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IN THIS ISSUE...

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

International Gas Turbine Institute / 1235 North Loop West, Suite 706, Houston, Texas 77008 / go.asme.org/igti

Letter from the Editorial Committee #2

DEAR READERS,

Welcome to this edition of the ASME Global Gas Turbine News (GGTN). As we continue to share advancements from across the turbomachinery community, we remain inspired by the creativity and collaboration that drive progress in our field. We are very excited to share that over 2000 abstracts have been submitted to Turbo Expo 2026 in Milan, Italy! This is an all-time record for Turbo Expo and we are looking forward to seeing not only technological innovation from these future papers, but also the dedication of engineers, researchers, and students worldwide who are shaping the future of propulsion and power generation.

This issue highlights two compelling perspectives on the technologies and strategies shaping a more efficient and sustainable energy future. In our first article, Professors Matteo Prussi and Davide Chiaramonti of Politecnico di Torino discuss the accelerating deployment of Sustainable Aviation Fuels (SAF) as a cornerstone of aviation decarbonization. Their contribution details the evolving regulatory frameworks, production pathways, certification challenges, and life-cycle analyses defining the transition to low-carbon aviation. The second article, authored by David Chapin of Colibrium Additive, explores how metal additive manufacturing is transforming the design and production of turbomachinery components. Chapin emphasizes the importance of a structured, business-driven approach to adopting additive technologies, illustrating how the method enables performance and efficiency gains across aerospace, power generation, and other energy sectors. Together, these contributions showcase how sustainable fuels and advanced manufacturing innovations can work in concert to enhance performance, reduce environmental impact, and sustain growth across the global gas turbine industry.

We also extend a note of appreciation to our contributors and reviewers who make GGTN possible. Your commitment ensures that the publication remains a trusted source for sharing insight and perspective from academia, industry, and government laboratories. Once more, the Editorial Committee would like to invite all of you to participate by submitting abstracts, sharing updates from your organizations, or suggesting emerging topics you would like to see featured in GGTN. If you would be interested in writing an article, or serving on the Editorial Committee, please reach out to AhmedH@asme.org for more information and include a recent CV.

Thank you for your continued support and readership. Together, we can sustain the spirit of discovery that has long defined the gas turbine community.

Warm regards,

DR. TAMY GUIMARÃES
On behalf of the Editorial Committee
ASME Global Gas Turbine News

Decarbonising Aviation by Deploying SAF at Scale: Fueling the Future of Civil Aviation

Prussi M. (Corresponding author: matteo.prussi@polito.it), Chiaramonti D.

Politecnico di Torino, Energy dep. DENERG, Nominated experts at ICAO/CAEP/WG5

THE ROUTE TOWARDS DEFOSSILIZATION IS WELL ESTABLISHED

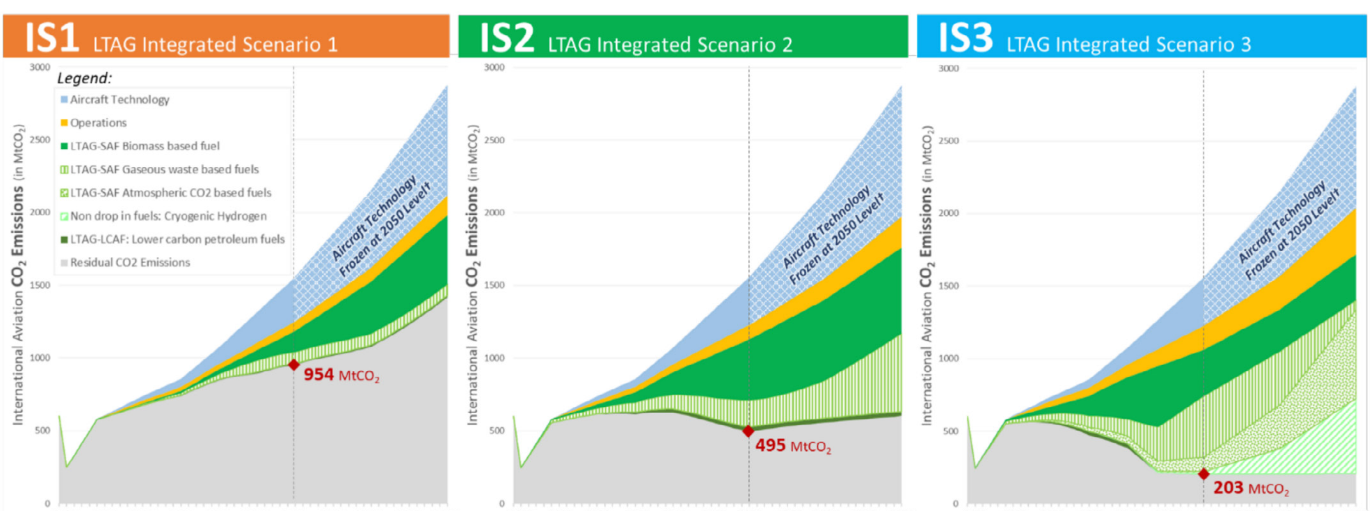
Recently, an ICAO/CAEP technical group called Monitoring and Reporting Task Group (LMR TG) has been established, with the aim to define and implement methodologies for monitoring and reporting progress towards the global goal of decarbonisation of international aviation, defined by ICAO in the Long-Term Aspirational Global goal (LTAG).

As emerged by the LTAG and other relevant studies, the role of SAF in the pathway towards net zero is crucial. World regions, such as Europe, already set mandatory blending targets for SAF. During October 2023, the ReFuel EU Aviation Regulation was adopted, to ensure a level playing field for sustainable air transport; the Regulation applies from 1 January 2024 and its first reporting obligation for aircraft operators is expected in 2025. Under ReFuel EU, fuel suppliers must guarantee a minimum share of SAF at EU airports, which will be gradually increased starting from 2% in 2025 to 70% in 2050, with an additional subtarget for synthetic SAF (e-fuels) from 1.2% in 2030 to 35% in 2050. Airlines must source at least 90% of the fuel required for their flights from the EU, to avoid the practice of tankering.

FILLING THE TANK

As of today, Sustainable Aviation Fuels (SAF) are produced using a variety of innovative technologies aimed at reducing the carbon footprint of aviation. These technologies include hydroprocessed esters and fatty acids (HEFA), which convert vegetable oils, waste fats, and greases into jet fuel; Fischer-Tropsch synthesis, which gasifies biomass or municipal solid waste to produce synthetic fuel; and alcohol-to-jet (ATJ) processes, where ethanol or other alcohols are converted into jet fuel. Additionally, other emerging technologies like power-to-liquid (PtL), which uses renewable electricity to produce synthetic fuels from carbon dioxide and water, offer promising pathways for the future. Each of these technologies is designed to ensure that SAF can be used in existing aircraft engines with no modifications (drop-in fuels), facilitating a smoother transition to greener aviation.

Ensuring SAF compatibility with existing aircraft technologies and related infrastructures without compromising safety or performance requires rigorous testing and certification. Achieving high fuel quality standard is a challenging task for SAF producers. In order to be eligible for commercial use, SAF quality has to be tested against existing fuel standards. Recognized specifications ensure that fuels traded internationally meet consistent standards accepted by O&M: institutions as ASTM (D1655) and UK Defence Standardization (DEF STAN 91-91) are key actors in this global standardization effort. The possibility to use fuels derived through alternative productions routes than the conventional fossil-based kerosine was already acknowledge by ASTM in 2009, when the ASTM D7566 Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons was issued. The new alternative fuel pathways (intended as conversion process and feedstock) are assessed following the ASTM D4054 Standard Practice, which defines the process by which a new blendstock (a fuel component that is either certified to be used as aviation fuel or is blended with other components to be certified) must be evaluated. It would be in fact correct to refer to pure alternative fuels as SAF blend components, limiting the term SAF to the final commercial product composed by



† Caution required with the interpretation of absolute CO_2 emissions levels after 2050 due to modelling assumptions e.g., frozen aircraft technology after 2050. Under these assumptions, CO_2 emissions are higher than in an alternative scenario (and modelling approach) where aircraft technology would continue to improve after 2050.

Figure 1. CO2 emissions from international aviation associated with LTAG Integrated Scenarios[1]

blends of fossil and alternative fuels, and/or mixtures of SAF blend components.

Once approved, each new pathway is added to the ASTM D7566 standard: as of today, more than ten pathways are included in ASTM D7566, also including two pathways dealing with co-processing of renewable feedstocks in petroleum refineries with a blending limit of 5%. The approval of a new SAF blending component includes extensive testing on the pure SAF component as well as on the final blends, in order to ensure that the resulting fuel fits for purpose and performs within expected norms. The process is based on a strict multi-tier approach, that can take 3-5 years and requires significant financial investments. For these reasons, United States set up a D4054 'Clearing House' which provides advice and support for SAF producers and/or coordinates the necessary tests required and funds Original Equipment Manufacturers (OEMs) to review the research produced reports. In 2019, the European Aviation Safety Agency (EASA) recommended establishing a European Clearing House modelled after the US Clearing House to address similar functions for supporting EU producers. The Polytechnic Univ. of Turin is part of the team developing the pilot for the European Clearing House.

Besides technical quality certification, the sustainability dimension is key for a real uptake of SAF in aviation market, as emissions reductions is a main driver for the sector transition. Among other benefits (e.g. SAF production typically results in very low levels of sulphur and aromatic content, reducing volatile and non-volatile particulate matter (PM)), the use of increasing shares of SAF is expected to allow significant GHG saving, compared to regular fossil-based Jet A1. The Polytechnic Univ. of Turin - on behalf of the European Commission (DG-MOVE) and the EASA - is

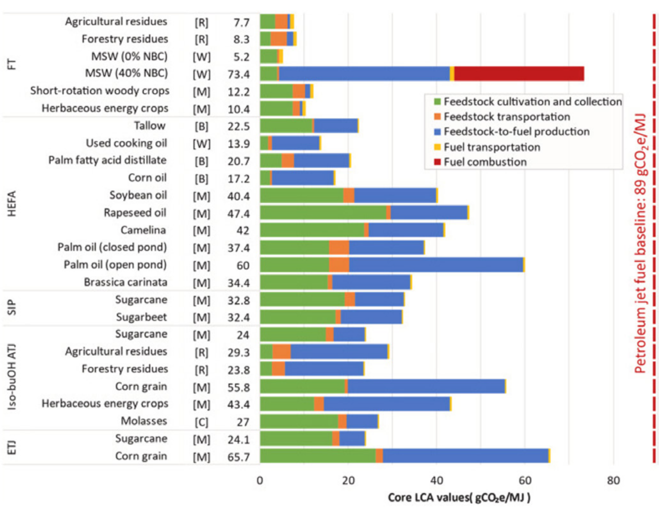


Figure 2. Default core LCA values of SAF production pathways approved by ICAO to date. (NBC: non-biogenic carbon content)[2]

co-leading the CoreLCA group of the ICAO WG5 (ex Fuel Task Group). The goal of this technical group of international experts is to define an agreed methodology to quantify the GHG saving potential of SAFs and new aviation technologies related to fuel. The LCA methodology developed for CORSIA has become the first internationally adopted approach for the calculation of life-cycle GHG emissions of aviation fuels. In terms of GHG savings, the advantage with respect to fossil fuel is determined by the production pathway: if waste-derived feedstock is used, it can result up to 94%.

In addition, the accounting methodology is being developed within ICAO, similarly to the current EU regulation for sustainable biofuels, to include soil carbon accumulation (SCA), which can even bring the sustainability of SAF to carbon negativity (i.e. beyond 100% GHG savings).

READY FOR DEPARTURE?

It has to be highlighted that, despite the growing interest in SAF, as of today the volumes used for commercial flights are still very low. This is supposed to change in the coming years, also as an effect of new policies entering into force (i.e. ReFuelEU Aviation), but still both technical and non-technical barriers remain to be solved, as well as the achievement of economic sustainability.

On the technical side, challenges include sustainable feedstock availability, the lack of fully harmonized quality standards, and the need for further advancements in refining processes to scale up production efficiently. According to the last EASA State of the EU SAF market[3], in 2023 the price gap was still relevant: the weighted-average SAF price for the European area was determined to be 2,768 €/tonne, against 816 €/tonne for the Jet-A1. Based on the same report, the expected price for synthetic aviation fuels (as no significant production is available yet), obtained from CO2 derived from various sources, ranges between 6600 and 8700 €/tonne.

Non-technical barriers may include regulatory hurdles, the partial lack of consistent and harmonised global policies and incentives (mitigated by ICAO CORSIA initiative), and the high initial investment costs that deter airlines from adopting SAF. The availability of production potential to cover the increasing ambitious mandates seems for the time being sufficient, but targets after 2040 can be met only by stimulating new investments in the short time on the entire value chain, in particular on the sustainable feedstock sourcing/production. Another important aspect is related to public awareness, acceptance and engagement, as increasing SAF demand is inevitably increasing the average cost of flying, at least in the short term.

All in all, we may have a long taxiing ahead before large scale SAF adoption takes place. ◆

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Using Metal Additive Manufacturing to Realize Performance and Efficiency Gains

David Chapin

Engineering Executive, Colibrium Additive – a GE Aerospace company

The advantages of metal additive manufacturing—such as lightweighting or the ability to create more complex designs with higher degrees of freedom—are brought to the forefront and excite potential users of the technology.

However, we find that those organizations who take a structured, pragmatic approach to assessing the potential of additive manufacturing, have the most success. For us, the starting point with any potential or existing users of metal additive is to explore their business case, their unique problem or challenge and their intended end-use application.

THE POTENTIAL FOR METAL ADDITIVE

Metal additive manufacturing is already bringing a host of performance, speed, and efficiency gains to part designs and manufacturing processes. While there are benefits to using additive manufacturing, organizations also need to ensure that they consider, and eventually deploy, the technology for the right reasons—with an intended purpose, that is going to provide a measurable return on investment (ROI).

There are other potential technological benefits of using additive manufacturing other than allowing for more design freedom. However, the first step should always be defining the business case for adopting additive manufacturing with demonstrable payback and business benefits—based on all aspects of the product and supply chain, from performance gains, to manufacturing lead times, to simplifying sourcing strategies, through to part consolidation. Regardless of industry, additive manufacturing users have occasionally fallen foul of using it for the wrong reasons or starting with parts that are too complex or beyond the capabilities of inexperienced users and the process. Adopting metal additive manufacturing should be a structured process based on impactful, regular wins that fit within the capability of the machines, materials, and processes.

To get the most out of metal additive, create a business strategy that progresses from initial quick wins to solving larger, more-complex challenges, evolving your characterization of the design space, process boundaries, and material property characterization as you go.

By first selecting and printing lower-complexity and lower-criticality parts and then progressively choosing more complex parts, the adoption and integration of additive into an organization's existing manufacturing processes can become much easier.

Taking on too much too early can lead to slower business-wide technology adoption or a period languishing in what industry analyst Gartner calls a "trough of despair."

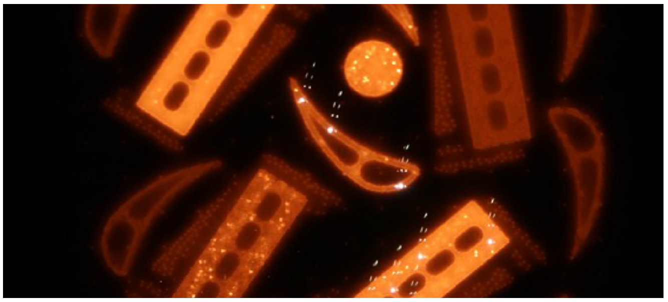

Figure 1. Colibrium Additive EBM PointMelt Technology

SHARE LEARNINGS FROM OTHER SECTORS

In industries where existing technologies and materials have been pushed to their limits, metal additive manufacturing often offers a solution to squeeze out additional efficiency gains. This might come from the process of creating more integrated features and efficient designs, the freedom to introduce a lighter material with a targeted design to maintain strength, or both.

Metal additive manufacturing is already being deployed to bring demonstrable efficiency gains and cost benefits across the commercial and military aerospace sector, as well as in the medical device and orthopedic implant sector.

Despite being highly regulated, both the aerospace and the medical sectors were early adopters of metal additive manufacturing for high-rate production. Over the past two decades, those early adopting organizations have become super users of the technology and today set the standard for industrial scale deployments.

Other sectors such as automotive, power generation and oil & gas, while comparatively slower in their adoption of additive manufacturing in production settings, are also making traction and increasingly demonstrate success with additive technologies, particularly in tooling, repairs and spares applications.

While pace is gathering in all sectors of industries, adoption rates for introducing additive manufacturing might be hindered by a singular or a combination of factors, including higher risk aversion, regulatory challenges and perceived lower ROI.

CONSIDERATIONS FOR POWER GENERATION GAS TURBINES

The stationary nature and larger footprint of land-based power generation turbines might decrease the incentive to pursue additive manufacturing. There are fewer constraints on space or

Figure 2. Colibrium Additive EBM Spectra H printer

weight savings that need to be achieved, which are often two of the biggest incentives for using additive manufacturing from a ROI value perspective.

In some cases, components made with conventional manufacturing methods have nearly exhausted their potential in terms of efficiency gains given other constraints on cost and durability, so the next step to achieving a better performance might be to consider designs enabled by additive manufacturing.

While engineers can look to additive manufacturing to identify design improvements, there are certain factors for land-based turbines to be considered. The main one is size and that, compared to jet engines, larger components are needed for land turbines. This has meant that the power generation industry has had to wait for larger industrial 3D printers to come to the market to best utilize the technology. Additionally, the business case may not always be as favorable for low-volume, larger parts that need to absorb larger machine installed base and operational costs.

The design freedom allowed by metal additive parts is beneficial for gas turbine design, as it allows efficiency gains to be achieved across thermal design and gas flow shape and design, in the combustion sections of the turbines and elsewhere.

Achieving efficiency gains in the first-stage turbine sections, which are extremely hot with high loading, remain a focus for the gas turbine industry. The materials required in these areas can be difficult to weld, making additive manufacturing a more challenging manufacturing method. However, recent advancements with crack-prone alloys in the electron beam powder-bed fusion (EB-PBF) space are beginning to unlock new applications in these hot sections.

AEROSPACE GAS TURBINES—RIPE FOR METAL ADDITIVE

The aerospace sector is one area where additive has gained momentum due to the ability to drive gains in efficiency and lightweighting and the ability to produce geometrically complex parts that fit the constrained spaces within smaller aircraft engines. Because jet engines need to “carry” all associated hardware and accessories during flights, there is a need for each component to be as light as possible to reduce fuel consumption costs. Increased engine efficiency yields fuel cost reduction. To that end, the aerospace sector is often at the forefront of new material systems and technology implementation to chase these key engine technology needs, making these OEMs well-placed to incorporate newer manufacturing technology such as additive manufacturing into their technology roadmaps.

PROS & CONS OF USING ADDITIVE

Heat exchangers are a ubiquitous technology in the turbine world, and in recent years additive manufacturing has become a sought-after method for most types of heat exchangers. The big question is: is additive manufacturing really needed for all of them? There has been hype around 3D printed heat exchangers due to the design freedom it offers, including the ability to manufacture complex internal structures and create intricate systems that fit into small spaces.

For aerospace turbines, heat exchangers are certainly an area where additive can be a game changer, because they can be designed to fit within available spaces—with the added benefits of weight saving and efficiency gains. Looking at land-based turbines where there are large components next to each other that do neither necessarily need lightweighting nor need the space and weight saving design that additive manufacturing offers, then the benefits of using conventional cooling technologies might be greater.

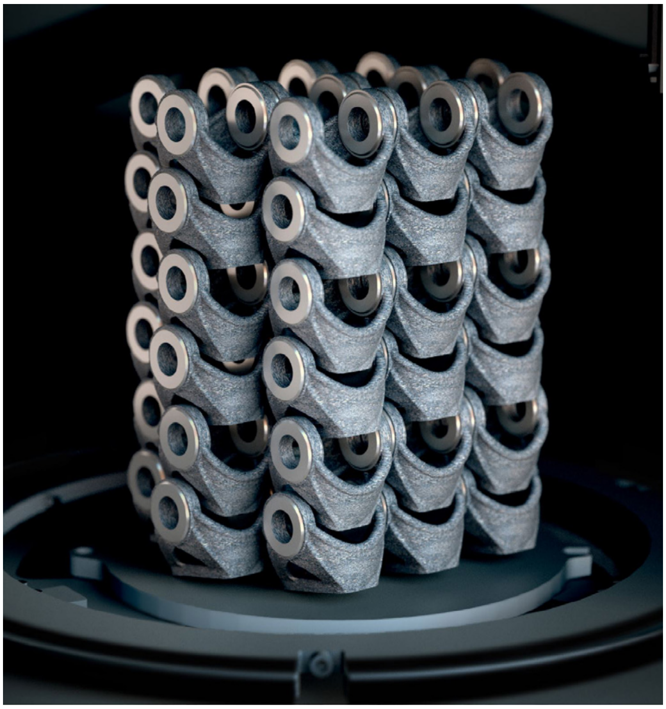

Figure 3. Colibrium Additive Ti6-4 printed structural parts

Some users elect to go straight to heat exchangers as their first additive design and manufacturing application, but the physics in these applications can be complex. Those users who have succeeded with additively manufactured heat exchangers have often spent years developing their design tools and empirical data, ensuring they select applications with the highest ROI and scrutinizing whether additive design is even needed with their specific heat exchanger geometries, fluids, and flow regimes. They have also spent years characterizing and demonstrating the capability of their manufacturing equipment and process to produce these geometries reliably.

ENGAGEMENT & EDUCATION WITH REGULATORY BODIES

The aerospace industry continues to proactively engage with regulators and educate on this new process. Important in this education has been the industry's ability to document and provide evidence of repeatable, consistent, quality processes, as well as identify and manage risk of any process changes that might result in poorer quality outputs.

This approach of working closely with regulators is not unique to additive manufacturing, and the specific processes and risk factors need to be controlled and mitigated like they would with any other manufacturing process.

Most industries are already in the process of developing and integrating standards for additive manufacturing and communicating to their regulators how they are controlling the inputs and the process to obtain predictable results on the backend to ensure that the parts are being designed to meet established requirements. ◆

Figure 4. Low pressure turbine blade parts

Early Career Engineer and Student Travel Assistance for ASME Turbo Expo

TURBO EXPO EARLY CAREER ENGINEER TRAVEL AWARD (TEECE)

DEADLINE FEBRUARY 2, 2026 APPLY HERE

The Turbo Expo Early Career Engineer Travel Award is intended for graduate early career engineers working in industry, in government or in academia to supplement their travel funding to attend ASME Turbo Expo to present a paper which they have authored or co-authored. The purpose is to help young engineers maintain active and fruitful participation with the Turbo Expo community. The award includes:

- One Complimentary ASME Turbo Expo Technical Conference Registration
- Complimentary hotel accommodations (Sunday to Friday)
- Up to $1,000 toward approved travel expenses

STUDENT ADVISORY COMMITTEE TRAVEL AWARD (SACTA)

DEADLINE FEBRUARY 2, 2026 APPLY HERE

The Student Advisory Committee Travel Awards (SACTA) have been made available for students in 2026, with priority given to students who both participate in the conference and actively contribute to the growth of the SAC.

The winners will receive reimbursement awards that cover up to $2,000 of approved travel expenses (including accommodation, transportation, conference registration, etc.).

Applicants for these awards must be seeking a degree. Communication with the SAC leadership team may be requested prior to, during, and following Turbo Expo.

FOR MORE INFORMATION ON THE ASME INTERNATIONAL GAS TURBINE HONORS AND AWARDS OPPORTUNITIES, CLICK HERE!

2026 ASME Turbo Expo

Plan now to join us in Milan, Italy. Over 2,500 turbomachinery colleagues from around the world will be at ASME TURBO EXPO, ASME's premier turbomachinery technical conference and exposition, set for June 15-19, 2026.

This year's technical program will include over a thousand presenting authors sharing their research and vast knowledge of turbomachinery. Keynote speakers and plenary panels will address various topics relevant to the bright and challenging future of the industry.

The conference offers various networking opportunities to build valuable connections with industry experts such as Monday night's Welcome Reception, Wednesday's Celebrating Women in Engineering Dinner, and two evening exhibit hall receptions.

The 3-day exhibition starting June 16th attracts the industry's leading professionals and key decision makers, whose innovation and expertise are helping to shape the future of the turbomachinery industry.

In addition, ASME Turbo Expo focuses on the future generation of turbomachinery experts providing an opportunity for students to showcase their works during the Student Poster session. Tutorials of Basics lectures are offered as an introduction to topics such as heat transfer, energy storage, and cycle innovations. An Early Career and Student Reception is hosted on Sunday night so attendees may foster connections that will benefit them through the weeklong conference and exposition.

Don't miss the opportunity to share your vast knowledge, grow your network, and contribute to the future of turbomachinery at Turbo Expo 2026!

ASME TURBO EXPO 2026
TURBOMACHINERY TECHNICAL CONFERENCE & EXPOSITION