental Management System (EMS) and Occupational Health and Safety System (OHS) standards as per ISO 14001 and ISO 45001.

The Company constantly improves its environmental performance by focussing on conservation of water, energy and materials, as well as waste reduction. Employees are involved in ensuring good EHS practices through various joint management committees.

The Company has enhanced its focus on improving the health of the employees and its supply chain partners. During the pandemic period, the Company extended COVID-19 vaccination to all employees and their family members. Community vaccination programmes were also organised for the benefit of the surrounding communities. Stringent protocols were introduced in the factory and office premises as per the relevant Government guidelines to contain the spread of COVID-19. Work from home (WFH) was also encouraged by providing appropriate facilities. With its focussed efforts, the Company was consistently able to maintain the health of its employees.

The Bengaluru factory has installed solar panels of 300 kW capacity, with net metering facility to export



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surplus energy. The entire sewage water is treated at the plant, and used for landscaping and gardening. Energy-efficient LEDs are being introduced in a phased manner to replace the conventional CFLs/fluorescent lights. Variable frequency drives are used in power intensive areas (cranes, boiler etc.) in order to reduce energy consumption. Power factor at both the facilities is maintained at near 1.0 to conserve energy.

TTL has an impeccable record of zero reportable accidents over the past many years. The entire campus is covered with electronic surveillance through CCTV and IT-enabled security systems.

BUSINESS OUTLOOK

Economic activity rebounded sharply in June 2021, pointing towards steady recovery till October 2021. November 2021 onwards, coal and semiconductor chip shortages; followed by the 3rd wave of pandemic in January 2022 led to some weakening in the momentum as the economic indicators took a downturn in January and February. On the back of significant loss of lives and livelihood during past 2 years, came inflationary pressures across the globe

and the Russia-Ukraine war in 2022. Fuel, food and raw material prices have increased rapidly that jeopardises not just post-pandemic recovery, but also threatens to put vulnerable population at risk. As per IMF World Economic Outlook update issued in April 2022, global growth is projected to slow from an estimated 6.1% in 2021 to 3.3% in 2022 and 2023. This is 0.8 and 0.2 percentage points lower for 2022 and 2023 than projected in January. Beyond 2023, global growth is forecast to decline to about 3.3% over the medium term. The advanced economies are looking at inflation projections of 5.7% during 2022 and emerging markets and developing economies face inflation projections as high as 8.7%. These projections are approximately 2-3 percentage points higher than January 2022 projections and are mainly attributed to the war in Europe.

The severity of inflation and economic pressures is expected to be felt more in the first half of the fiscal year 2022-23. Increasing inflation will complicate trade-offs that various central banks face between containing price pressures and maintaining growth. Interest rates are expected to rise as central banks tighten policy, putting pressure on emerging market and developing economies. Moreover, many countries have limited fiscal policy space to cushion the impact of the war on their economies. Recent lockdowns in key manufacturing and trade hubs in China is likely to compound supply disruptions elsewhere. As per the IMF World Economic Outlook update, employment and output will typically remain below pre-pandemic trends through 2026, with few exceptions. Although the drivers of inflation are beyond the control of central banks (the war, sanctions, the pandemic, supply chain disruptions), price pressures are increasingly broad-based. The appropriate monetary policy response will therefore differ across economies.

Real term economic growth in India was pegged at 9.2% for 2021-22, with GDP growth for 2022-23 projected at 8% to 8.5%. Sustained long-term expansion, the country's economy is contingent upon various supply side reforms undertaken by the Government of India (GoI). Capital expenditure during April – November 2021 grew by 13.5% YoY, indicating impetus to recovery. These positive signs were also evident in recovery of employment indicators bouncing back to pre-pandemic levels during the last quarter. Index of Industrial Production (IIP) grew at 17.4% (YoY) during April-November 2021 as compared to -15.3% in same period last year. Aggressive spending by the GoI on railways and road construction is strengthening much-needed infrastructure for improving ease of conducting business with optimised logistics. Introduction of Production Linked Incentive (PLI) Scheme is providing major boost to infrastructure – both physical as well as

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digital, along with measures to reduce transaction costs and improve ease of doing business. PLI Scheme would also support the pace of recovery. However, key areas to watch would be CPI-Combined inflation and food inflation rates, which are pegged at 5.2% and 2.9% respectively for April – December 2021.

The Union Budget 2022-23 envisages accelerating the pace infrastructure development through *PM GatiShakti* driven by seven engines - Roads, Railways, Airports, Ports, Mass Transport, Waterways, and Logistics Infrastructure. With more than 50% of Indian workforce dependent on agriculture and related industries, resilient growth in agriculture and food processing is sought of by linking water supplies (e.g. Ken Betwa Link Project) and enabling technology-driven solutions (e.g. Kisan Drones). The Government is also encouraging and envisaging growth in digital learning platforms for schools, skill development and higher education. Another promising policy decision underlined in the Union Budget 2022-23 was mobilisation of resources for green infrastructure and sunrise sectors – energy storage, 5G, Bharat Net, coal gasification, battery swapping, data centres, etc. While large part of the allocation of PLI Scheme is towards electronics, IT hardware, telecom and networking products, ₹ 16.3 billion is allocated towards Pharmaceutical industry.

With strong carry-forward order book at the beginning of the fiscal year 2022-23, the Company is well positioned to achieve robust performance levels. Its entry into new segments, such as energy-efficient API turbines for Oil & Gas industry and turbines between 30.1-100 MW also provided opportunity to widen its net of addressable market. The Company will continue to focus on its efficient sourcing and manufacturing practices to counter higher input and logistics costs. Also, manufacturing,

subcontracting and supply chain capacities are being scaled up to address increased number of turbines. However, fallout of recent global turmoil due to continuing restrictions in China, Russia-Ukraine war and rising inflation will be watched closely to anticipate impact on the Company's business and respond with appropriate control measures to maintain its market leadership position and grow internationally.

SUBSIDIARIES

The growth potential of foreign subsidiaries to expand in international space is encouraging. Through these foreign subsidiaries, the Company has increased its capabilities to connect with global EPC players and industries. During the year, the Company engaged with industries from various segments, such as API, Waste to Energy, Combined cycle, Process industries, of global scale through its subsidiaries. The connections have enhanced the visibility of the Triveni Turbines brand and future business potential.

During the year, Triveni Turbines DMCC (TTDMCC), Dubai (a wholly-owned subsidiary of TTEPL), acquired 70% equity shares of TSE Engineering Pty. Ltd. (TSE), a company registered under the laws of South Africa which is engaged in high precision engineering, repairs and servicing of industrial plant machinery in South African Development Community (SADC) region. This would greatly enhance the ability to provide faster response to its customer in the SADC region and build relationships with new customers requiring service and upgrades of turbines of other makes.

As reported earlier, for more than two years, the Company had several disputes with DI Netherland BV (DI), joint venture (JV) partners, and General Electric and its affiliates (GE Parties) in relation to TESL, the Company's erstwhile joint venture. The Company and GE Parties, including DI, executed a Settlement Agreement on September 6, 2021, to fully and finally settle and resolve all such disputes, litigation, and arbitration pending before various legal forums, which have been withdrawn. According to the Settlement agreement, the Joint Venture Agreement and other Ancillary Agreements with GE Parties were terminated

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The Company expects that the foreign subsidiaries will further augment business growth in the near future. /

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Following the termination of the Joint Venture with GE parties on September 6, 2021, both parties were free to approach the 30.1-100 MW market independently. Thus, the Company approached this segment with renewed vigour from Q3 FY 22, and focussed on larger machines business segment. The Company has since gained good initial traction with orders both from India and overseas.

In FY 22, Triveni Energy Solutions Ltd. (TESL) achieved a total revenue of ₹ 841 million, with a profit after tax of ₹ 147 million.