



Photonics21 Press Release

New report: photonics key to limitless clean energy

Fusion energy, the ultimate tool for generating endless clean, safe and decarbonised energy sources, depends on advanced light technologies, according to a new report.

A report published today by Europe's premier platform for light-based technologies, [Photonics21](#), has highlighted the critical role photonics plays in developing fusion power.

Called '*Photonics for the Energy Production Market: Focus on Fusion Energy*,' the report reveals that light technologies are vital for advancing future clean energy sources and are key to enabling critical processes necessary for fusion power.

Fusion power is a form of energy generation that mimics the process of powering the sun and stars. It involves combining two light atomic nuclei to form a heavier nucleus and requires temperatures of around 100 million degrees Celsius with immense pressures to overcome the repulsive forces between the positively charged nuclei.

Generating power in this manner has been seen as a "holy grail" of energy science. While it has been a subject of serious research for decades, it has often been considered more of a distant future possibility than a reality. Unlike nuclear fission, which relies on scarce resources and produces long-lasting radioactive waste, fusion energy promises a nearly limitless power supply with minimal environmental impact.

This latest research, conducted by French market intelligence group Tematys, shows that while fusion energy is an extremely complex endeavour, photonics – or the science of generating and harnessing light – is essential for developing the high-precision components required for fusion reactors.

According to the report, powerful lasers, which are essential for initiating fusion reactions in inertial confinement fusion, are used to mimic the conditions inside stars by compressing and heating fuel pellets. The report shows that photonics is also a viable option for controlling fusion plasmas with great precision and managing the extreme temperatures involved in fusion reactions.

Photonics21 President Dr Lutz Aschke said: "In the new Tematys thematic report on fusion energy, we see that lasers and optical technologies have the potential to turn the science fiction dream of limitless fusion power into a reality. We are already optimising and expanding renewable energy sources using photonics today, such as advanced thermographic cameras that detect faults in electrical systems, LIDAR technologies that enhance wind turbine efficiency and lasers for improved photovoltaic cells. This cutting-edge science and technology has the power to make what once seemed impossible — clean, sustainable power for all — into a tangible goal."

According to the study, photonic technologies like LIDAR, optical sensors, and high-precision imaging will be crucial for monitoring and controlling the extreme conditions within fusion power plants, which will ensure the stability and efficiency of the fusion process.

The report discusses a number of fusion approaches, where photonics is essential for manufacturing complex components and the high-precision assembly for these reactors, including magnetic confinement in tokamaks and stellarators.



The report reveals that no matter what the fusion approach, and even when the confinement is magnetic or electrostatic, no fusion reactors can work without photonics as a critical enabler.

Industrial Innovations and Economic Impact

The report highlights the innovative efforts of Renaissance Fusion, a French start-up that secured €16.4 million from venture funds last year to develop stellarator reactors using cutting-edge photonics techniques. By employing lasers to shape superconducting coils precisely, Renaissance Fusion is a working example of how photonics can simplify the manufacturing process and enhance the efficiency of fusion power plants.

The new fusion report also shows how the photonics industry's impact extends beyond energy production. The development of facilities like France's Laser Megajoule has catalysed the growth of a robust photonics ecosystem, creating thousands of jobs and fostering technological advancements that benefit multiple sectors.

To learn more about how photonics is a key enabling technology for fusion energy, click [here](#) and download a copy of the report.